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Department of Prehistory

Strategy paper on research and science communication activities

natural history
museum vienna

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Introduction

The Natural History Museum Vienna is characterised by the strong interweaving of the natural sciences and the humanities. This interdisciplinarity has been a fundamental principle of the museum since its beginning, concerning the extensive collections themselves as well as the magnificent decor of the building in which they are housed. The department that practices this interdisciplinarity most strongly on a day-to-day basis is the Department of Prehistory. Its focus lies on human culture, which always interacts with the respective environment. These are interactions in the truest sense of the word – just as natural conditions influence people's actions, people shape themselves and their environment to the same extent. This culminates in today's Anthropocene era, where the exploitation of fossil fuels, large-scale changes in land use, and products such as plastic have already left indelible traces in the sediments of the Earth as a signal for the coming millennia.

The Department of Prehistory has an interdisciplinary approach not only in relation to questions concerning human existence in the world but also with regard to the methods it uses. Archaeological finds are analysed and interpreted together with experts from other departments of the NHMW. Typological studies and raw material analyses allow conclusions to be drawn about trade routes and exchange between earlier cultures.

Together with colleagues from the Central Research Laboratories, structural analyses of the various objects are supplemented by modern imaging techniques such as Scanning Electron Microscopes and CT scanners, which make high-resolution three-dimensional internal structures visible. Recently, for example, an Iron Age sword handle from the Hallstatt cemetery was examined in this way. The results are made available to a global community via the NHMW website and the pioneering internet portal THANADOS.

The strategy presented here makes it clear that the Department of Prehistory will continue along this interdisciplinary path, which is based on cooperation and thus opens up spaces for reflection for our further cultural development. These reflections aim to help us to make decisions so that we can live well together on this planet.

Katrin Vohland
Director General and
Scientific CEO

Summary

With over 140,000 inventory numbers and more than one million individual objects, the Department of Prehistory of the Natural History Museum Vienna (NHMW) contains one of the largest prehistoric collections in Europe. As a department of the NHMW it also looks back on a research history of more than 170 years – from its beginnings as the first state collection and research centre for prehistory during the Austro-Hungarian monarchy to today's interdisciplinary networked research intuition.

The collection itself spans the period from 300,000 years BCE to around 1,000 CE and mainly contains finds from Austria and the territories of the former monarchy. In addition to donations and purchases, the objects came to the NHMW mainly through the department's lively excavation and research activities. The collection houses objects from three Austrian UNESCO World Heritage sites: the Palaeolithic site complex Willendorf (UNESCO World Heritage Wachau), the pile-dwelling sites at the Attersee and Mondsee lakes (UNESCO World Heritage Prehistoric Pile Dwellings around the Alps), and the burial ground and mines of Hallstatt (UNESCO World Heritage Hallstatt-Dachstein/Salzkammergut). Notable inventories also include the Gravettian site Grub-Kranawetberg, the early Neolithic site complex Brunn am Gebirge, as well as the Iron Age sanctuary near Roseldorf.

The main objective of the Department of Prehistory is to research the history of mankind on the basis of their material cultural remains. This is done by maintaining and analysing the existing collection and through research excavations as well as through cooperation with national and international partner institutions. One focus is on the investigation of interpersonal relationships, but also the relationship between humans and the environment, animals, resources, and technology. In this context, archaeological objects and structures are seen as primary sources to investigate the individuals and societies behind them. A further focus are research activities and projects in the Digital Humanities, an area in which the department has played a pioneering role for many years.

The department also aims to make the results of its research accessible to both the scientific community and the wider public – through scientific talks and publications as well as popular science presentations, action days, participation in exhibitions, collaboration in the Young Science Initiative of the Federal Ministry for Arts, Culture, the Civil Service and Sport, podcasts, press work, etc.

The Department of Prehistory of the NHMW endeavours to be a repository of knowledge for society and, through cutting-edge research into our rich cultural heritage, provide knowledge about the past and inspiration for the future.

Mission Statement

The goal of the Department of Prehistory at the Natural History Museum Vienna is to study the history of mankind on the basis of its material culture and to communicate this knowledge. To meet this goals, the museum's staff collects, preserves and examines unique evidence from the past.

Vision Statement

The Department of Prehistory at the Natural History Museum aims to be a hub of knowledge for society. It draws on a rich cultural heritage and is committed to state-of-the-art research and communication in order to serve as an inspiration for the future.

State of the Art: The Department of Prehistory at the Natural History Museum

Today's Natural History Museum Vienna (NHMW), the basis of which originated from various imperial collections of the Habsburg dynasty, was founded as a legal entity in 1876 and finally opened to the public in August 1889 as the "k. k. Naturhistorisches Hofmuseum" ("Imperial and Royal Natural History Museum").

The original plans for the museum in the 19th century included the establishment of an Anthropological-Ethnographic Department dedicated to the study of humanity alongside the natural science departments dedicated to the geo- and biosphere. This gave the three classical human sciences of anthropology, ethnology, and prehistory the first state collection and research centers in Austria, each with separately inventoried collections from 1884. In 1924, major advances in these scientific fields made it necessary to divide the department into three, with ethnology being moved into what was then the Museum für Völkerkunde (now the Weltmuseum) in 1927. Today, the Department of Prehistory and the Archive for the History of Science are the only scientific departments at the museum dedicated to the humanities and cultural studies.

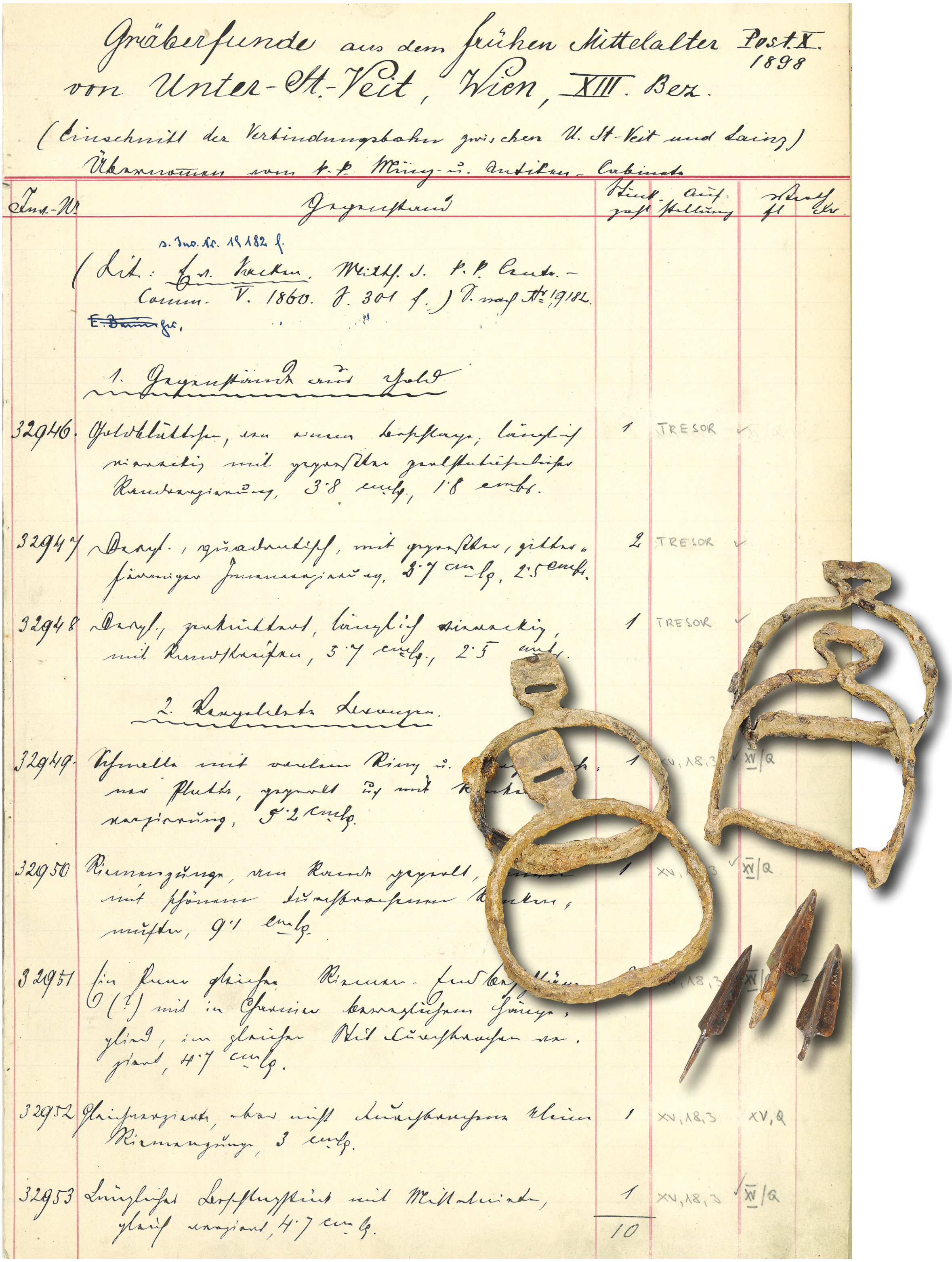

Figure 1: Inventory book entry on early medieval finds from Vienna/Ober St. Veit with the artefacts mentioned. Archives of the Department of Prehistory; Photo: Alice Schumacher / NHMW

The Department of Prehistory today comprises over one million individual objects (over 140,000 inventory numbers). The creation of the Prehistoric Collection within the setting of the multi-ethnic Habsburg Monarchy (Heinrich 2018), established its important position. It is International and European in the true sense of the words. From the very beginning, it was intended to embrace the diversity of European cultural phenomena. The Department of Prehistory houses one of the largest and most diverse archaeological collections in Europe (Grömer & Kern 2018) with outstanding individual finds of international standing. These include the Venus of Willendorf, the bull of Býčí Skála, the Maiersdorf dagger, the vessels of Sopron with their figural engravings and the finds from the Hallstatt mine and burial site as well as the outstanding migration period grave finds from Hauskirchen – to name just a few. Three of the UNESCO World Heritage regions are prominently represented in the collections (Grömer & Vohland 2022): the Wachau region including Willendorf (Antl-Weiser & Posch 2022), the prehistoric pile dwellings around the Alps (https://www.pfahlbauten.at/), and Hallstatt-Dachstein/Salzkammergut (Brandner *et al.* 2022).

Periods of Focus at the Department of Prehistory

Stone Age Research

The Venus of Willendorf (29,500 years old) (Antl-Weiser 2008) is one of the iconic objects at the Natural History Museum and is one of the oldest "works of art" in human history. The Ice Age is a period of early human history with people living in hunter-gatherer-communities in a climatic environment that was very different from today's and therefore also harboured a different animal and plant species. The climate of the Ice Age shaped the landscape – a loess tundra where mammoths, woolly rhinoceroses, wild horses, and reindeer lived. Tools made of bone, ivory, and stone were used, as well as jewelry made of ivory, as well as fossilised mussels and snail shells (Rau *et al.* 2009). This period also saw the domestication of the wolf (Perri *et al.* 2021), which has accompanied humans in their evolution into modern-day dogs. Ice Age sites represented in the Natural History Museum's Stone Age collection include Willendorf I to VII, Grub-Kranawetberg and the Gudenus Cave.

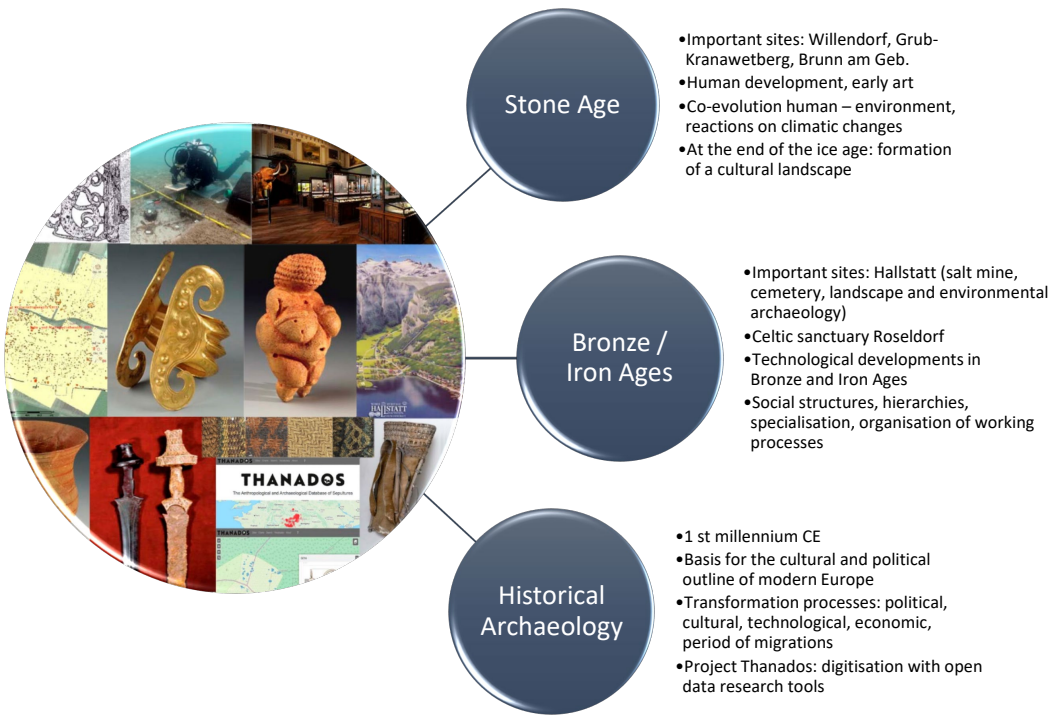

Figure 2: Periods of focus at the Department of Prehistory; Graphics: Karina Grömer / NHMW

Stone Age research at the department is not limited to the Venus of Willendorf and Ice Age art but also studies sites such as Grub-Kranawetberg in Lower Austria (a 30,000-year-old campsite) and the Obere Schöntalwiese in East Tyrol (a 9,000-year-old Alpine hunting camp; Lamprecht *et al.* 2024) through a range of excavations and analyses. In-house research also looks into the subsistence of Pleistocene and Early Holocene people, their hunting strategies, and their reactions to a changing climate during and after the last Ice Age and at the beginning of the Holocene 12,000 years ago.

However, it must be noted that humans living in the Paleolithic and Mesolithic periods did not yet reshape their environment. It was not until the Neolithic period (around 5,600 BCE in Central Europe), when the first farmers and cattle breeders appeared, that people began to make a visible impact on the landscape – a process which continues to this day (Otten *et al.* 2015). In Brunn am Gebirge in Lower Austria, the department is researching one of the initial settlements of early farming cultures in Europe. Important find complexes from the late Neolithic period, for example in the area around the Mondsee lake, are being investigated in collaboration with the Kuratorium Pfahlbauten (https://www.pfahlbauten.at/) who are strongly associated to the NHMW.

Figure 3: Cow-calf bowl from the Hallstatt burial site, Early Iron Age: find location in the grave and after restoration; Photos: Hallstatt excavation team and Alice Schumacher / NHMW

Metal ages

The Bronze and Iron Ages are characterised not only by the improvements in the technological capabilities of humans living at the time but also by the increasingly differentiated social structure that developed as a result (Vandkilde 2007). The new materials of copper (in Central Europe from 4,000 BCE), bronze (from 2,300 BCE) and iron (from 850 BCE) radically changed people's lives and led to completely new divisions of labor and specialisations in everyday life, which extended to the formation of new groups of workers and hierarchical structures. Important sites can be named from the Traisen Valley, as well as Mannersdorf, Ebreichsdorf and various sites from Slovenia.

From around 850 BCE, a major new cultural epoch began in Central Europe: the Iron Age. Iron became the most important metal for the manufacturing of tools, im-

plements, and weapons. Agriculture intensified and trade expanded across the entire continent, stretching even as far as Africa and Asia. Places emerged that rose to become social, cultural, and religious centers in their respective regions. Named after the Upper Austrian site Hallstatt, which the Department of Prehistory has been investigating for over a hundred years, this period in the history of Central Europe is also known as the Hallstatt Culture (Early Iron Age, 850–450 BCE).

In the course of the 5th century BCE, a new era began with the younger phase of the Iron Age, which was named after a sacrificial site in La Tène in western Switzerland and which lasted until the beginning of the Common Era. The La Tène Culture is the era of the prehistoric Celts in Central Europe, whose numerous tribes battled each other for supremacy.

The site Hallstatt (most recently: Brandner *et al.* 2022) played a central role in the research activities on the Bronze and Iron Ages, both the excavations at the Hallstatt cemetery, Late Bronze Age structures and the mine excavations. Research into the Late Iron Age is mainly represented by the excavations in the Celtic sites at Roseldorf (Holzer 2018). Textile research (Grömer 2019) at the NHMW also focuses on the Bronze and Iron Ages.

Historical Archaeology

The period from around 375 CE until around 1,000 CE (Wolfram 1995), when the foundations were laid for the political and cultural shape of today's Europe, can be seen in the objects in the Historical Archaeology Collection. It contains evidence of European settlement by Germanic, Avar, Lombard, and Slavic populations during this era of great migrations and numerous military conflicts.

These finds make it possible to trace numerous transformation processes in political, ethnic, cultural, linguistic, technological, and religious terms that still have an impact today. Finds in the collection come from all over the former Habsburg Monarchy. They are still being added to by new finds discovered during excavations in Vienna and Lower Austria.

Tasks of the Department of Prehistory

Embedded in the general tasks of the Natural History Museum (Collect – Research – Preserve – Disseminate – Educate), the department's *mission* and *vision statement* (p. 5) already formulate its general objectives.

The acquisition of finds for the Prehistoric Collections (Fig. 4) – based on the imperial Habsburg collections and donations from the Anthropological Society Vienna (Heinrich 2018) – took place from the end of the 19th century up to the First World War through purchases, donations, and various excavations across the Habsburg Monarchy. Finds from areas outside Europe were rare. The finds added to the inventories of the Prehistoric Collections since the mid-20th century have been concentrated on the territory of present-day Austria, with the focus primarily on the museum's own excavations. Rarer are donations, such as the gold treasure from Ebreichsdorf and its accompanying finds (over 4,000 find numbers), which were acquired by the NHMW from the Austrian Federal Railways in 2023.

In the past, the department's activities went through various phases (Heinrich 2009). After the Second World War, under the department directors Karl Kromer (director from 1958 until 1966) and Wilhelm Angeli (director from 1967 until 1988), the focus was primarily on the collections and their inventory, the documentation of war damage/losses, and publications. During this period (until the 1980s), inventory materials were transferred to other departments within the NHMW (above all to the Department of Anthropology and the Department of Archaeozoology of the First Zoological Department) as well as to the Kunsthistorisches Museum Vienna (including prehistoric materials from Greece and Egypt).

In the era of Fritz-Eckart Barth (director from 1989 until 2000), large-scale research excavations began, above all in Hallstatt (salt

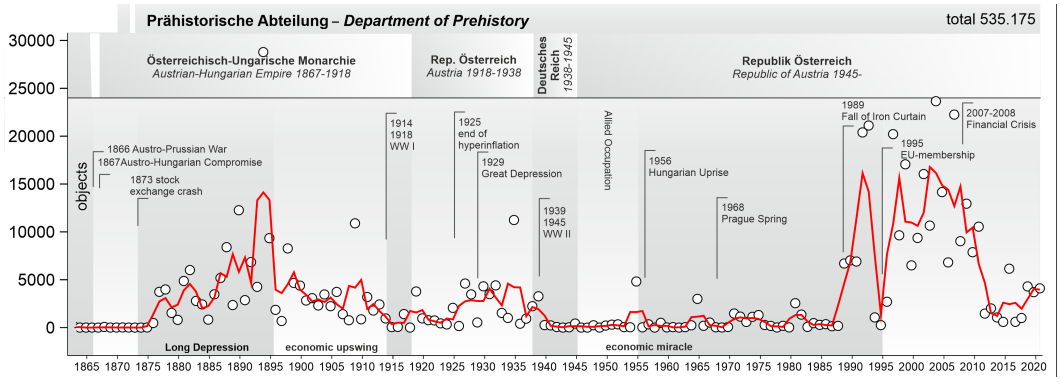

Figure 4: Timeline showing the intensity of acquisition of archaeological artefacts for the Prehistoric Collections; Graphics: Karina Grömer & Mathias Harzhauser / NHMW

mine and cemetery), later also at the Palaeolithic camp site of Grub-Kranawetberg, in the early farming settlement of Brunn am Gebirge, and in the Celtic site at Roseldorf.

The turn of the millennium and the first decades of the 21st century under Anton Kern (director from 2001 until 2022) were characterised by the continuation of research excavations and the corresponding increase in collection material (Fig. 4) as well as international and interdisciplinary research projects at national and international level. In addition, the permanent exhibition of the Prehistoric Collections was modernised in Halls 11–13 and the Venus and Gold Cabinet were reopened in 2015 (Grömer & Kern 2018).

In addition to archaeological research on the department's collections, digitisation has increasingly come to the fore in the last decade in order to make the research and the processes behind it visible to the general public as well as to researchers and specialists. This goes hand in hand with an increased awareness of the need to embed the department's research into the needs of a broader society (Sustainable Development Goals, inclusive aspects, participation, etc.). Provenance research on the restitution of objects from contexts of injustice and the research history of the archaeological disciplines, such as the misuse of archaeological content by the Nazi regime, is now also coming to the fore. The activities also include sensitive parts of the collection, such as the objects from the Gusen concentration camp excavation.

Research Excavations by the Department

The excavation and field research activities of the Department of Prehistory have always been carried out in strict compliance with the legal requirements set out in the Austrian Monument Protection Act and the highest international standards.

Field research and excavations are also taking place on the Carnic Ridge in East Tyrol, where Mesolithic hunting and resting stations are being investigated (led by Caroline Posch).

For several decades, field research has been documented by the work in Hallstatt in Upper Austria (Brandner *et al.* 2022). Successful excavations are carried out in the prehistoric salt mine (led by Daniel Brandner) and the excavations at the Iron Age burial site and in the Bronze Age "industrial area" above ground (led by Johann Rudorfer). Both have produced results of international importance and can be considered groundbreaking in some areas.

Since 1960, the Natural History Museum has been conducting research in the prehistoric salt mines of Hallstatt at its Hallstatt branch in close cooperation with Salinen Austria (Fig. 5). Due to the special preservation conditions in the salt, the salt mine finds allow detailed insights into prehistoric living and working conditions, resource use, and human-environment relationships. The focus of the current excavations and exploratory drilling is on the Bronze and Iron Age mining chambers, which can be studied and disseminated using scientific analyses, such as high-precision dendrochronological data and 3D visualisations using state-of-the-art technology. The outstanding preservation conditions of salt-preserved organic finds have also provided internationally renowned expertise in the development of specialised restoration and conservation tech-

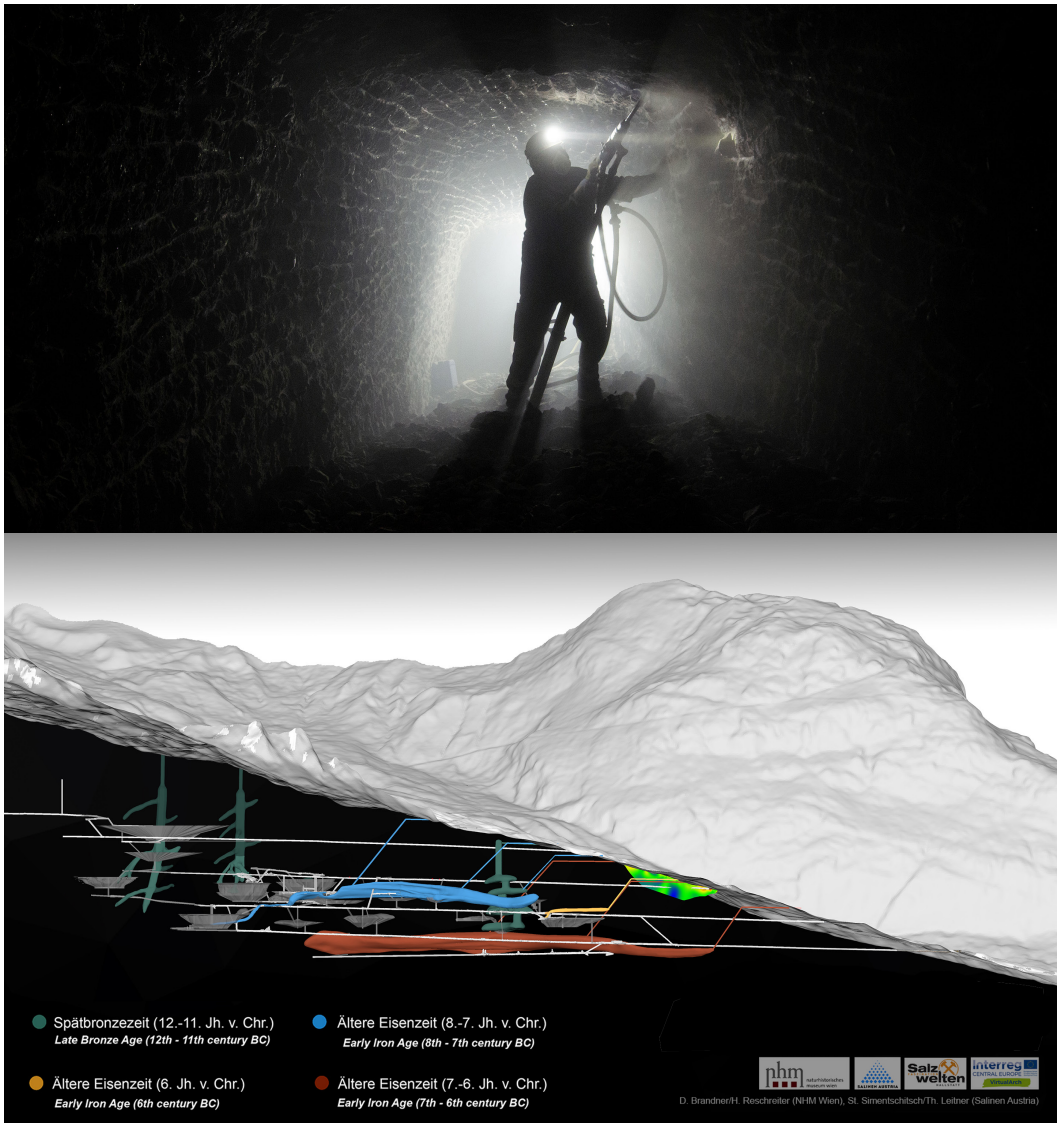

Figure 5: Excavation in the salt mine Hallstatt and graphic representation of the Bronze and Iron Age mines; Photo: Daniel Brandner / NHMW, Graphics: Daniel Brandner, Hallstatt excavation team, and Salinen Austria

niques. The Department of Prehistory also considers itself responsible for preserving this world heritage below ground. Together with modern-day miners from Salinen Austria and financed by the Austrian Ministry of the Arts, Culture, the Civil Service and Sport and the Upper Austria Regional Government, access to the most important sites in the mountain will be preserved for future generations.

A particular value lies in the continuity of this work, which is guaranteed by the intensive cooperation with Salinen Austria and Salzwelten. In return for their financial support, the NHMW provides the scienti-

fic background for communicating this archaeological treasure to the tens of thousands of visitors every year.

In general, the need for archaeology to accompany construction work has also increased significantly in Hallstatt and the NHMW is taking on the necessary groundwork for the infrastructure work in coordination with the Monument Protection Act and the Federal Monuments Office. A core project here was the "Wildbachprojekt 2014–2024". In close cooperation with the Upper Austrian River and Avalanche Control Authority, numerous archaeological structures have been professionally documented.

Annual research excavations form the core of the archaeological fieldwork in Hallstatt. Above ground, the focus here is on structures outside or below the eponymous Iron Age cemetery, which has been the main focus of research over the last 180 years. In recent years, complex Late Bronze Age building structures have been documented, and the interdisciplinary research provides information about environmental and climatic conditions and even natural disasters.

The above-ground excavations are not limited to the Salzberg Valley alone, however, but also include the wider surrounding area in order to gain a better and holistic diachronic understanding of the Hallstatt phenomenon in its environment. Over the next few years, this research will be supplemented by targeted excavations at sites in the Aussee and Mitterndorf basins as well as in the Enns Valley (*e.g.*, Kulm near Aigen), which will shed light on Hallstatt's hitherto barely tangible southern neighbors (led by Georg Tiefengraber). This will also close a

Figure 6: Excavations in the Hallstatt cemetery: grave with a large set of ceramic vessels; Photo: Hallstatt excavation team / NHMW

gap in the landscape archaeology research project on the archaeology of the Upper Mur Valley and its tributary valleys, which is now being conducted in cooperation with the Institute for Southeast Alpine Bronze and Iron Age Research (ISBE), with a focus on research into the Hallstatt-period "Princely Seat" at Strettweg/Judenburg.

For over 20 years, the Celtic "central settlement" near Roseldorf (Holzer 2018) has been a focus of research and excavation, culminating in the excavation of six Middle Latène sanctuaries (led by Veronika Holzer, from 2025 on Georg Tiefengraber). Since 2022, targeted large-scale prospections with metal detectors and systematic surveys have been carried out, which provide data on the internal structure, settlement density, and special areas of use inside the settlement, the extent of which is now well known thanks to geophysical investigations. Targeted excavations are planned here for the coming years. Excavations and geophysical investigations are also planned on the Magdalensberg in Carinthia, whose outstanding importance in the Middle and Late Latène period has already been proven – most recently in several rescue excavations.

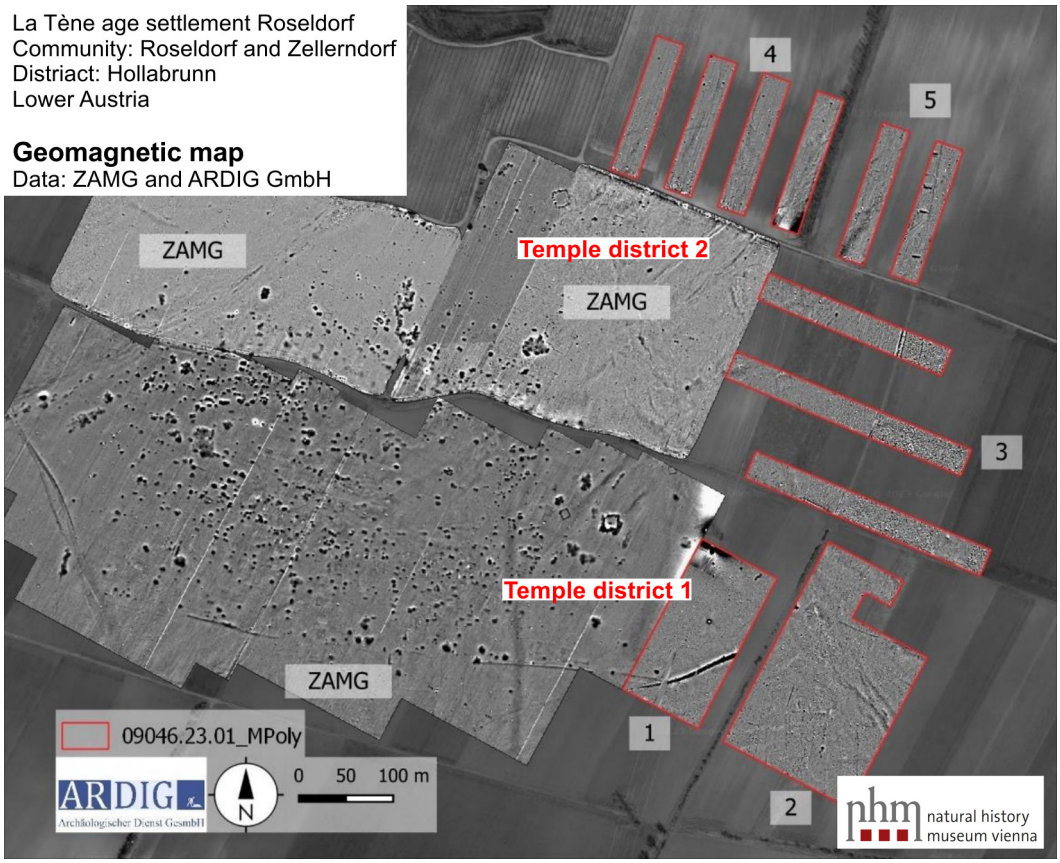

Figure 7: Geomagnetic map of Roseldorf, as of 2023/24; Graphics: Veronika Holzer / NHMW

Figure 8: Restoration workshop at the Department of Prehistory; Photo: Ernst Hausner

Restoration | Conservation

The central task of the Restoration | Conservation at the Department of Prehistory is to preserve the archaeological finds from the collections and ongoing excavations and to make object-related information available for archaeological research. This forms the interdisciplinary and structural link between the excavation of the finds and their scientific research as well as the exhibition.

The fundamental objective is the long-term preservation of the physical, chemical, and aesthetic integrity of the finds. All methods used, such as conservation and restoration methods as well as sampling for scientific research, must be discussed and evaluated strictly on the basis of this objective. Conservation methods serve to preserve the material and are selected and applied on the basis of an assessment of the condition and an evaluation of the basic damage mechanisms. Preventive conservation is one of the most important fields of conservation in the department. This involves non-invasive measures in which the damaging factors and in this consequence the damage mechanisms are minimised by controlling and manipulating the environment in which the objects are stored and exhibited.

Restoration methods are used to restore objects to a certain original or historical condition. This serves to make them legible and understandable for scientific research and, in particular, for a presentation to a broad audience. This work is based on the needs of the scientific and didactic concept of the department.

Figure 9: Restoration of a metal object with textile remains from Hallstatt; Photo: Irina Huller / NHMW

In many cases, the analysis and preservation of information related to the object requires in advance and subsequent investigation of the material and structural composition or the technological details of the finds. Interdisciplinary collaboration within the museum is the basis for this and uses the research infrastructure of the NHMW as well as cooperation with external partners.

The range of materials in the collection includes all prehistoric material groups: pottery, stone, metal, amber, and glass as well as organic materials such as wood, leather, textiles, tree bast, and grasses. The organic materials from the excavations in the Hallstatt salt mine represent a special archaeological and conservation case. This is a particular challenge and justifies the need for specific conservation research.

The systematic documentation of the condition of the finds, the constant evaluation of the conservation materials used, and the techniques applied enable the generation of long-term expertise and an adaptation of the techniques based on this or an empirical build-up of experience. In addition to the latter, the intensification of cooperation with other specialist institutions is one of the most important foundations for clarifying future research questions.

Analysis and Sampling strategies for the Collections

The scientific investigation and cataloguing of the collections are one of the central tasks of the Department of Prehistory. With this in mind, the department welcomes interdisciplinary scientific analysis in collaboration with external partners.

The Department of Prehistory of the NHMW is responsible for preserving its collections *"taking into account current museological, scientific, logistical, security, climatic, conservation, and restoration standards"* (Article 4 Federal Law Gazette II No. 399/2009). The collections of the NHMW in general are the property of the Republic of Austria (Article 14 Paragraph 2 Federal Law Gazette II No. 399/2009). The objects in the collection are listed in accordance with Article 2 Paragraph 1 of the Monument Protection Act, Federal Law Gazette No. 533/1923 (Article 14 Paragraph 2 Federal Law Gazette II No. 399/2009). This responsibility results in the need for a comprehensive review and assessment of the requirements for an intended non-destructive or destructive examination of the NHMW's collections.

The need for a non-destructive research or a minimally invasive or destructive analysis may have to be evaluated on a case-by-case basis. This is particularly important as different specialist areas interpret and use these terms differently. Fundamentally, all examinations that involve an irreversible change to the object in question are described as destructive. This also applies to minimally invasive procedures. Methods in which the objects primarily or secondarily come into contact with potentially damaging substances or chemicals – such as solvents or with heat, cold, certain electromagnetic radiation such as laser, X-ray or gamma radiation, vacuum or particle radiation – are classified as destructive depending on the degree of damage potentially caused. The decision as to whether an examination can be carried out is made at the Department of Prehistory at the NHMW on the basis of a six-eyes principle, in which three bodies (an administrative body in the form of the head of the department as well as a curator and a conservator; see Fig. 10) assess, evaluate and discuss the following points, among others:

- Reason for the analytical method and its academic or scientific quality
- General scientific significance of the research question
- Benefits for research in general as well as for the research strategy of the Department of Prehistory and the curatorial/conservation value for the NHMW
- Condition of the objects to be analysed or sampled
- Availability of the objects to be analysed or sampled
- Whether and how the objects or subsequent analyses are permanently impaired
- Internal resources required for the sampling or analytical method (personnel/technical/spatial)
- Location of the proposed work, or whether borrowing/transport/temporary storage is required and whether any special restrictions apply in this respect

- Presented schedule, protocols and workflows
- Publication strategy for the results

In the case of destructive sampling, the following points must also be assessed by the NHMW:

- Proof of the researchers' specific expertise in the description of the respective method or the experimental protocol and, if applicable, the material to be sampled
- Are there any fundamental conservation and/or ethical concerns?
- Precise justification of why the respective analytical technique was chosen
- Appropriateness of the proposed methodology for answering the research questions
- Explanation of why the selected method cannot be replaced by a less destructive one
- With regard to the technical development of analytical methods, is it foreseeable that an equivalent but less destructive method could be available in the near future?
- Why are the requested samples or objects essential for the project?
- Has the object already been analysed using a comparable method?
- Possible location of the sampling point on the object, appropriateness of the number of sampling points and the amount of material per sample. This has to be seen with regard to the disparate relationship between the grade of destruction and the value of the information gained, as well as whether another test protocol may be sufficient with a smaller sample quantity
- Is the result of general benefit or in the public interest?
- Is there a concrete strategy for communication to a broad public (pursuant to Article 2 Paragraph 1–2 Federal Law Gazette II No. 399/2009)?

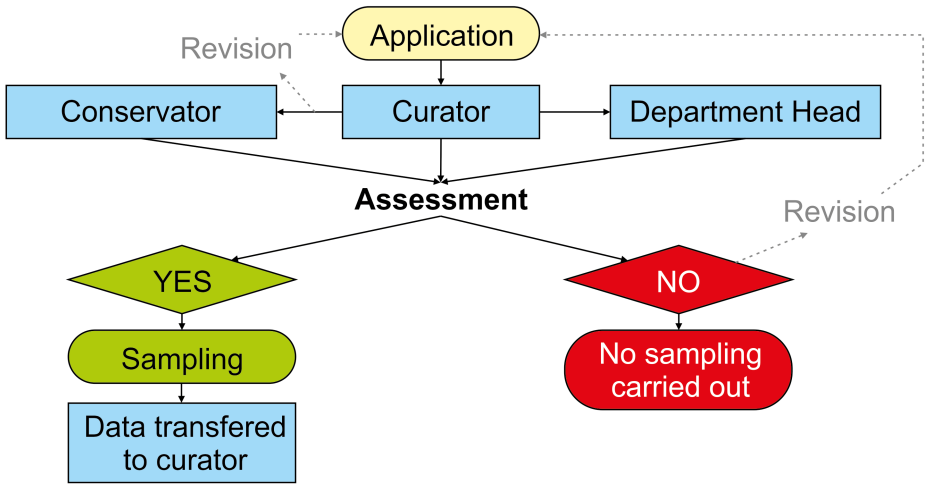

Figure 10: Flowchart for the evaluation of applications for the destructive examination of collection stocks; Graphics: Daniel Oberndorfer, Georg Tiefengraber & Andreas Kroh / NHMW

Overarching Agendas for the Research and Science Communication Activities at the Department of Prehistory

Overarching question of the Department of Prehistory:

"Humans and their relationships from prehistory to the Middle Ages and what we can learn from them today".

These are complex relationships that are studied on various levels for the entire period of early human history (the Department of Prehistory houses artefacts from around 300,000 BCE up to 1,000 CE). This is embedded in interdisciplinary research both within the NHMW and beyond with various research partners.

The most important research agendas are:

a) Human-Human Relationship
b) Relationship between Humans, Landscape, and the Environment
c) Relationship between Humans, Resources, and Technology
d) Relationship between Humans and Animals

The humanities, cultural, and social sciences have developed or adapted numerous theoretical concepts for researching human relationships. At least since Bruno Latour's work in the 1970s (most recent-

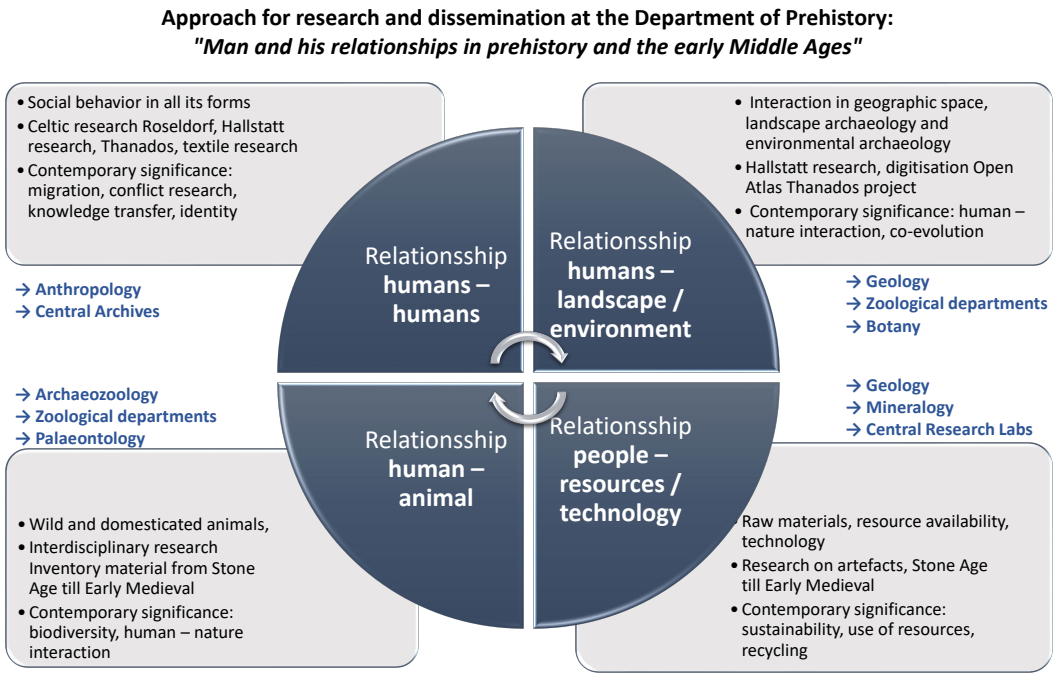

Figure 11: The overarching research agendas of the Department of Prehistory at the NHMW; Graphics: Karina Grömer / NHMW

ly in 2005), it has been evident that humans and non-human actors (environment, landscape, animals, artefacts, etc.) are interrelated and that objects also have "agency". The scientific study of the co-evolution of human societies, nature and technology (Schulz-Schaeffer 2012) is an important research desideratum of the Department of Prehistory. Researching these networks between human individuals, their environment, immaterial culture and material culture (Knappet 2011; Hodder 2012) as well as their significance and changes in meaning, makes it possible to visualize diverse networks of relationships.

Linking research to the Global Challenges and Sustainable Development Goals (https://unric.org/en/sdg-1/) is essential in order to highlight the relevance of research for today's societies. For almost a decade, the historical sciences, including archaeology, have also been dealing with the Sustainable Development Goals, with archaeology contributing to contemporary issues relating to the interaction of human societies and their complexity, resilience research, mobility and migration, integration, and human-environment interaction (see Kintigh *et al.* 2014). Reference was also made to the needs of contemporary societies, for example, in the redesign of the exhibition rooms at the Department of Prehistory in 2015 (*e.g.*, media stations on migration and identity; Kern 2018) as well as in various science communication activities and participatory activities of the department.

In its research agendas, the Department of Prehistory is making use of the entire spectrum of methods available to the discipline (Trachsel 2008) and thus cooperates closely with the other departments of the NHMW, with various national and international research partners, and specialised laboratories. The most important methods that are frequently dealt with, are mentioned in the discussions of the individual research agendas.

a) Human-Human Relationship

Humans as individuals and their relationships with other people – social behavior in all its forms – is one of the most fundamental research desiderata in cultural studies. In the absence of written records, for prehistoric periods archaeological research uses material remains as a source – be they archaeological finds (pottery, tools, jewelry, weapons, art objects, etc.), features (settlements, graves, deposits) or bio-archaeological analyses. They are all equally manifestations of human activity and interaction.

The humanities and social sciences have developed or adapted numerous theoretical concepts for researching human relationships (*e.g.*, actor-network theory: Latour 2005; Schulz-Schaeffer 2012). An important role is played here by "visual coding", *i.e.,* communication via people's outward appearance, which can be traced via material legacies (Wells 2008).

One focus is on individuals and their intrinsic personal characteristics (age, biological sex, geographical origin, ancestry, identity, *etc.*), which can be described, for example, through associated finds and bio-archaeological or anthropological analyses in cooperation with the Department of Anthropology and also with specialised analyses *e.g.*, on diet, pathologies, or DNA. In addition, the vertical social status of the individual within the context of its community is also of interest so as to answer the question of leadership and its emergence, maintenance,

and transmission. Grave goods and grave construction – but also other immaterial characteristics that can be traced archaeologically (such as the effort involved in constructing a grave) – provide information on this. It is also about the horizontal relationships between individuals and the properties of social systems in relation to each other.

Numerous models from sociology as well as cultural and social anthropology are applied to specific questions in archaeology, for example, in order to understand the transformation of human society in a neo-evolutionary sense from egalitarian systems to ranked societies, to stratified societies and even states (*e.g.*, Fried 1967; Service 1977).

The basis for this is the analysis of the economic and social networks of human societies throughout the ages. Trade, exchange, and the movement of people (migration) are also indicators for our understanding of human patterns of action and relationships, as is the complex system of chronological sequences or spatial distributions of cultures and interactions of groups of people. An important role – especially in prehistoric research – is played by the creation and transmission of knowledge, the question of the penetration of specific technologies/knowledge within certain areas or within a society.

European history, including that of the Danube region, has been characterised by conflicts, the most visible legacies of which are weapons, fortifications, horizons of destruction, and anthropological evidence of violence.

Studies on early social behavior are conducted both through the analysis of cemeteries (*e.g.*, depiction of social hierarchies based on grave furnishings) and through research on pictorial sources (statuettes, paintings, situlae, etc.). From the latest phase of the Iron Age and in historical archaeology, written sources can also be used. The relationship between people is also expressed through clothing and visual identities, as human appearance is based on strong aspects of non-verbal communication that provide information about gender, age, or group affiliations. Studies on this are carried out as part of textile research at the NHMW (Grömer 2019 and https://www.nhm.at/en/research/prehistory/research/textile_research).

Human relationships are also investigated, for example, in Celtic research at the site near Roseldorf (Holzer 2018 and https://www.nhm.at/roseldorf), in research at the salt mines and burial sites in Hallstatt (Brandner *et al.* 2022 and https://www.nhm.at/hallstatt/en/hallstatt), and in the THANADOS project (https://thanados.net), in the latter case through the analysis of Iron Age and Early Medieval burial sites.

Global challenges: Today's topics of migration, conflict research as well as knowledge transfer and the appropriation of knowledge play a role in the human-human relationship.

b) Relationship between Humans, Landscape, and the Environment

This network of relationships focuses on humans and their interaction within geographical space and with their environment. Landscape archaeology and environmental archaeology, as well as research into economic and social systems (Renfrew & Bahn 2004), are the essential basis on which further questions are based. How do people use the geograph-

ical space available to them? Which landscape features are used or perhaps also avoided (*e.g.*, certain alpine areas) in different periods of time (*e.g.*, during the Ice Age, by early farmers, by the Celts, in early history)? What explanations are there for this behavior, *e.g.*, accessibility, time-specific mobility patterns, specific features of a landscape, certain resources, climatic options, cultural taboos, or religious beliefs?

What can be deduced from the traces of human activity within a certain area of land? Where, for example, were settlements and burial sites established within a certain time period? What are the settlement structures, the spatial placement of settlement – burial site – place of worship, etc.)? From the point of view of archaeological research, there is cooperation needed with the biological sciences and geo sciences.

Modern landscape archaeological research (Doneus 2013) makes use of many methods, such as surveys, excavations, geo-radar, aerial archaeology, lidar measurements and mapping of archaeological sites. In addition to settlement and landscape archaeology, environmental archaeology (Bork *et al.* 2011) is primarily characterised by research into how humans interact with their environment as well as their reactions to risks, stress and disasters (*i.e.*, the more complex perspective of interaction between humans and nature).

In particular, the research carried out on the site Hallstatt and its surrounding area (Brandner *et al.* 2022; Kowarik 2020) is strongly based on the principles of landscape and environmental archaeology. The large-scale data collection on landscape archaeological reference systems of human networks is also part of the Open Atlas database system, which shall be used by the Department of Prehistory in the long term.

Global challenges: The human-environment relationship is one of the most pressing issues facing society today.

c) Relationship between Humans, Resources, and Technology

The topic of resources and technology is the basis of any study of archaeological material, be it in the scientific analysis of artefacts from the time of the Venus of Willendorf to the Middle Ages, from graves and settlements to textile research. One particular site with a specific resource – salt – is Hallstatt.

The theoretical concept of the *"chaîne opératoire"*, primarily introduced by André Leroi-Gourhan (1945), is essential for understanding prehistoric and early historical societies. It describes the process from the extraction of raw materials through all stages of production (including the tools, groups of people, and resources involved) to the finished product and its use. The research agenda "Humans, Resources, and Technology" is applicable to every group of raw materials used in past societies (clay, metals, stone, glass, animal-based materials, plants, *etc.*). An important part of the traces of human activities that can be studied at the NHMW are artefacts. In addition to their classification by form and typology (for their chronology: using typological sequences and C14 dating), it is important to have a basic understanding of the materials used in certain time periods, the production techniques, and the information that can be derived from them. The methods of experimental archaeology (Hurcombe 2004) are also important here, as they provide valuable information on the *châine opératoire*.

Classic studies on resources and technology (Steurer *et al.* 2010) include questions on the origin of raw materials, such as which resources are available in different geographical areas and how they are brought to other areas. To this end, a variety of instrumental methods (*e.g.*, SEM-EDS, ICP-MS, isotope analyses, etc.) are used to analyse the material composition of artefacts, to investigate the origin of raw materials and to determine trade routes. Moreover, research is carried out into the regional availability of resources (including possible monopolies in certain regions) drawing on methods and techniques from landscape archaeology. Special analyses, for example on textile finds, include dye analysis using high-performance liquid chromatography.

The perfectly preserved artefacts from the prehistoric salt mines of Hallstatt hold great potential for scientific analysis. Detailed questions regarding the use of wood can be investigated in cooperation with the University of Natural Resources and Life Sciences. High-precision dendrochronological data provide key information on prehistoric salt production and the use of resources.

The patterns of use within a society are also interesting. What is used? How is it used? By whom is it used? Various properties of a material (whether copper, iron, bone, ivory, amber, wood or wool) and the use or non-use of certain materials are also analysed. This allows researchers to draw conclusions about aspects such as the level of technological knowledge, trade relations, aesthetic preferences, and taboos within a society. Topics such as producing waste vs. complete use of all components (*e.g.*, in the case of animals) and recycling are also important focal points. Contextual research also plays an important role. For example: Where and in what contexts we find evidence of recycling? What does this mean? What are the motivations behind it?

Global challenges: One of the sustainable goals today deals with the issue of resources and sustainability. The topic of recycling is also important.

d) Relationship between Humans and Animals

Wild animals and domesticated animals (in Central Europe livestock farming began around 5,600 BCE) are important components of human societies. The human-animal relationship is a fundamental one, as animal as well as plant-based food has played an important role in human subsistence since the beginning of mankind's history – and continues to do so today. Among the most important questions concerning past societies is research into when certain animals have been available to be used as food or for other aspects *e.g.*, as a supplier of other raw materials such as bones, sinews, furs, etc. It is also of interest, if they have been consumed for food at all (or have there been certain taboos not to eat specific animals) and how they were handled (hunting, breeding, dissection techniques, preparation methods, etc.).

In addition to the aspect of the animal as a source of food, a new aspect was added from the beginning of the Neolithic: the animal as a worker and as a companion – even if the wolf had already been domesticated earlier. Animal labor in agriculture was just as important for the further development of human societies as the horse was later for transportation of people and goods. As well as expand-

ing the travel radius of people in certain time periods, the use of animals for transportation also had a strong influence on research fields such as warfare (mounted warriors, social element, further development in weapons technology, etc.). Among other things, the status of animals in human thought, including in religious and ritual terms, and the changes in the spiritual relationship between humans and animals are of interest to researchers.

Interdisciplinary research in zoology and archaeology is not only based on the analysis of animal bones using various analytical methods such as ZooMS, but also with pictorial and written sources, evidence of animal remains in settlements/graves, *etc*. Within the NHMW, the intensive cooperation with the First Zoological Department (Archaeozoology Division) is of key importance (Mikschi *et al*. 2023).

Future Prospects for Research and Science Communication at the Department of Prehistory

Research

Long-term research activities are based on the collections and the focal regions and periods of the department, as mentioned at the beginning, with interdisciplinary approaches carried out in relation to the overarching research questions. Research work at the Department of Prehistory includes excavations (long-term: Hallstatt salt mine and burial site) as well as artefact-based studies and scientific analysis.

One of the strengths of the Department of Prehistory lies in its interdisciplinary approach. The department is interlinked with all other departments of the NHMW due to the diversity of objects collected during archaeological excavations (both man-made artefacts of various raw materials as well as animal and plant remains, human skeletal remains, minerals, and diverse stone material), the corresponding pictorial and written documentation of the observations made during the excavations, and the archival material that is important for research. This also applies to the technical infrastructure required as present at the Central Research Laboratories of the NHMW (scanning electron microscopy, MicroCT, DNA laboratories, etc.). These long-standing collaborations and joint research projects shall be continued and even intensified in future, together with other national and international research partners, for example as part of the HEAS research consortium (https://www.heas.at/), universities and the Academy of Sciences, Austrian Archaeological Institute.

Another important area of research is experimental archaeology (Hurcombe 2004), which has been carried out by various members of the department for decades and covers a wide range of aspects. Experimental archaeology contributes to the understanding of individual technological production processes (*e.g.*, bronze casting, prehistoric weaving techniques), the creation of archaeological features (*e.g.*, cremation experiments) or the simulation of complex systems (prehistoric salt mining in Hallstatt) and also serves to study social interactions (visual effects, soundscape, and body language in prehistoric clothing). Experimental archaeology is also an important tool in the science communication activities of the NHMW.

Citizen Participation and Citizen Science

Since the 19th century, cooperation between scientists and interested laypeople in the field of archaeology has contributed to public awareness of our cultural heritage. The research and curatorial activities of the Department of Prehistory have long relied on citizen participation, interactive events, and citizen science in coordination with the Citizen Science Strategy of the Natural History Museum (Schmid *et al.* 2023). This encompasses the entire research workflow and includes the collaboration of volunteers in the restora-

tion of objects for research (*e.g.*, https://www.nhm.at/en/research/prehistory/get_involved/processing_excavation_finds), as well as participation in research processes and the development of scientific questions (*e.g.*, https://www.nhm.at/en/research/prehistory/get_involved/weaving_techniques) or the public presentation of research results (https://www.nhm.at/en/research/prehistory/get_involved/publication_activities).

Digitisation Processes

The Department of Prehistory at the NHMW had been among the pioneers in the field of digital archaeology and digital humanities. These include the Montelius Image Database (Stadler 2005) and the Winserion analysis software, which decades ago laid important foundations in the field of digitisation. In line with the NHMW's Open Science Strategy (Vohland *et al.* 2022), special consideration is being given to three specific pillars, that will also be continued in the future:

Open data/open content: The public communication and provision as well as visualisation and presentation of digital data and content without any access restrictions. This includes research data as well as popular content (*e.g.*, https://thanados.net or https://bitem.at; Eichert 2021).

Open source: Software development of tools for use across the entire spectrum of archaeology (*e.g.*, https://openatlas.eu or https://github.com/nhmvienna/OpenLidarTools)

Open science: The scientific study of prehistoric and medieval sources using digital technologies. This includes GIS analyses, network analyses as well as machine learning and artificial intelligence.

The use of open and established standards in both the technical and conceptual sense (*e.g.*, CIDOC CRM, IIIF), the provision of well-documented interfaces and export formats (Restful API, JSON-LD, XML, RDF), and the licensing of data and content under Creative Commons licenses enable excellent compatibility with the FAIR principles and the embedding of departmental data in European and global projects (https://portal.ariadne-infrastructure.eu/search?q=&contributor=THANADOS) and as linked open data in the Semantic Web

Inventory materials from the Department of Prehistory are also the subject of large-scale digitisation activities, such as the *"Kulturerbe digital"* projects 2024/25, and are visible via the *"Kulturpool"* (https://kulturpool.at/en).

Science Communication

The department's educational activities are very diverse and are constantly being expanded. The research activities are presented to the **general public** by members of the department through exhibitions, lectures, press work (radio interviews, television interviews, blogs, newspaper interviews, podcasts, YouTube videos #NHMfromhome, Instagram appearances, etc.).

As part of the radio/podcast format "The Archaeonaut", Johann Rudorfer swaps his usual role of interviewee for that of interviewer. Thanks to his background knowledge, he is able to ask well-informed questions in order to make complex specialist knowledge accessible to a wide audience. With three radio stations in Upper Austria, Styria and Vienna, he has a potential listenership of around 2 million people. He strives to use the medium of radio to reach people who have so far had little or no interest in archaeology.

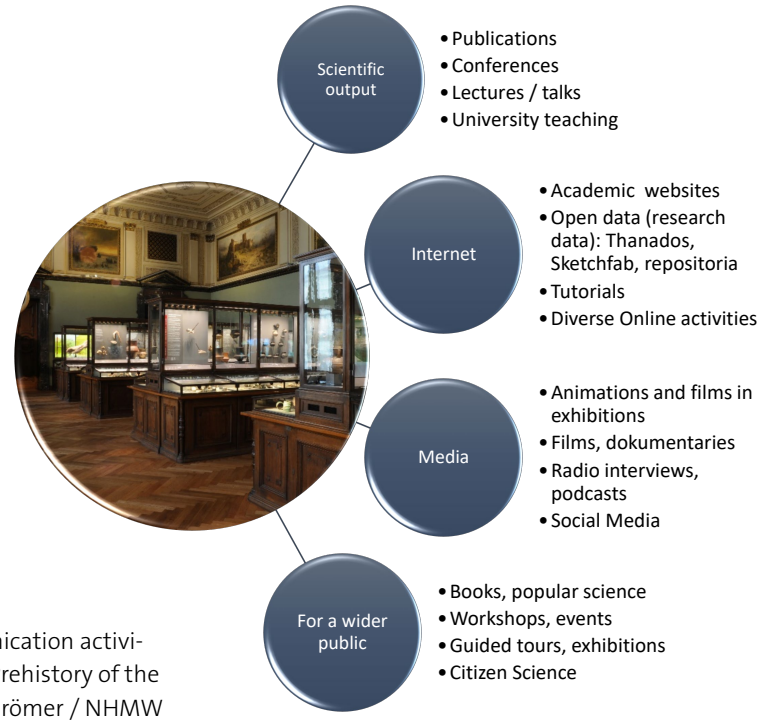

Figure 12: Science communication activities at the Department of Prehistory of the NHMW; Graphics: Karina Grömer / NHMW

Research content is also communicated in events (*e.g., "Archäologie am Berg"* – "Archaeology on the Mountain", Long Night of the Museums, historical fashion shows, etc.) and as part of Young Science Ambassador activities and internships for interested pupils, with repeated reference to the Sustainable Development Goals. In the various activities, great effort is attached to communicating research content in an understandable way, also being aware of inclusion and participatory elements. In the future, events such as summer schools, for example at Hallstatt, are also planned.

For academic exchange within the scientific community, the staff members of the Department of Prehistory are involved in research collaborations, publications, conferences, and teaching at various universities (University of Vienna, Brno, Ljubljana, Prague, etc.). The **academic exchange of knowledge** also includes the supervision of visiting researchers and students who are conducting research on materials from the Department of Prehistory as part of their academic work.

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