



colours of Hallstatt

Textiles connecting Science and Art





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Cover illustrations:
(top) Christina Dörfler, Wandering Tribe. (Photo: C. Dörfler)

(bottom) Iron-Age rep fabric from the salt mines at Hallstatt, Halltex 100.
(Photo: NHM Vienna)

Inside cover:
Hallstatt tablet-weaving. Graphic design: Anna Moser, patterned after a
sketch by Karina Grömer and partially altered by Anna Moser.

colours of Hallstatt

Textiles connecting Science and Art

Exhibition in the Natural History Museum Vienna
February 1, 2012 – January 6, 2013

Archaeology



Art



Natural Science



Research project with the support of the Austrian Science Fund (FWF, Translational-research-program): [L 431-G02]
“Dyeing techniques of the prehistoric textiles from the salt mine of Hallstatt – analysis,
experiments and inspiration for contemporary application” (2008 – 2012)





BÄREN
TRAUBEND.

Andrea Liebl, „immerse · fade · connect“.

Pieces of linen dipped in a bearberry leaf tea; card from a compendium of 377 colour samples.

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Our colourful world

Univ.-Prof. Dr. Christian Köberl

Director General of the Natural History Museum Vienna

Colour plays an important part in our world and our perception of it. The development of the human eye and its photoreceptor cells in particular bear witness to an interesting aspect of evolution. Our ability to see what we see has not come about by chance. Only some electromagnetic radiation – which includes, with increasing wavelength, X-rays, ultraviolet radiation, the aptly named visible light, infrared radiation, and long-frequency radio waves – can penetrate the Earth's atmosphere. The most important among these “windows” is the visible light. Even if our eyes were sensitive to infrared or ultraviolet radiation – which they are not – we could not see very far in these wavelengths because of the limited transparency of the atmosphere.

In other words, biological evolution has caused humans to see exactly those colours, from blue through green and yellow to red, for which the Earth's atmosphere is transparent. It is these colours that have fascinated man from earliest times, and that can sometimes convey particular associations. Recently, evidence was discovered in a Stone Age cave in South Africa of 100,000-year-

old dyes produced and used decoratively by early man. Twenty to thirty thousand-year old drawings of animals and humans in Stone Age caves demonstrate the fascination colour held, even under difficult conditions. The elegant white temples of Greece as we know them today were originally painted in bright colours. Thus it is natural that various pigments were also used to dye clothing from early times. Among the first finds of this kind are the 2,500-year-old dyed textiles that have been preserved in the salt of the prehistoric mines of Hallstatt. Not only do these samples form the basis of multiple interdisciplinary research projects, they represent inspiration for fashion designers of today.

The “colours of Hallstatt” exhibition is the culmination of cooperation between artists and scientists and of the collaboration between the Natural History Museum and the University of Applied Arts. Precious archaeological material was studied jointly by scientists and artists. From this grew a project that would inspire an enterprise in the field of modern textile art: a further example of the interconnections that inform the disciplines of art and science.



*Iron Age woven cloth from the Hallstatt salt mine, Halltex 30.
(Photo: NHM Vienna)*



Brigitte Zaussinger, Shroud. (Photo: Peter Hoiss)

Communication > Interaction > Innovation

Dr. Gerald Bast

Rector, University of Applied Arts Vienna

We are living in a world in which fixed boundaries are becoming increasingly blurred, a world in which apparent differences converge and force us to redefine traditional patterns of thought and behaviour. Since the discovery of quantum mechanics, if not since well before that, the natural sciences have taught us that the truly decisive physical forces do not develop along a straight timeline of calculable causalities. Contrary to popular opinion, vagueness, once attributed to the emotional realm, is in fact a scientific, even a natural-scientific dimension. Inversely, the arts could not possibly have advanced, and still couldn't today, without an input of scientific insights, technological innovation and an adequate social environment; the development of perspective in painting, photography, film, concept art, digital art, bio-art and social design are only a few examples of this.

With increasing systemic complexity, innovativeness, whether artistic or scientific, stands in a significant relation to cross-boundary communication. The ability to build both in theory and in practice synergetic bridges between different disciplines, systems and institutions and to cross these bridges without losing the

sense of one's own core competence is an essential indicator of a person's innovative capacity.

The University of Applied Arts Vienna, nationally and internationally recognized as one of the most important and innovative institutions in the artistic-creative sector, seeks the challenge of interdisciplinary communication and institutional cooperation both in teaching and in artistic and scientific research. The Hallstatt project in collaboration with the Natural History Museum Vienna is convincing proof of the enormous potential of cooperation between the arts and the sciences. The present publication also proves that cooperation between institutions can be a factor of success – not only as far as the artistic and scientific work itself is concerned, but also in the sense that universities of the arts and museums alike, in order to be successful, must be willing to accept the challenge of communication and interaction with the public. Only by doing so can they have their impact in a world where constant change and a short span of attention have become the rule.

Recognition and Invention

Univ.-Prof. Mag.art. Barbara Putz-Plecko

Vice-Rector of the University of Applied Arts Vienna

What we call reality is not something we discover, it is something we invent.

Every experience of certainty proves in the end to be an individual phenomenon that is blind to the cognitive acts of others. ⁽¹⁾

We picture facts to ourselves. A picture is thus a model of reality. ⁽²⁾

Receptive sense organs and adequate tools, perseverance and flexibility in the search for knowledge, the ability to develop passionate interest and to ask the right questions, a sportive sense of pleasure and joy in experimentation, audacity balanced by prudence, a capacity for reflection that orders insights, gives foundation to learning processes, provides knowledge and fosters development – all of these are requisites in the practice of the arts and sciences. And yet, in the end, the artist and the scientist go about their business of exploring, discovering and constructing the world in different ways.

The project presented to you here profits from these affinities but also from the differences between the disciplines, from their respective specificities. The work on display evinces a great variety of approaches and methods and conveys some of the logic of each

discipline, and at the same time it constitutes in its entirety a network of interconnections and transformation processes.

Both the artist and the scientist have provided us here with pictures, objects and commentaries – elements of construction or reconstruction, but also ways of relating to the objects found at Hallstatt and to the realities that can be deduced from them.

Every (historical) object is embedded in a context and can be perceived and interpreted on various levels. In each given case the context allows us to establish connections between the separate pieces and to find coherence and meaning.

The variety of approaches to the work in this project, the themes chosen and the treatment of material reflect the multileveled nature of this object-experience and object-analysis.

This artistic-scientific encounter has produced a response to the Hallstatt culture that connects it quite remarkably to our own culture today.

⁽¹⁾ Humberto R. Maturana, Francisco J. Varela, *The Tree of Knowledge*

⁽²⁾ Ludwig Wittgenstein, *Tractatus Logico-Philosophicus*, 2.1

Dyeing techniques of the prehistoric Hallstatt textiles

AProf. Mag. Dr. Regina Hofmann-de Keijzer
co-ordinator of the FWF-Project

Many conditions had to be fulfilled for the realisation of this international research project. The coloured textiles from the Bronze Age and the Iron Age could only be examined because they were used in the salt mine of Hallstatt and survived there in the salt for up to 3500 years. Thanks to the archaeologists of the Natural History Museum Vienna it is possible to observe and analyse these textile objects. The dyes analysed in the prehistoric Hallstatt textiles allow us a glance into the origins of textile dyeing. These analyses were only possible because in our time chromatographic techniques have been developed that enable us to determine dyes in small fibre samples.

Dr. Anna Hartl conceived the project of transforming the prehistoric dyeing techniques into our modern time. Dyeing experiments and experiments in textile-archaeology led to replication

of ribbons from the Hallstatt Culture made of hand-spun yarns, dyed with natural dyes. The prehistoric objects, the dyeing and weaving techniques inspired students of the University of Applied Arts Vienna to create artistic works.

This project could only be realised because many people contributed enthusiastically to the interdisciplinary dialogue with their knowledge, ideas and experience.

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Hallstatt Textiles and Textile-Art-Research

Peter Bichler President of the Austrian Society for Textile-Art-Research (TKF)



In 2012 the Austrian Society for Textile-Art-Research (TKF) will celebrate its 30th anniversary and it is therefore an honour to be able to assist in the organization of the 2nd International Symposium on Hallstatt-Textiles “3000 Years of Colour – from Tradition to Art and Innovation”.

The prehistoric textiles of Hallstatt can be regarded as some of the oldest textiles in the world. Since 150 years archaeologists excavate these fragile remains under most extraordinary circumstances. Presently the team of the Natural History Museum Vienna are tracing the old, prehistoric shafts of the old salt mines in search for the artefacts firmly encrusted in rock salt. This laborious research takes them deep into the mountains of Hallstatt often hundreds of metres below ground.

Before the TKF, the Natural History Museum Vienna and the University for Applied Art Vienna organized the first Hallstatt Textile Symposium in 2004 only a relative small group of experts were aware of the significant importance of these rare finds. Inspired by the results of the first symposium further research was carried out which enables us now to open a window into the past and gives us a glimpse what life over 3000 years ago must have been like. Not only do we know how the people dressed and what kind of patterns they donned, we also know what kind of wool they used, what spinning and weaving implements they worked with, the colours of their clothes and what kind of dyes they used. All this new evidence will form the basis of the 2nd International Symposium on Hallstatt-Textiles and its special theme “3000 Years of Colour – from Tradition to Art and Innovation”

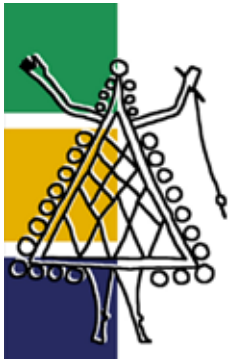
When we are confronted with a traditional textile we notice that three important components will catch our attention and perception: the pattern or ornament, the material or structure and probably most important the colouring. Knowledge and experience lead us to compare the visual impression with what we consider

as traditional, original or important. Most likely it will be the colour which will be the judge if we are able to regard the textile as aesthetically pleasing. This knowledge of the importance of colour drove craftsmen throughout thousands of years to constantly implement, develop and refine the process and the art of dyeing. Due to the fact that the Hallstatt textiles were left in the old salt mines, totally encrusted in rock salt and therefore being spared any exposure to oxygen or sunlight they are in a surprisingly good state of preservation. It is evident that during the 3000 years some process of corrosion and alteration of the wool and of the colouring has occurred. A unique research project funded by the Austrian Science Fund (FWF) enabled the co-operation between the Natural History Museum Vienna, the University of Applied Art Vienna, the University of Natural Resources and Life Sciences Vienna (BOKU) and the Cultural Heritage Agency of the Netherlands (RCE) to trace and re-construct the complex methods used in the past for dyeing yarn or the fabric as a whole. This data enables us to discuss these long forgotten methods at the 2nd International Symposium on Hallstatt-Textiles.

The aim of the 1st symposium was to involve and inspire students in the field of research of archaeological textiles and their conservation. This symposium tries to target the creative side of the students of the University of Applied Arts. Colour and fabric of the ancient Hallstatt textiles are the source of inspiration that will lead to a Fashion Performance and the exhibition “colours of hallstatt | textiles connecting science and art”.

A further, remarkable dimension of the symposium will be based on the studies carried out at the BOKU in the field of natural dyes and dye plants. This re-gained knowledge about the use of sustainable and environmentally friendly dyes can be regarded as a valuable implement in the present search for a fairer and environmentally conscious production of textiles and garments.

International Symposium



3000 Years of Colour from Tradition to Art and Innovation

2nd International Symposium on Hallstatt-Textiles
Natural History Museum Vienna, 21st - 23rd of March 2012

*3000 Years of Colour – from Tradition to Art and Innovation
2nd International Symposium on Hallstatt-Textiles*

Natural History Museum Vienna, 21st – 23rd of March 2012

Registration and information: <http://3000yearsofcolour.nhm-wien.ac.at>

As a result of the three-year research project ‘Dyeing Techniques of the Prehistoric Hallstatt textiles’, supported by the Austrian Science Fund (FWF, [L431-Go2]), the second international symposium on Hallstatt textiles has been organized. The theme of the symposium is “3000 Years of Colour – from Tradition to Art and Innovation”. The program offers a colourful spectrum of research and art, presented in cooperation with the University of Applied Arts Vienna, the University of Natural Resources and Life Sciences Vienna, the Austrian Society for Textile-Art-Research and the Cultural Heritage Agency of the Netherlands.

Hallstatt in Upper Austria is known for its prehistoric salt mines. The climatic conditions in the mines are such that organic materials were preserved for more than 3000 years, among which the oldest dyed textiles of Europe, from the Bronze Age (circa 1600 – 1200 BC) and the Early Iron Age (Hallstatt Culture, 850 – 350 BC).

At the symposium scientists and artists give an insight in the unique world of the prehistoric textiles and their colours. The tra-

ditional use of the colours from nature for dyeing textiles and the today’s meaning of these dyeing materials are presented and discussed. A scientific team worked for some years to investigate prehistoric textiles and their dyeing techniques. They analysed dyes and fibres from the Hallstatt textiles, they collected dye plants as reference material, grew dyer’s woad and performed dyeing experiments. They also did textile-archaeological experiments and made reproductions of Iron Age ribbons. Students of the University of Applied Arts Vienna were inspired by the prehistoric textiles, colours and motives in making modern art objects.

The three-day symposium presents lectures on these themes, a Fashion.Performance and guided tours in the exhibition of the Natural History Museum Vienna „hallstattfarben | Textile Verbindungen zwischen Forschung und Kunst“ (Colours of Hallstatt | Textiles connecting Science and Art) and in the textile collection of the Papyrus Museum in Vienna.

Fashion. Performance

Thursday, March 22, 2012, 7:00 P.M.

Cornelia Bast: Freeze - Thaw

Christina Dörfler: Wandering Tribe

Prehistoric Hallstatt

Anton Kern

Not many places can claim, amidst the various strands of Europe's eventful ancient history, to have an entire cultural era named after them. It was salt and not iron that was behind the naming of this early Iron Age epoch from 800 to around 400 BC. A narrow valley, high above the diminutive location of Hallstatt at the south-western shore of Lake Hallstatt, saw the opening of the one of the most fascinating of chapters in prehistory.

The research history

In 1846, the honour of laying the foundation stone for subsequent research activities went not to a prehistorian, but to the local salt mine's chief of mine working. Under the direction of Johann Georg Ramsauer, almost 1,000 graves had been uncovered by 1863. As would be established later, their dates spanned the entire Hallstatt culture period of approximately 400 years. Ramsauer documented and described each of the graves as well as its particular condition and the circumstances of discovery. He had drawings made of many of the graves; these were subsequently rendered in watercolour. The material, a valuable record of the moment of discovery of the burial ground, has to a large extent been preserved for researchers of prehistory. In the decades after Ramsauer's work, excavation carried on and a further 400 graves were uncovered. Alongside the work at the cemetery, Ramsauer carried out the first archaeological investigations in the mines too.



"Cremation graves in shallow clay pans, – Watercolour", watercolour sketches of particular cremation graves at the Hallstatt cemetery, a unique portfolio documenting the work of J.G. Ramsauer and colleagues. (Photo: NHM Vienna)



Newly uncovered graves at the Hallstatt burial site in the 1990s. (Photo: NHM Vienna)

The Natural History Museum of Vienna has been closely linked to the work at Hallstatt, with the first director of the newly founded institution, Ferdinand von Hochstetter, starting the research activity at the Hallstatt burial site in 1877. From this time onwards, the link has been rewarding, as can be seen from the 50 years of investigations in the prehistoric mines. The most recent work at the burial site, as 'late' as 1993, began with a salvage excavation on the northern edge of the famous cemetery. Between that year and 2011, regular excavations have brought 100 new graves to light.

Together with the archaeological work in the mine, the activities at the prehistoric burial site represent a very important aspect of the research of the Department of Prehistory and both have resulted in the establishment of a field office in the former forge at the site of the mine.



From an artist's impression of a burial in the Hallstatt Hochtal. (D. Gröbner/ NHM Vienna)

The Hallstatt cemetery

Consisting of almost 1,500 graves, the Hallstatt burial ground is one of the largest of the Hallstatt culture. Individual graves crowd together in a confined space at the eastern end of the Hochtal (high valley). Some overlap across others, some are imposed over earlier burials; older graves were at times completely destroyed to make way for new interments.



The richly furnished cremation grave of a man. The attached tools may suggest he was an artisan. (Photo: NHM Vienna)

Evidence of two types of ritual, cremation burial and inhumation burial, are present in both earlier and later graves. The most common grave orientation is from west to east, with the skeleton supine, the skull looking towards the east. Some deviations occur with north-south orientations appearing, the head positioned to the east again. Newborn babies and small infants are buried as well as older children and adults; analysis of both adult and child skeletons reveals the signs of heavy mining and salt production work. It is possible to discern a certain social differentiation in the circumstances of burial. Compared to inhumations, the cremations were furnished more richly. A general comparison with other burial sites of the Hallstatt culture shows the graves of this site to be more “affluent”. Extensive grave furniture, at times featuring specific items, reflects the wealth or position the owner held in life. Some are luxurious objects, fashioned from rare and precious raw materials such as ivory, amber or glass.

has yielded no remnants of clothing. But woven fragments appear in conjunction with many swords and daggers made of iron, where the oxidation of the metal has preserved the woven material intact.



Iron dagger with ‘antenna’ shaped handle, approximately 600 – 400 BC. Cloth binding around the blade has been partially preserved due to rust. (Photo: NHM Vienna)



Ceremonial iron sword with carved ivory handle and amber inlay, 800 – 600 BC. (Photo: NHM Vienna)

The wealth displayed in the graves of the prehistoric Hallstatt people is solely attributable to salt. This treasure from the deep of the mountain defined the lives of the local people during the Hallstatt period, before that era as well as in later epochs. One of the tasks of the archaeologists is to investigate the unique conditions of human life in this far-flung place and to use the extraordinary legacy of both organic and inorganic artefacts to illustrate and reconstruct the story of the Hallstatt valley.

Only fragments of the original items are left however. Almost everything organic has decomposed and is lost. We know very little, for instance, of fabrics and the clothes from which they were made. Isolated finds from the graves of Hallstatt chieftains in other find spots testify to a wide range of valuable textiles and skilfully crafted items of clothing. The Hallstatt burial site itself

HR Dr. Anton Kern, Director of the Department of Prehistory of the Natural History Museum Vienna since 2001; head of excavations at the Hallstatt cemetery since 1993.

Oh shoe . . .

Racheli von Hofacker

When I first met you, you were only an idea. Oh shoe . . .

Racheli von Hofacker's journal reads like a sensitive, respectful story of a relationship, a devotion, filled with amazement, reflective, passionate and discreet. An emotional, delicate portrait of an object. In her mind she sees a shoe, she searches for it, she finds it in a black and white photograph, little by little, without ever actually meeting it, she gets to know it.

How simple these pieces of leather were, how quickly made, purely functional, quickly cut from rawhide or from the skin of a pig, wrapped around the foot and sewn together. And that was it.

Then the encounter. Its home is a drawer in the Prehistoric Department of the Natural History Museum Vienna. The shoe suddenly has a face, creased leather with plenty of life lived; it can tell a story, but just the remains of a shoe. So thin, so cold... How was it possible? With so much hard work to do? She walks in a circle around it, reconstructs it, puts it away, recognizes it in other objects. The hole in its sole intrigues her. Worn through from all the climbing of ladders and stairs? Using etching techniques, she produces a series of 38 pictures. The sole in movement – back and forth, the hole gets bigger and bigger, until the shoe finally disappears altogether. Temporarily? Perhaps. Because it stays on her mind. Its surface is now a silkscreen print on goatskin. “And – what next?” she asks.

Things are watching me, *les choses me regardent*. (J. Lacan)

Racheli von Hofacker is currently studying art and communicative practices and textile design in the art education programme of the University of Applied Arts Vienna (director of studies: B. Putz-Plecko). She has broadened the scope of her interests with parallel studies at the University of Vienna and the University of Natural Resources and Life Sciences, Vienna. She is also completing a training course in ceramics in Landshut, Germany.



Inspiration: Iron-Age leather shoes from the salt mines at Halstatt: the front part of the sole is visibly worn out (top left); archaeologists assume the shoe was used for climbing ladders and stairs in the mines; only rarely are the shoes worn down at the heel (photos right). (Photo at top right: R. von Hofacker; other photos: NHM Vienna)



Top three photos: silkscreen print on goatskin done with tannin and ferrous salts; traces of wear and tear on leatherhosen; shoe moulds. (Photos: R. von Hofacker)



Etching: Rachel von Hofacker

Hallstatt: Prehistoric mines

Hans Reschreiter

From the early Stone Age (5000 BC), salt has been an essential raw material because of its utility value in food conservation. Vital though it is, salt is not found everywhere: Hungary, Bohemia and Switzerland, for instance, have no deposits of this mineral. Places with viable salt reserves are thus all the more important. One such rare location is the Hallstatt Hochtal.



The narrow valley, 400 metres above Hallstatt, is unique in having salt beds that have been compressed and pushed to a position near the surface. Three thousand years ago, salt from this valley was most probably traded many hundreds of kilometres north, east and over the Alps to the south. (Photo: Aerial archive of the Department for Prehistoric and Early Historic Archaeology at the University of Vienna)

Everything the miners left behind millennia ago was preserved in the so-called Heidengebirge. The most common implements are the burned pine-wood chips that were used for lighting. (Photo: A. Rausch/NHM Vienna)



A gallery in 500 BC may have looked like this. Rooms of up to 20 metres in height and more than 170 metres in length were dug out. (D. Gröbner, H. Reschreiter/NHM Vienna)

Evidence of extensive below-ground mining of salt in Hallstatt has been detected dating as far back as the 16th century before Christ. Rock salt was carved out of beds in large 'rooms' using bronze picks. Broken work tools and daily objects that were no longer needed were simply left on the spot, so that, over the centuries in which the mines were operational, metre-high piles of detritus accumulated in these enormous mining rooms.

Thousands upon thousands of burnt wooden chips for lighting the mine galleries; broken picks and other tools that were no longer serviceable; pieces of clothing (fur and leather caps, fabric, shoes made of leather or skin); deerskin carrying baskets; cords and ropes made of grass and bast, and many more items were left in the mines.

Salt has preserved this prehistoric depository perfectly. Besides Hallstatt, such conditions exist only at the prehistoric mine at Dürnborg near Hallein.



Today, archaeologists from the Natural History Museum of Vienna construct galleries to plumb the depths of the prehistoric mines that have become buried over time. (Photo: A. Rausch/NHM Vienna)



*Pneumatic hammers are used to expose finds.
(Photo: A. Rausch/NHM Vienna)*

The many finds represent almost every step of the mining process, from breaking the salt loose with bronze picks to its transport out of the mine.

Research in recent decades has paid particular attention to the operation of the mines during both the Bronze Age (ca 1600 – 1200 BC) and the early Iron Age (ca 850 – 350 BC). For several centuries, mining activities continued without interruption and attained considerable size. Although the raw material was the same, there were fundamental differences in the mining and transport techniques of the two periods. They nonetheless share a high degree of mechanisation and a production process clearly based on division of labour.

The Bronze Age miners left many fragments of thick woollen material which appears to have been used as bags in which the mined salt was carried. As yet, no convincing explanation has been found for the hundreds of pieces of fabric that were discarded in the Iron Age. It seems likely that expendable textiles (clothing and domestic items such as blankets and cloths) were collected in the settlement, ripped up and taken to the mines. It is unknown what part these rags played in the work process before they were discarded.

Both Bronze and Iron Age mines were destroyed by catastrophic events.

Mag. Hans Reschreiter works in the Department of Prehistory at the Natural History Museum Vienna and has been head of excavations at the Hallstatt salt mines since 2001.



A way of seeing things

Cornelia Bast

Time transformations.

For Cornelia Bast, the point of departure was above all the fragmentary – the value of the small piece, no matter how small.

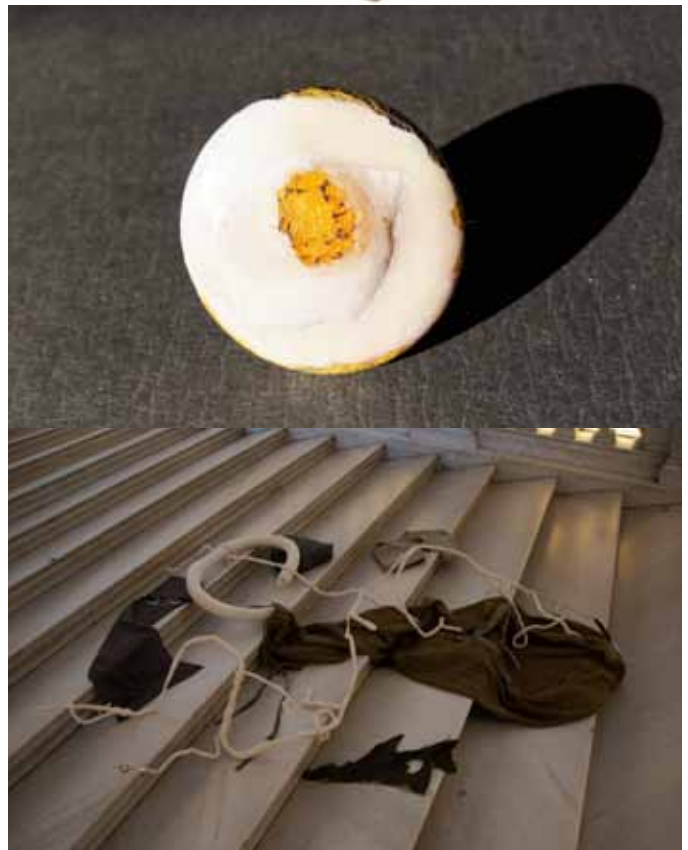
Hallstatt textile finds that give an idea of how precious fabrics once were because of the work and materials invested in their manufacture inspired her to construct coverings for the body combining old and new. The high regard that people in earlier times had for materials and for the things made of them as well as their ability to appreciate differently than we do today the relation between material value, labour and time available in one's life provided the initial stimulus for an artistic, associative interrogation: What does it mean to look at things? And just what constitutes value?

"Insight and transparency", "fixing in time and space", "ordering", "reevaluation" and "construction" as helpful notions for understanding the world around us are to a certain extent the leitmotifs of her work. The question of where best to place each individual part of the whole becomes a game of possibilities and meanings.

Cornelia Bast was professionally trained as a biochemist and midwife with supplemental training in hypnotic communication. She is currently studying "applied arts and design communication" in an individual bachelor's study programme at the University of Applied Arts Vienna.

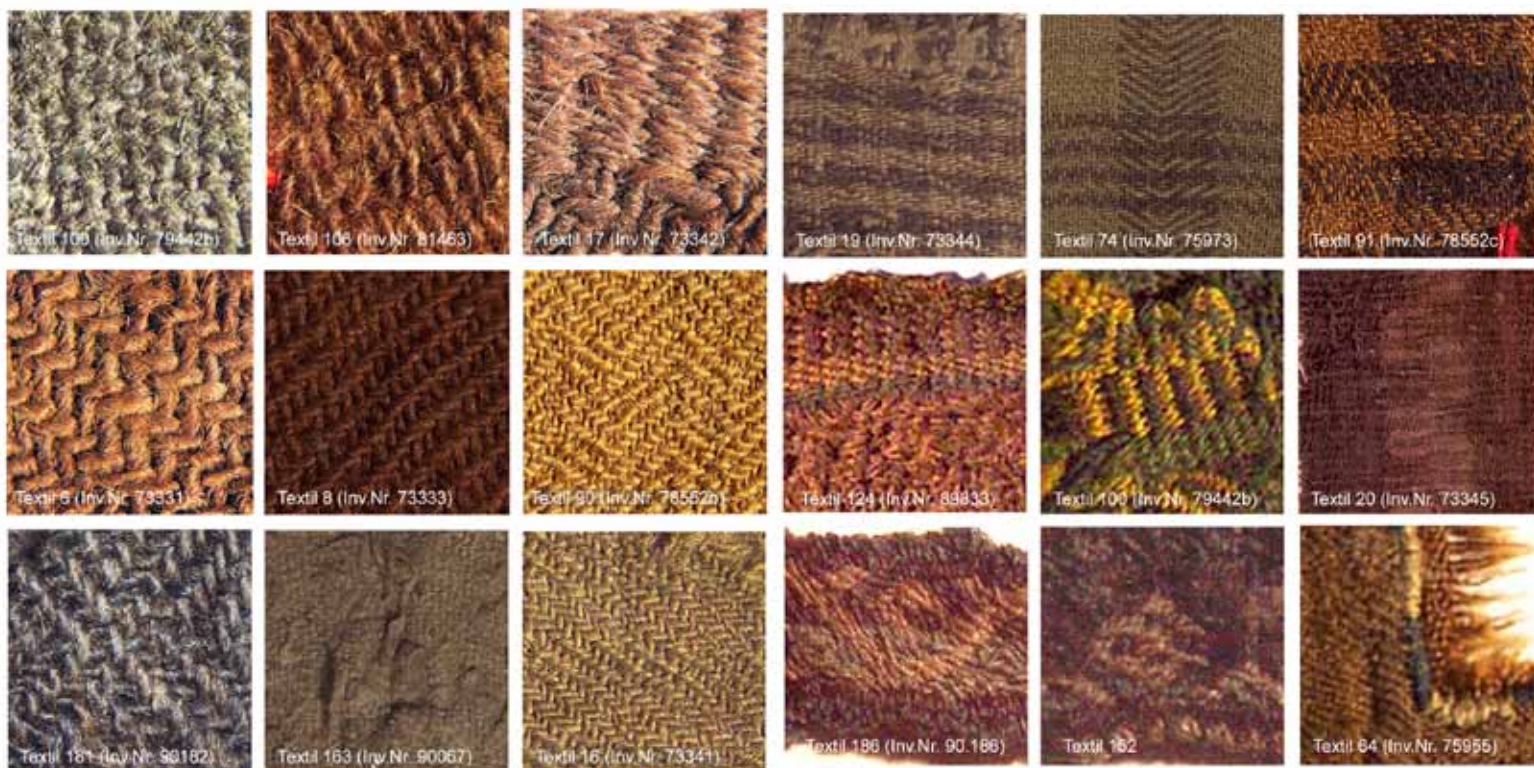


Inspiration: (top) Hallstatt textiles stored in the repository of the Natural History Museum, contents of one of the drawers. (bottom) Bronze sheet metal with animal motifs, from the burial site at Hallstatt (Photos: NHM Vienna)



From top down: Trekking Collection, all components; ready-made piece from Trekking Collection; knight's satchel; element for a fastener, designed for the collection "Time Transformations", design: C. Bast; body extensions: felted material and appendages with cutlery attached and ready-made pieces from Trekking Collection (All photos: C. Bast)





Textiles from Hallstatt. (Photos: A. Rausch /NHM Vienna)

The textiles of Hallstatt. Unique finds!

Karina Grömer and Helga Rösel-Mautendorfer

Remnants of textiles found in the Hallstatt salt mines can be traced back to the period from 1500 – 350 BC. They provide material for researching the high quality handwork of our ancestors. Interestingly, even at such an early date, all the major spinning and weaving techniques had been developed that are still used today, albeit on more modern equipment.

Most textiles recovered by archaeological excavation are not preserved intact. During their use in prehistoric times, parts might be torn off and materials would wear thin and rub away. If cloth were left on the ground, whether discarded, lost or deliberately disposed of, microorganisms would have caused its decomposition. Only where special conditions prevail, such as ice, salt, or peat bog, organic material can survive. The excellent conditions of the prehistoric mines of Hallstatt in terms of preservation of organic material mean that we can glimpse a world that existed 3,000 years ago - something that most archaeological excavation sites do not afford. Textile remnants have a particular rarity value.

The fabrics from the salt mines are mainly woollen, and some are of extraordinarily fine quality. These valuable articles were woven on warp-weighted looms that could produce not only a plain tabby (see above, first picture of top row) but more complex weave constructions including various twills. The most popular at Hallstatt is the even-sided twill (above, first image on second row). Less common are pointed twill (third from left on second row), herringbone twill or basket weave.

An interesting and sophisticated pattern was applied to some simple twills. In this pattern, the simple twill was varied by alternat-

ing groups of S- and Z-spun threads. The resulting weave gives the optical impression of a pointed twill: depending on the angle of light falling on the fabric, some stripes appear darker than others. The leading edges of the fabric are often in a rep weave to achieve extra robustness. Rep is also applied in the manufacture of braids that can form part of grid weaves. The rep braids (similar to today's costume ribbons) are sometimes executed in several colours. Evidently, people of the Hallstatt period prized coloured ribbons as a facing for the edges of woven fabric: this is evidenced by some fine examples of tablet weaving. One sample was apparently attached on a sleeve.

The Hallstatt weaver was familiar with the dyeing of thread or finished fabric in colourful shades of blue, yellow, green, red and brown. Natural shades of sheep's wool, from white through brown to black were also deployed in their designs. This fondness for using colour is particularly effective in striped and 'plaid' patterns, created using coloured warp and weft threads.

There are many examples of sewn work in Hallstatt. Some evidence of methodical tailoring derives from as early as 700 BC. Hems and seams were deftly executed: we can admire impressive stitching in blue and white. Patches applied with varying levels of care tell us about the value of cloth in ancient times. Repairs carried out, sometimes with very thick threads, testify to the need to quickly reinforce areas that were subject to wear. The remnants of fabric in the finds are unfortunately too small for us to be able to reconstruct a full item of clothing as it once would have appeared.

Iron Age decorative ribbons – reconstructed

Three Hallstatt ribbons were selected to make replicas of. They were analysed for their method of manufacture and inherent dyestuffs so that they could be reproduced using prehistoric techniques.

During the Hallstatt period, decorative braids were applied to hems. We can observe this fashion in various representations such as bronze vessels and fragments of woven bands with the vestiges of stitching along their edges point to a trend. The bands with their varied ornamentation are amongst the artistic and craft masterpieces of the Hallstatt period.

Hallstatt Textiles no 100 and 179 are examples of rep edging and are made of yarn in thicknesses from 0.3 mm to 0.4 mm. The first sample is a 1.4 cm wide rep edging sewn onto blue-black woollen fabric, featuring a striped design in yellow, teal and dark brown. The second sample of edging comprises several pieces of a 1.2 cm wide woollen rep edging band with a chequered design in a red-dish brown, yellow and teal.

Hallstatt textile no 123 is a sample of tablet-woven braid. Twisted yarn of 0.2–0.3 mm thickness is woven into a complicated design.



*The original multicoloured rep and tablet-woven braids.
(Photo: A. Rausch/NHM Vienna)*

The rep ribbons were produced using a web stretched across a wooden heddle, examples of which have been found at early Roman sites. The weaving process involves simple raising and lowering of grids that are prepared according to a set pattern with coloured warp threads to make a weave.

For tablet woven bands, we used a 6 cm square tablet made of leather and wood – reconstructed with reference to ethnological templates. Tablet weaving involves stringing the tablets with warp threads in various colours. These are turned through 45 degrees to form a shed. Complex series of movements with individual tablets turned in various directions can be used to obtain a copy of the Hallstatt pattern.

At the start of the experiment, we found weaving with the thin, hand-spun yarn a particular challenge. The mechanical stress of the weaving technique is considerable, above all in tablet weaving. As the tablets are turned, the threads passing through the



*Tablet weaving.
(Photo: K. Grömer)*

holes of the tablets are subject to quite severe rubbing. Interestingly, the threads withstood the strain well – which is probably due to attentive preparation of the fibres and care in the spinning process. Using a hand spindle, the fibres were turned quite tightly, in keeping with our observations of the original fabric. Machine-spun commercial yarn is spun far more loosely and is thus more susceptible to tearing. We should add a further note: the wool in question was from the fleece of an indigenous breed of sheep (Montafoner Steinschaf). It consists of many thick strands of kempy wool and finer fibres from the undercoat. Whilst thick strands were reduced at the early picking and carding stages, during fine spinning and subsequent weaving, they could still be seen coming away from the fabric. The end product consisted almost exclusively of fine threads.

The very smooth yarn of the Hallstatt edging bands tell us of many deliberate and carefully executed procedures in the preparation of the wool. The result testifies to the work of specialists: the quality achieved in the edgings and the enormous dedication involved make these woven bands truly precious objects.

The construction of each band would involve several people, due to the various handwork techniques, some of them needing specialists. Two shades of colour indicate the hues the original bands might have been. We also carried out additional experiments on colour changes as a result of contact with cuprous salt. The ancient remnants were interred in the salt mines for millennia and may have been lying in contact with bronze picks, whose copper content could be responsible for the olive green discolouration of numerous of the Hallstatt textiles.



Heddle rod with reconstruction. (Photo: K. Grömer)

Mag. Dr. Karina Grömer works for the research project “DressID – Clothing and Identity” under the Department of Prehistory of the Natural History Museum Vienna and specialises in textile analysis.

Experiments to excite

Helga Rösel-Mautendorfer and Karina Grömer

Where to begin with fabric remnants dating back 2,700 years? Analysis of textiles can reveal key data behind the finds: yarn strength, weaving method and surface quality. In experimental textile archaeology, we attempt to reconstruct methods of production using these data.

What textiles relate . . .

Textile analysis can explain much about methods of production. Strengths of threads, and direction and angle of twist can be measured, providing data that is of direct relevance to the activity of spinning. Were spindles rotated right or left - and is this a question of being right- or left-handed, or a question of tradition? The weave and thread count of a fabric help us come to conclusions about the loom or type of weaving. Felting of a textile's surface can indicate deliberate thickening of a weave, or signs of wear and tear. With fabric that is as well preserved as the samples from Hallstatt, we can even derive colours and dyeing methods. Seams and hems also give clues on the cut, sewing techniques and construction of the garment. Some investigations yield further treasures in the form of insects such as human body lice that tell us that, 2,700 years ago, this piece of cloth was next to human skin.

. . . Conclusions on production drawn from the end product

Conclusions can be drawn on methods of textile production using experimental archaeology. A basic tenet of this method is that several skilled people should repeat the experiment in order to achieve a result that is of statistical relevance. The persons involved must have experience in the relevant handcraft and the process must be completed with precise documentation. Archaeological experiments in the manufacture of textiles give us information on the steps involved and possibly their sequence, as well as time spent.

Textile production is certainly one of the more time-consuming tasks. For one metre of fine patterned tablet-woven braid (not counting dyeing) the following times are estimated: 1 hour to sort the fleece, 1 hour to tease the wool, 5 hours to card, 80 hours to spin and twist the yarn, 5 hours to wash and dry, 25 hours to weave: a total of 117 hours spent.



Waldschaf (Bavarian Forest Sheep), an archaic breed of sheep. (Photo: J. Leskovar)

From fleece to fabric

Using the results of analyses, every step of the process, from the raw wool to the finished braid, was carried out in the reconstruction, using original equipment. The results of analysing the Hallstatt textile finds, trials of dyeing techniques using historical recipes and experimental investigation of weaving techniques were all instrumental in the reconstruction. Several processes go into the finished product.

From fibre to material

Picking over or slashing the wool with a stick or bow teases out the fibres and rids it of the coarser impurities.

After teasing, the woollen fibres must be aligned. To do this, the teased fleece is combed or carded. The oldest finds of long-toothed combs come from the late Neolithic Age around 3700 BC and were used until the Middle Ages. Carded wool was removed from the comb, resulting in so-called tops.

The next step is spinning of the tops, followed by twisting the yarn – this is where Applied Physics comes into the story. Here, a

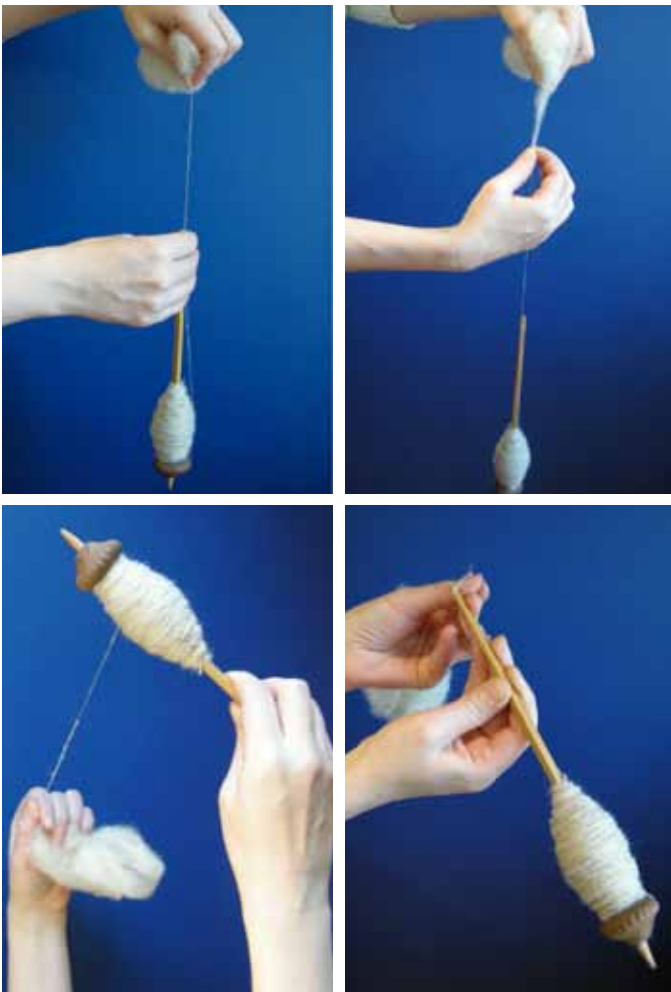
Teasing, combing, carding. (Photo: G. Rösel)





Hand carding. (Photo: K. Grömer)

device known as the spindle whorl is set spinning. The symmetrical rotation of the spindle's geometry effects a high moment of inertia, causing fibres from the fleece to twist into a single thread. The twine is then washed at around 50 degrees Celsius with an infusion of soapwort. Washing removes the grease, which is essential if one intends to dye the wool. Washing can be performed on the fleece, the yarn and even on the sheep before shearing.



Spinning using a hand spindle. (Photo: K. Grömer)



Weaving on a weighted loom. (Photo: G. Weinlinger, 7reasons)

About weaving

Weaving is the interlacing at right angles of warp and weft threads. The warp is the set of threads that run longitudinally (working direction) along the weave. The weft or filling is the set of threads running across the direction of the work. By raising all the even-numbered and lowering all uneven-numbered warp threads, a 'shed' is formed. The weft thread is inserted into the shed and pressed against the fabric. The shed is changed and the process repeated.

In prehistory, warp-weighted looms were used from as early as the Neolithic. This loom employed clay or stone weights to stretch the warp threads. The loom is leaned against a wall and this inclination produces a natural shed. From the position of loom weights in Iron Age house finds, we know that materials were produced in widths of 60 to 120 cm, but also up to three to four metres.

Dyed and natural threads were interwoven to create narrow bands. Rep ribbons can be easily manufactured using a wooden grid or heddle rod. Tablet weaving requires tablets with four holes to create colourful, strong braids. It was especially favoured as a method of producing complicated patterns. Five tablet woven bands have been found at the Hallstatt salt mines, made in different ways. Two carry patterns that replicate triangle, fret and diamond forms – designs that were also used on clay vessels of the period.

Mag. Helga Rösler-Mautendorfer works on the research project entitled "CinBA – Creativity and Craft Production in Middle and Late Bronze Age Europe" in the Department of Prehistory at the Natural History Museum Vienna and is mainly engaged on sewing and tailoring techniques and reconstruction of prehistoric garments.

Of twisting and turning

Anna Moser

What can excite and motivate Anna Moser are solid workmanship, the joy of artistic experimentation, creative power and the spirit of scientific investigation in highly specialized technological fields.

It was only natural, therefore, that she should become fascinated by the intricate patterns of the woven bands found in the salt mines, by jewellery from the burial fields at Hallstatt and by clay vessels with ornamental friezes, and it was only natural that these should then become the central points of reference in a systematic process of challenging experimentation with various materials.

First, in order to go from what is in itself a common procedure for altering natural colouring substances by means of metallic salts to one in which metal can be coloured through immediate contact with coloured textile fibres, it was necessary to carry out systematic, patient research in close collaboration with experts; then, as a next step, the production of tablet-woven bands of silver thread, silver wire and silks.

Thanks to experiments with dyes carried out at the University's research laboratory for archaeometry (laboratory supervision: Prof. Dr. Bernhard Pichler), experiments that were totally attuned to her project interests and needs, Moser was able to achieve the desired metal-colouring results. In a next step, she experimented with tablet-weaving techniques using silver thread and silver wire – also a challenge, which required her to rework templates.

These intensive efforts inspired by Iron-Age manufacturing and dyeing techniques produced a series of brooches and torques.

Anna Moser, Mag., took a degree in painting in the Department of Painting, Tapestry and Animated Film at the University of Applied Arts Vienna, where she was a student of C. L. Attersee. She is currently studying textile design at the University (director of studies: B. Putz-Plecko).



Ornament, silver and tablet-woven silk threads dyed with natural indigo. (Photo: A. Moser)



Artificial colouring of metal, tests. (Photo: Anna Moser)



Inspiration: Iron-Age tablet-woven bands from the salt mines at Hallstatt, Halltex 123. (Photo: NHM Vienna)



Inspiration: sheet-bronze armband, burial site, Hallstatt. (Photo: NHM Vienna)



Above: Silver spiral and tablet-woven band dyed with natural indigo. (photo: A. Moser in collaboration with Margarete Neundlinger); below: tablet-woven band of silver thread. (Photo: A. Moser)

Shifts of perspective and transformation Claire Chatel

What may be worthless to one person may be precious to another.

Clair Chatel's source of inspiration was the peplos – a tube-like garment from the Iron Age, 2.64 m. long and 1.68 m. wide, found completely preserved on a Danish moor, a voluminous piece of clothing, a fullness of fabric that raises questions about the object itself and about the context in which to place it.

Every context links separate parts and gives them a sense. Sense is a construct in transition.

Inherent in every process of change is a trans-form. To transform is to change what is given to make it other, the purpose generally being to adapt it to new functions or to give it new meaning, a function or meaning that was hitherto only present as a potential. For Claire Chatel, the woven blue peplos becomes such a form in transition, a tool. The large mesh of the fabric makes it possible to gather the garment in various ways and thus to give it varying, temporary forms. As the garment is reshaped again and again, our perspective of it changes: we find ourselves looking into it from the outside, or out of it from the inside, or through it. Each transitional structure becomes a kind of mask that affords a different glimpse of the world. These changing forms determine for a moment how we picture the world.

As the material is gathered, its flat surface is progressively reduced to a frame-like form. The garment, initially conceived as a covering for the body, is thus progressively undone: by being manipulated in various ways, it undergoes a kind of “decomposition” in which nothing but a framework is left, and through this framework we see, in the end, the body underneath. What becomes manifest is that each element of the whole is relative; it is defined in relation to the others within its changing context. A change in one causes a change in the way we see the others. The position of an element within a system of relationships gives it its specific significance.

Claire Chatel is studying textile design (director of studies: B. Putz-Plecko) and design, architecture and environment (director of studies: J. Skone) in the art education programme of the University of Applied Arts Vienna. In addition to the textile arts, her particular interests centre on art projects in the social space and on intercultural projects.



(right) Hand-woven wool dyed with natural indigo; Kroll Dyeing Plants, Gamlen. The woollen yarn used in tablet-woven fabrics on exhibit (not shown in photo) was dyed with chamomile and cochineal.

Inspiration: Peplos, Iron-Age garment, reconstruction, Gosau, 2006. (Photo: K. Grömer)

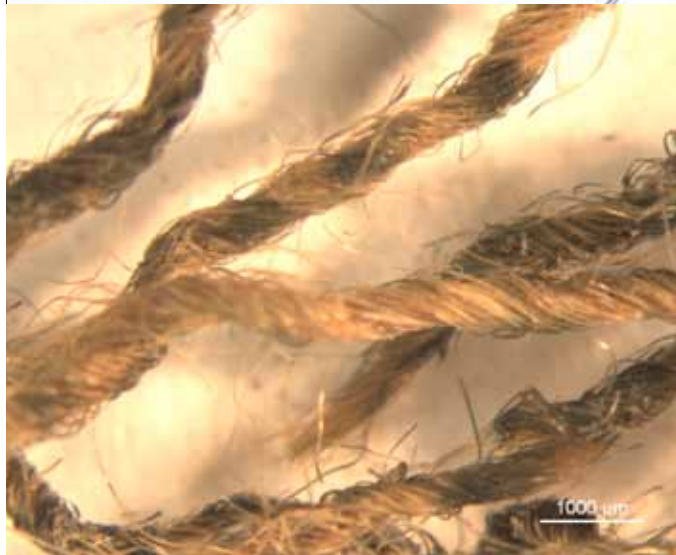
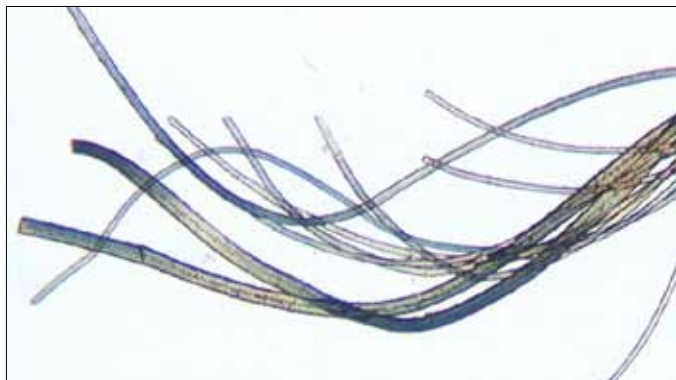
Hand-woven peplos. Woollen yarn dyed with natural indigo. (Photos: Peter Hoiß)



Textile dyeing in Prehistory

Regina Hofmann-de Keijzer

One of the basic needs of people is to decorate one's body, clothing, utensils and dwellings with colour. The use of colorants can be traced back to early times. Mineral pigments in cave paintings have lasted for more than 20,000 years, but special conditions were required for dyes of vegetable and animal origin – so dyed fibres as well – to last for about 3000 years. The salt of the prehistoric mines of Hallstatt preserved coloured textiles from the Bronze and the Iron Age. The analyses of the dyes allow a glance upon the origins of textile dyeing. Prehistoric man had experienced that the colours found in nature could not easily be applied to textiles. Green leaves, blue and red flowers and fruits did not provide fast textile dyes. They used tanning extracts, yellow and red mordant dyes and the blue vat dye indigotin. It has been microscopically proven that they dyed wool after spinning as well as after weaving, but probably also fleece.



Optical light microscopic image of a yarn sample from an Iron Age textile, Halltex 86; when dyeing strongly twisted yarn with woad, these parts of fibres that lay in the centre of the yarn often remained undyed. (Photo: R. Sauer)

Optical light microscopic image of a textile fragment from the Bronze Age with the oldest woad dyeing, from the salt mine of Hallstatt, Halltex 211; the fabric was dyed after weaving. Places where threads were covered by others remained not dyed. (Photo: NHM Vienna)

Many plants dye a brown or yellow colour

Numerous barks, leaves and galls contain tanning substances that bond directly to textile fibres. In that way prehistoric man could dye brown colours, from a yellowish to a reddish shade. The analytical technique that was applied for dye analysis does not permit to identify the tannins respectively tannin plants, but by the detection of tannin components it has been shown that tannins were used, both in the Bronze Age and the Iron Age. Probably, one knew already the technology of dyeing dark brown to black using tannins and iron containing materials. Yellow flowers and green parts of plants are sources for yellow dyes. For some yellow dyeings in the Hallstatt textiles various dye plants come into consideration, e.g. in the Bronze Age and Iron Age textiles in which luteolin and apigenin both have been determined. Many plants contain these yellow dyes taken up by the textile in the dyeing process, e.g. weld (*Reseda luteola*), dyer's broom (*Genista tinctoria*) and sawwort (*Serratula tinctoria*). In textiles from the Iron Age the scientists found the yellow dyes rhamnetin, from Persian berries (*Rhamnus species*), and crocetin, from saffron (*Crocus sativus*).



Iron Age textile fragment from the salt mine of Hallstatt, Halltex 78, dyed with a plant that contains luteolin and apigenin, e.g. weld. (Photo: NHM Vienna)

Only a few plants and animals give a red colour

In nature red dyes for textiles are rare. Yet, prehistoric man had discovered them already in lichens, in roots of plants of the Rubiaceae family, like Lady's bedstraw species and madder, and in dye insects, like kermes from the Mediterranean and Polish cochineal from North-East Europe. Kermes and madder were not found in the Hallstatt textiles of the Bronze Age and the Early Iron Age, but were identified in Celtic textiles from the late Iron Age: kermes in Hochdorf (Germany) and kermes and madder in Dürrenberg near Hallein (Austria).

Long-lasting yellow and red with mordants only

Yellow and red dyes are soluble, so upon washing they can easily detach from the fibres. Tanning agents and fermentation could have created a stronger bond between the dye and the textile fibres. Prehistoric man only achieved colourful and long-lasting dyeing of yellow and red after the discovery of mordants that bind the soluble dyes strongly to the fibres. Mordants with polyvalent metal ions gave the best result. When the colour shade had to remain unaltered, aluminium containing mordants had to be used. Clubmosses (Lycopodiaceae) with a relatively high content of alu-

minium were at hand. The finding of these plants together with dye plants at a Viking age excavation in York (England, 9th - 11th century AD) indicates their use as a mordant. Ever since Antiquity alum was the most important aluminium containing mordant. Copper based mordants change the colour to green, iron compounds and tannins to brown.

Aluminium, iron and copper were identified in the prehistoric Hallstatt textiles. These elements may originate from mordants, but they may also have penetrated into the textiles during the centuries in the salt mine.

Purple red to indigo blue – dyeing with insoluble pigments

The production of indigotin, a blue pigment from the green leaves of indigo plants, and of purple red to blue pigments from the glands of the purple snails are among the outstanding achievements of prehistoric man.

In order to dye textiles with these insoluble pigments people in prehistory had to develop a special technology, vat dyeing. In an alkaline and reducing solution it was possible to alter the insoluble pigments into soluble, green-yellowish compounds. It gave a dyeing vat in which the textile could be immersed. When the textile was taken out the contact with oxygen in the air reconverted the green-yellowish compound into the insoluble pigment which was now bound to the fibres.

Purple red (*Argaman*, *Tyrian purple*) and blue-violet (*Tekhelet*) from purple snails are mentioned in the Hebrew Bible. In chemical structure the Tyrian purple pigment is almost identical to indigotin: it contains two additional bromine atoms. In dyeings with Tyrian purple chemists have also identified a violet pigment containing only one bromine atom, and the blue indigotin. The dyers apparently had the know-how to prepare vats with a smaller bromine concentration and dyeing violet and blue-violet in that way. Tyrian purple was not found in the prehistoric Hallstatt textiles.

In more than 40% of the investigated textiles, dating back to Bronze Age, scientists identified the blue pigment indigotin proving the use of an indigo plant. The indigo plant of prehistory in Europe was woad (*Isatis tinctoria*).

Red dyes in the blue of Hallstatt

So far red textiles have not been found in the prehistoric salt mines of Hallstatt. The analyses, however, have shown that red

dyes from insects and lichens came into use in the dyeing practice of the Hallstatt period. Scientists analysed traces of red dyes in textiles dyed blue with woad. Apart from the vat dyeing with woad apparently a red dye was used in order to give the blue a bit more reddish shade.

No plant dyed green

Leaf green (*chlorophyll*) is unsuitable for dyeing a textile green. Already in the Hallstatt Culture 2500 years ago people have realised that a blue and a yellow dyeing have to be combined for dyeing green. They dyed blue with woad and yellow with a plant such as weld.

AProf. Mag. Dr. Regina Hofmann-de Keijzer is a biologist specialised in natural dyes. She has worked at the University of Applied Arts Vienna since 1995 and is an assistant professor in the Department Archaeometry since 2006.



Iron Age textile fragment from the salt mine of Hallstatt, Halltex 122, dyed green by combining a blue dyeing with woad and a yellow dyeing, with for example weld. (Photo: NHM Vienna)



Iron Age textile fragment from the salt mine of Hallstatt, Halltex 87; the woad blue was tinted with a red dye from a dye insect, probably Polish cochineal. (Photo: NHM Vienna)



The fragrance of chamomile, the poetry of lines Brigitte Zaussinger

Fabrics displayed in the Natural History Museum, Vienna. Wool fabric dyed with chamomile and Rubia tinctorum; black ink made from tannin and ferrous salts on linen. (Photo: Peter Hoiß)

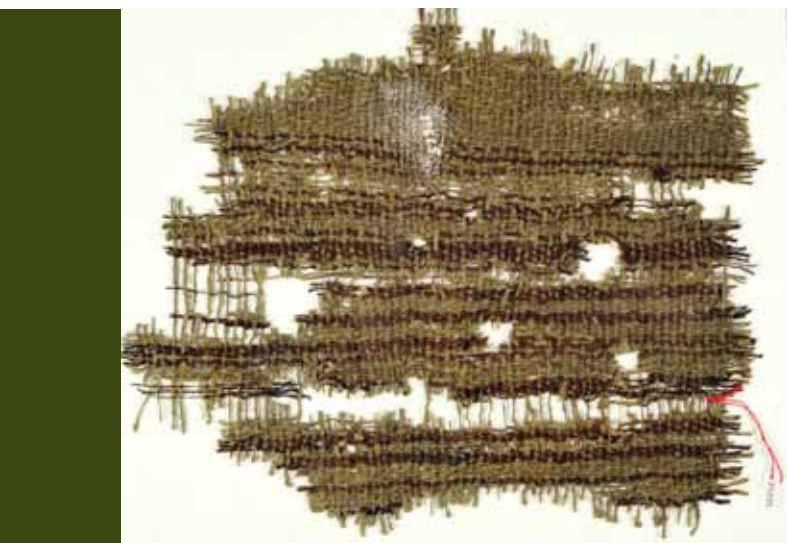
For Brigitte Zaussinger, patterns and colours were the starting point of a journey through time and the road pointers that led her to deeper and deeper insights into the production and design processes of the Iron Age. It began with her amazement at the variety of chequered and striped patterns found on historical textile fragments, which gave these fabrics an altogether modern appearance. Then came an increasing fascination with the quality of colours and nuances as well as an artistic interest in determining the value these coloured fabrics must have had due to the elaborate processes involved in their production.

Intensive experimentation with dyeing and printing enabled her to explore historical production techniques and, where possible, to combine them with modern methods. These experiments gave

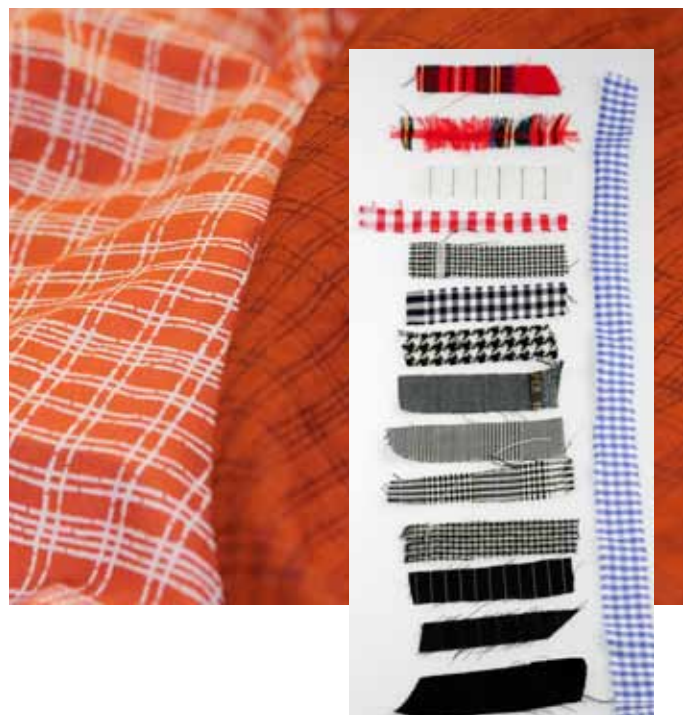
rise to a fabric archive intended to serve as a material basis for the production of a series of garments. All those who took part in the project distinctly remember – and with pleasure – the specific quality of production and its effect on the senses – above all “the brilliance and intensity of the colours and the truly therapeutic effect of the olfactory sensations.” (Robert Wiesner)

The exhibit offers a first contact with the fabric archive as the fruit of a collective effort, a convergence on different levels: associative, analytical and poetic.

Brigitte Zaussinger has a Swiss diploma in dental hygiene and is an art therapist. She is currently studying art and communication practices and textile design in the art education programme of the University of Applied Arts Vienna (director of studies: B. Putz-Plecko).



Inspiration: Iron-Age textile from the salt mines at Hallstatt, HalltEX 52. (Photo: A. Rausch/NHM Vienna)



Background photo: a comparison – fabric chemically dyed and printed (left) and fabric dyed with Rubia tinctorum and printed with cochineal (right). (Photo: Konrad Cernohous); Inset: swatches with a variety of patterns. (Photo: Felix Zaussinger)

Linens and wool dyed with Rubia tinctorum and chamomile; silkscreen print done with tannin, Rubia tinctorum, cochineal and ferrous salts as well as chemical printing pastes. (Photo: Peter Hoiß)



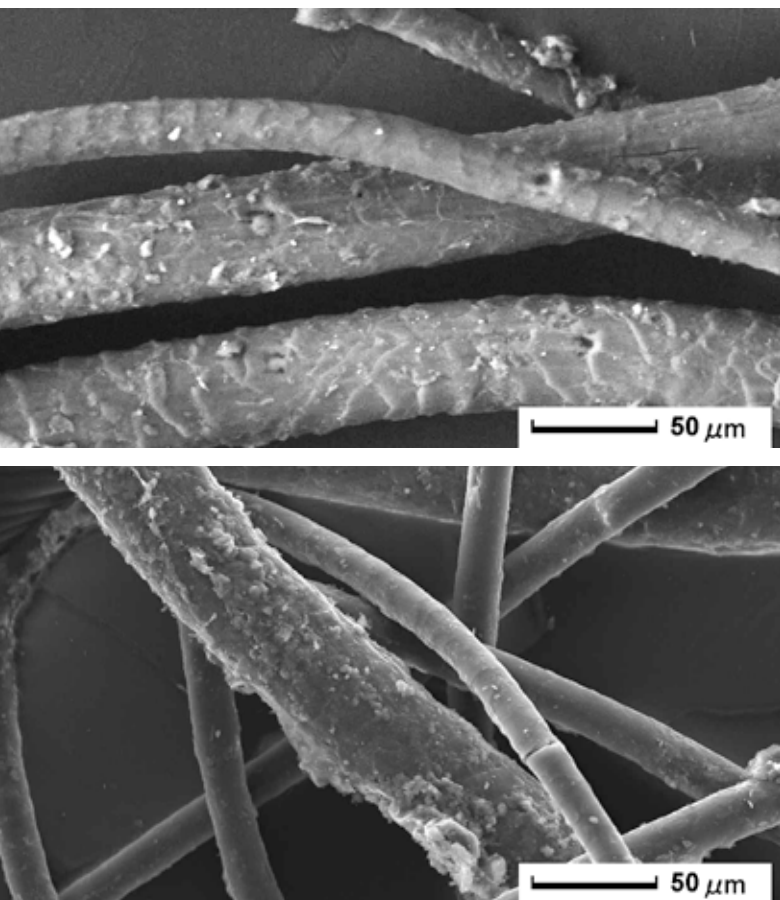
An analytical view on the origin of textile dyeing

Regina Hofmann-de Keijzer interviews three scientists of the Cultural Heritage Agency of the Netherlands (RCE)

Regina Hofmann-de Keijzer interviewed three scientists of the Cultural Heritage Agency of the Netherlands who have investigated the coloured textile fragments from the prehistoric Hallstatt salt mines. Ineke Joosten specializes in the analysis of fibres and elements using scanning electron microscopy (SEM-EDX), Maarten van Bommel and Art Néss Proaño Gaibor are experts in the analysis of dyes using High Performance Liquid Chromatography (HPLC-PDA).

R. Hofmann-de Keijzer: Your investigations allow an insight in textile dyeing of the Bronze Age (circa 1600 – 1200 BC) and the early Iron Age (Hallstatt Culture, circa 850 – 350 BC). What was the most fascinating issue in your investigation of the prehistoric Hallstatt textiles?

I. Joosten: The fact that the woollen fabric was so well preserved by the salt. The electron microscope image shows mostly minor degradation of the wool fibres. The characteristic scales on the wool fibres can still be recognized clearly.



Electron microscopic image of wool fibres from the prehistoric Hallstatt textiles with well recognizable scales (photo above) and with hardly visible scales and contamination (photo below). (Photos: RCE)

M. van Bommel: In our climate zone it is very rare that coloured textiles, 2500 to 3500 years old, are preserved and can be analysed. An advantage for the investigation of the dyes is the fact that nowadays a thread sample size of only 0.5 cm is sufficient.

R. Hofmann-de Keijzer: What do you do with the sample?

A.N. Proaño Gaibor: The dyes, which are strongly bound to the wool fibres, have to be dissolved from the fibres with chemical reagents. After this preparation a minute amount of the dye extract is injected into the analytical instrument.

R. Hofmann-de Keijzer: In the dyeing process dye plants and dye insects leave dyes on the fibres. How do you identify a dye? And how many dyes could you identify in the prehistoric Hallstatt textiles?

M. van Bommel: Depending on their chemical properties the dyes are transported at different rates in the column of the HPLC instrument and they leave the column each after a certain time, the retention time. The chromatogram shows the dyes, with their retention times. Subsequently a Photodiode Array (PDA) detector produces a spectrum of each substance. A dye is positively identified when the retention time and the spectrum match with those of a reference dye. We could identify thirteen dyes in the Hallstatt textiles.



High Performance Liquid Chromatography (HPLC-PDA) instrument used for dye analysis at the Cultural Heritage Agency of the Netherlands. (Photo: A. Hartl)

R. Hofmann-de Keijzer: You also found over 250 unidentified dyes in the textiles, mostly yellow and red. What does that mean?

M. van Bommel: Even when we cannot identify a dye it is possible to conclude from the spectrum what its colour was. So we can say, for instance, that a textile was dyed with a yellow or a red dye.

R. Hofmann-de Keijzer: Is it possible to tell from which dyeing material each identified dye originates?

M. van Bommel: This is often possible in non-archaeological. Many dyeing materials leave a fingerprint in the textile in the form of a pattern of relative amounts of main and minor components. In the Hallstatt textiles some dyes cannot be ascribed unambiguously to a certain dye plant. Often dyes were found that may originate from different plants. As yet there are too little reference data for dye materials used in prehistory. In the course of the centuries characteristic minor components may have degraded so far that they cannot be detected any more.

R. Hofmann-de Keijzer: Is it true that a collection of possible prehistoric dyeing materials has been established for the first time on the occasion of this research project to be used as a reference collection for dye analysis?

A.N. Proaño Gaibor: Yes, based on literature research on red and yellow dyeing plants Anna Hartl collected many wild plants and dyed wool with them. Then we analysed the extracts of the collected plants as well as the dyed woollen yarns. These analytical results were compared to those of the original textiles.

M. van Bommel: We had to compare hundreds of components with different retention times and spectra with each other, searching for a needle in a haystack. However, we found a needle. The scentless chamomile (*Tripleurospermum inodorum*) might be the source for those dyeings in which only the yellow dye apigenin was identified in the textile.

R. Hofmann-de Keijzer: The two most important dyeing methods are vat dyeing and mordant dyeing. Can you also tell the dyeing method from the dye analysis?

M. van Bommel: When we find the blue pigment indigotin in a textile, we know that it was a vat dyeing. From the chemical analysis we only know that an indigo plant was used but not which one. From archaeobotanic and historical research we know that only woad can have been the indigo plant of the European Bronze and Iron Age.

R. Hofmann-de Keijzer: And how is that with mordant dyeing? Can you tell whether mordants have been used for binding the insoluble dyes?

I. Joosten: In the case of textiles of non-archaeological origin we can draw conclusions about the use of mordants based on the elements identified, like aluminium, iron and copper. In the Hallstatt textiles these elements could also have diffused into the textile during their long stay in the prehistoric mines. Aluminium and iron ions may originate from the minerals in the mine and copper from the broken-off tips of bronze picks.

R. Hofmann-de Keijzer: Because already in the Bronze Age the complicated vat dyeing was practised, one can assume that people also knew already how to bind soluble yellow and red dyes to the wool fibres more strongly. Among others tannins, aluminium containing clubmosses, and aluminium, copper and iron containing materials are candidates.

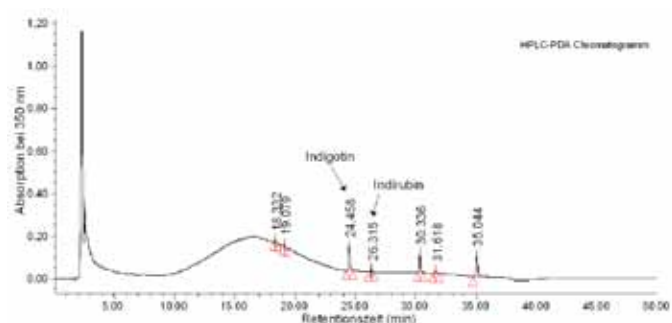
M. van Bommel: We have found tannins in the Hallstatt textiles. They may have been used as mordants or for dyeing brown. There is some evidence that tannins, in combination with iron containing compounds, were used for dyeing black in the Bronze Age and the Hallstatt Culture.

R. Hofmann-de Keijzer: What is, in your opinion, the important next step in research on dyes in prehistoric textiles?

M. van Bommel: A new analytical technique, *Ultra Performance Liquid Chromatography*, promises even better results with still smaller amounts of sample material. The interdisciplinary discussion of the results between researchers of dyeings from the Bronze and Iron Age is important as well.

A.N. Proaño Gaibor: Also collecting of more reference data and reference materials such as dye plants and dyed textiles is an important prerequisite for future investigation of prehistoric dyeing techniques.

I. Joosten: An important task for electron microscopy is the investigation of fibre degradation in connection with the chemical elements found in dyed and undyed fibres.



Bronze Age textile from the salt mine of Hallstatt, Halltex 211, with the oldest woad dyeing (left); chromatogram of the analysed sample from this textile, with the blue pigment indigotin and the minor component indirubin (above). (Photo and chromatogram: RCE)

Dyeing experiments

Anna Hartl

„Das Mischen, Sudlen und Manschen ist dem Menschen angeboren. Schwankendes Tasten und Versuchen ist seine Lust.“

Johann Wolfgang von Goethe (1749 –1832): Zur Farbenlehre

Within the FWF Project numerous dyeing experiments with natural dyes were performed at the University of Natural Resources and Life Sciences Vienna. We started the development of dyeing processes with a literature search in ethnological and historical sources. One should not imagine experimenting as a linear process (read, dye, successful result) especially in the case of a fermentation dye process. It rather follows the principle of ‘trial and error’: read, try, fail, read again and ask questions, try again – till it finally works. The exchange of practical experiences with artists and innovative companies specialising in natural dyes was important as well.

The traditional dye process was simulated with materials available today, using laboratory equipment. This means for instance mordanting with alum from the drugstore instead of using alum shale; keeping the fermenting liquids warm on a water bath or in the incubator instead of placing the dyeing pots on the kitchen stove or burying them in the dungheap.

Searching for the unknown red and yellow

The dyestuff chemists analysed many yellow and red dyes in the Hallstatt textiles that could not be ascribed directly to any known dye plant. The idea was to enlarge the range of possible dye plants by means of literature research and by dyeing reference materials. The selected indigenous plants were only to a small extent available commercially or from botanic gardens. The greater part had to be collected in nature. Woollen yarns dyed with these plants, as well as extracts from the plant material were analysed at the Cultural Heritage Agency of the Netherlands by Art Néss Proaño Gaibor and Maarten van Bommel. Next they compared the analysis results of the reference materials with those of the Hallstatt textiles.

Discovery of the plant for a yellow dyeing . . .

In the yellow of a ribbon and other Hallstatt textiles the yellow dye apigenin was identified exclusively. None of the known dye plants leaves just apigenin on the fibre. Which plant did the prehistoric dyers use? Only one suitable plant could be found among the many reference dyeings: the scentless chamomile (*Tripleurospermum inodorum*). This plant was also used for the reconstructions of the ribbons.

. . . and red?

Not every plant that was indicated for red in the historical sources actually allowed a red dyeing in the scientific experiment. Possibly the appropriate dyeing procedure was lost somewhere in the past. The resulting colour depends strongly on factors in the process as temperature, duration, pH-value, and mordants. The colour of the reference dyeings, however, is not relevant for the detection of characteristic dyes which can be compared with unknown dyes from the Hallstatt textiles.



Gathering dye plants.

Scentless chamomile, abundantly flowering along roads, on fallow land and fields.

Dyer's chamomile soaking to be extracted.

Fresh poppy flowers being extracted by boiling.

Reference dyeings with yellow and red dyeing species. (Photos: A. Hartl)

The search for blue

At first sight plants are green – not blue. Yet, a few species contain colourless precursors of indigo that turn blue on exposure to atmospheric oxygen. On closer look one can observe the blue in injured parts of the leaves. Possibly the blue was discovered in this way. Also soaking fresh green leaves of woad in warm water produces a bluish film on the water surface after some hours.

Woad blue

In our climate zone woad (*Isatis tinctoria*) is the traditional plant for dyeing blue. Over 40% of the analysed Hallstatt textiles were dyed with woad. It requires special methods of preparation and of dyeing (vat dyeing). In order to be able to penetrate into the fibres, the indigo has to be converted into a water-soluble form, in an alkaline and reducing solution. The blue colour develops in the atmosphere through a reaction with oxygen.

In several series of experiments three methods were tested:

- Dyeing with fresh woad leaves;
- Dyeing in vats with fermented woad balls;
- Dyeing with woad pigment in fermentation vats with urine respectively madder and bran.

The hand-spun yarns for the reproduction of the ribbons were dyed in fermentation vats as well. The method of the prehistoric people in Hallstatt is unknown.

Only fresh woad can be processed; dried leaves cannot be used. We grew woad for the experiments on a field of 100 square meters in the garden of the University of Natural Resources and Life Sciences Vienna.

Smell, taste, a good nose

The skill of dyeing with woad is to get only the blue out of the plant. Woad contains considerably more colours than only blue! In search of blue one discovers a palette of yellowish, beige, mint-coloured, bright yellow-green, pink, violet and gray-blue tones. The vat dyeing process only works within a certain range of pH, and a lot of experience is required for steering the fermentation process and recognising the right moment for dyeing. Smell, taste and a good nose for the condition of the solution are to some extent even today the 'measuring instruments' of experienced dyers.

Storage, transportation, trading

The production of woad pigment and the method using woad balls, described since the Middle Ages, has a distinct advantage over dyeing with fresh leaves. Woad balls and woad pigment were dried. They did not perish hence they could be transported and traded. One could dye independent of the harvesting time and the place of cultivation.

Injured leaves show indigo formed by contact with the oxygen in the air. Woad leaves can be harvested repeatedly in the first year of cultivation. The pounded leaves are moulded into balls.

Preparing the woad pigment.

Drying the woad pigment.

Hand-spun yarns, dyed with woad.

(Photo of woad ball: M. Kohler-Schneider, other photos: A. Hartl).



The search for the original colour of the ribbons

Three multi-coloured Iron Age ribbons from Hallstatt were reproduced within the research project. Dyestuff and fibre analyses of the ribbons were the starting point for the experiments aiming at the reproduction of the colours. Were the yellow yarns of the ribbons actually dyed, or did they show the natural colour of the sheep's wool? Which dyes can be identified? Which plants contain these dyes and therefore could have been used by the dyers of the Hallstatt Culture? Dyeing procedures were developed on the basis of analytical results and interpretations by Regina Hofmann-de Keijzer (University of Applied Arts Vienna), Art Næss Proaño Gaibor and Maarten van Bommel (Cultural Heritage Agency of the Netherlands)

The palette of Hallstatt colours

The result was a palette of colour samples in various shades and intensities. Fermentation vats with woad (*Isatis tinctoria*) gave bright and dark blue colour shades. The yellow tones were mordant-dyed with scentless chamomile (*Tripleurospermum inodorum*) and with dyer's weld (*Reseda luteola*). Green tones were made by combining yellow and blue dyeings. Further colour effects were achieved by using white, gray and brown sheep's wool.

Copper induced colour alterations

Ineke Joosten of the Cultural Heritage Agency of the Netherlands could measure a high copper concentration in many Hallstatt textiles. Was copper a mordant or did it get into the textiles later as contamination from the salt mines? In the 'heathen's rock' - this is hard salt stone, with traces of early man's presence - the archaeologists found broken-off tips of bronze picks which were used for breaking the salt. Bronze contains copper and copper alters colours to greenish. Did the ribbons look different originally? Samples of all colour shades from the palette of dyed specimens were post-mordanted in a copper acetate solution and the colours altered by that procedure were compared to the prehistoric Hallstatt ribbons. In a joint decision the project team selected those that were closest to the prehistoric originals. Then I dyed the hand-spun yarns for the reproduction of the ribbons using the same dyeing process. Every reproduction exists in two colour variants. In order to show the colour changing effect of copper, a part of every reproduced ribbon was treated with copper acetate solution.

Dyeing before or after spinning?

Wool may be dyed as a fleece or as a yarn. Highly twisted spun yarns, that are necessary for ribbon weaving, get tangled as soon as they are immersed in water. The dyeing becomes irregular and spotty, especially in vat dyeing. From history the use of dyeing sticks when dyeing skeins is known. Following this idea cooking spoons were used in the experiments. In this way the thin, strongly twisted yarn could be dyed evenly, without getting tangled. Fleece is easier to handle. By mixing the dyed fleece an uneven dyeing can be compensated for. Both fleece and yarn should be washed and degreased for a proper dyeing. For the preparation of the wool it is easier to wash the ready-made yarns than the fleece. This gets felted quite easily during washing and heavily felted parts often cannot be combed anymore and become waste. An alternative is to wash the sheep before shearing – a method that is known from historical and ethnological sources.



The hand-spun yarn gets tangled when put into water. With this construction the yarns could be dyed evenly and without getting tangled. Undyed wool, wool dyed with scentless chamomile and wool dyed with woad (above) and the colours as changed by the copper solution (below). Dyed hand-spun yarns for the reproduction of the ribbons. (Photos: A. Hartl)

Natural dyes today – tradition and innovation. Anna Hartl

Until the middle of the nineteenth century only natural dyes from plants and animals were used in textile dyeing. After the discovery of industrial synthetic dyestuffs the natural dyes lost their great economical importance. Yet, dyeing with natural dyes is not a technique of the past! This was shown impressively in various international symposiums on natural dyes (ISEND) organised by UNESCO. Nowadays dyers are still working traditionally with natural dyes, e.g. in Asia, Africa, South America and Eastern Europe. Apart from that, in many countries, also in Europe, artists, innovative companies and scientists rediscovered traditional dyeing techniques in historical sources and have given them a new life. Natural dyeing today is practised as a craft but also on an industrial scale.

Co-operation within the FWF Research Project

It was a major intention in the project to link the beginning of textile dyeing in Austria to the present-day use of natural dyes. The exhibition shows this nicely for woad. It ranges from the oldest woad dyeing from Hallstatt to the woad-dyed towel woven of cotton and bamboo fibre of the English company Woad-inc. We built a network of natural textile manufacturers and companies specialised in natural dyes. Some products of these companies were used in the artistic works of the students of the University of Applied Arts Vienna. There was a close cooperation with the 'Blaudruckerei Koó'. In the symposium '3000 Years of Colour – from Tradition to Art and Innovation' speakers of companies and NGOs will give lectures on the today's use of natural dyes and will also present naturally dyed products.

Potentials

The production and use of natural dyestuffs can contribute to the economic development in rural areas. As an example of the many initiatives, the Indian non-governmental organisation AVANI shows this in its work in the Kumaon region in the Himalayas. Using traditional knowledge, appropriate technology and locally available and processable raw materials, over 1,100 craftsmen and -women in 48 villages are making a living of it now.

Working with natural, renewable resources, can contribute to a sustainable production process, provided that ecological criteria are met in the overall production process. Combined with the new developments in the field of slow fashion, fairtrade and organic textiles, with natural dyes there is a great potential to realise clothing aesthetically pleasing and socially and environmentally responsible.

Dipl.-Ing. Dr. Anna Hartl is a scientific employee at the Institute of Organic Farming of the University of Natural Resources and Life Sciences Vienna, supported via the project 'Dyeing techniques of the prehistoric Hallstatt textiles', sponsored by the Austrian Science Fund FWF [L431-Go2]. She has participated in several research projects on the present-day use of natural dyes and eco-textiles. She is co-applicant of the FWF Project.

Scientific publications about the dyeing experiments will be available at the website of the author (www.nas.boku.ac.at/ifoel-anna-hartl.html).

Naturally dyed yarns of AVANI, India. Naturally dyed fabrics of Couleur de Plantes, France. Fashion show, ISEND Hyderabad, India and Daegu, South Korea. Shawls dyed with natural indigo, Living Blue, Bangladesh. (Photos: A. Hartl)





Wandering Tribe

Christina Dörfler

Christina Dörfler's contribution occupies a special position here in the sense that it constitutes both artistically and scientifically the final year project for her diploma.

Artistically, the project is a fashion collection. It is based, however, on results of experiments and investigation that account for a significant portion of Dörfler's scientific work: namely, experimentation with dyeing techniques using metal corrosion and natural dyes and experiments combining, on the one hand, Austrian blueprint techniques with patterns from Hallstatt and, on the other, Japanese shibori techniques. The project also grew out of research collaboration and work experience with Lara Torres, Ma Ke, Fabrics Interseason and Cosmic Wonder.

The result is an aesthetic collage linking past and present, individual aspects of which are variously combined and interpreted in the collection. A cross-cultural transfer is in operation here: between Iron-Age Hallstatt and the Edo and Meiji periods in Japanese cultural history, between these and nineteenth-century Austria and, finally, textile production today.

Christina Dörfler occupies a unique position among the University's students in her capacity of fashion designer with her own team for production design and performance. Aside from the collection itself, the professional network she has built up in the process of its creation is also quite remarkable. As an example: all natural materials used in the production of textiles for the collection were acquired from small manufacturers in various parts of Austria, Germany and Greece. The title of the collection – Wandering Tribe – can therefore be understood as also referring to the many individuals whose collective efforts made the collection possible.

"Wandering Tribe" will be presented in a fashion performance at the Natural History Museum Vienna, on 22 March 2012.

*Examples of clothing dyed with techniques using metal corrosion, from the collection "Wandering Tribe".
(Photos: C. Dörfler)*



Experiment – metal corrosion in conjunction with textiles; in collaboration with Prof. Bernhard Pichler, Department of Archaeometry. (Photo: C. Dörfler)

Inspiration – corroded blade of a dagger from the burial site at Hallstatt bearing an imprint of fabric texture. (Ph: A. Rausch/NHM Vienna)





Waldviertel
Resources
Inspiration
A Unit
Cooperation
Workshop
Quilted Foundation
Greece
Silhouette
Fragmented
Iron Dye
Trade
Make
Blueprint
Construct
Hallstatt
Craftwerk Germany
Performance
Dimension Cosmic Wonder
Iron Age Together
Transfer
Global - Local
Spin
Time Yarn
Culture
Folk
stitch
Family
Natural Fibres
Tablet Weaving
Share
Prehistoric Patterns
Re-do
Wandering Tribe
Social Network

Dye
ragged
build up
Come
Together
Ko@
Japan
Weaving
Value
Wood
Salt
Part
Linen

Looking back to the future

Transfer as method in the practice of the arts

The scientific portion of Christina Dörfler's thesis covers work that she carried out more or less simultaneously with the creation of the collection "Wandering Tribe". The quality of this work underscores the great potential of interdisciplinary collaboration.

The thesis consists of two parts: in the first, Christina Dörfler describes the current state of Hallstatt research and gives an overview of Iron-Age textile techniques; in the second, focus is on the fashion collection itself, its artistic conceptualization and elaboration. In a series of thorough experiments with various materials (scientific supervision: Prof. Bernhard Pichler and Prof. Regina Hofmann-de Keijzer), prehistoric techniques were upgraded and combined with traditional blueprint and Japanese manufacturing techniques, which in their turn allowed comparisons with prehistoric techniques.

For Christina Dörfler, the strongest artistic inspiration came from Hallstatt artefacts on which textile structures had been preserved indirectly: fabrics that had remained a long time in contact with metallic objects buried in the ground, although themselves unpreserved, left a lasting imprint of their structure on the rusted or otherwise corroded surface of the metal. Extensive experimentation with corrosion processes and indigo dyes and research on patterns and materials from the Hallstatt period determined the colours, patterns and materials used in "Wandering Tribe"*. A source of inspiration for form was Japanese boro cloth and the elaborate technique used in the production of these precious patchworks of scraps of material sometimes of the minutest size.

***Colour: Blue** Cross-cultural combination of the blueprint technique used by the Koó family (Burgenland) and patterns, colours and forms from Hallstatt, as well as a variation on Japanese boro

Rust: Dyeing with copper and iron corrosion on wool and linen

Natural colouring: On wool, linen, leather and sheepskin

Material: Wool and linen from selected textile manufacturers in Austria (*Viehböck*) and Germany (*Anita Pavani, Naturtuche, Mediterranea*); leather: *Moser Wr. Neustadt*; sheepskin and wool: *Gottfried Neuwirth* in the Waldviertel

Accessories: Belts, tablet-woven bands; leather caps modelled on finds from the Hallstatt mines, leather straps used for fastening; embroidered wool dyed with woad (*Isatis tinctoria*) and indigo; horn and corroded iron as elements of jewellery; woven jute sandals (Japanese *waraji*), leather shoes of prehistoric inspiration

Cooperation: shoe design – *Craftwerk Bernadette Hehenberger*; jewellery design – *Christine Schöpf*.

Christina Dörfler, MMag., completed her studies in art education at the University of Applied Arts Vienna, receiving a diploma with honours – thesis title: "Looking Back to the Future: Transfer as Method in the Practice of the Arts". Since 2008 she has been working in the area of fashion and performance and has gathered work experience in collaborative projects and in practical training in Portugal, Berlin and Vienna.



Experimenting with resist-dyeing techniques, Koó workshop. (Photo: C. Dörfler)



Garment with corrosion patterns (left)
Garment in boro style, various patches of material dyed with natural indigo. (Photo: C. Dörfler)

Pioneering work in workshops

Manuel Wandl

The Hallstatt textiles project at the University of Applied Arts Vienna (2009 – 2012) was a part of the FWF Project, in which an exchange of knowledge between the project partners of the different science disciplines was established. The students did research in the collection of the Prehistoric Department of the Natural History Museum Vienna, at the excavations in Hallstatt and in the Hallstatt Museum. They also performed experiments in the field of textile dyeing and printing and tested dyestuffs, recipes for dyeing and pattern techniques. They used mainly cochineal, madder, dyer's chamomile, dyer's broom, oak bark and alder buckthorn combined with various pre- and post-mordanting treatments. Moreover, they practised vat dyeing with indigo. On the open day at the University of Applied Arts Vienna in 2011 the visitors could observe the dyeing experiments of the students in the Textile Department and discuss their work with them.

Especially for this project Mr. Joseph Koó prepared a vat with natural indigo from South India and he enabled the students to work with resist-printing techniques and vat dyeing in his workshop 'Blaudruckerei Koó' in Steinberg, Burgenland. Ute Huber-Leierer developed pastes for screen printing with plant materials and iron salts and Robert Wiesner adapted the dyeing equipment for dyeing with vegetable materials.

<i>Student</i>	<i>Natural materials and techniques (dyer/printer)</i>
Anna Moser	Silk yarns, dyed with indigo (Joseph Koó).
Christine Dörfler	Linen and woollen fabrics, dyed with indigo, blue printing technique and various resist-dyeing techniques (Joseph Koó).
Cornelia Bast	Dyeing linen and woollen fabrics with cochineal and dyer's chamomile in resist techniques and double dyeing (Manuel Wandl).
Claire Chatel	Dyeing woollen yarns with dyer's chamomile and cochineal (Manuel Wandl).
Racheli v. Hofacker	Experiments with tannins and iron salts, adapted for screen printing (Ute Huber-Leierer).
Brigitte Zaussinger	Dyeing of linen and woollen fabrics with madder and dyer's chamomile (Robert Wiesner), screen printing with tannins, madder, cochineal and iron salts (Ute Huber-Leierer).
Debora Däubl	Dyeing experiments with indigo (Joseph Koó), dyeing of different fabrics with madder, cochineal, dyer's chamomile and oak bark (Manuel Wandl).

Manuel Wandl studied at the University of Applied Arts Vienna in 2004 – 2009. He teaches weaving and printing in the 'Höheren Lehranstalt für künstlerische Gestaltung – Herbststraße' in Vienna; for the projects of the students in the FWF Project he organised the dyeing experiments and lectured the principles of card-weaving.

Dyed with indigo, workshop Joseph Koó. (Photo: M. Wandl)

Dyeing experiments on the open day, 2011. (Photo: M. Wandl)

Dyeing yarns and fabrics yellow with dyer's chamomile. (Photo: M. Wandl)

The fabrics after dyeing in the indigo vat. (Photo: B. Zaussinger)



Dyeing with indigo in the workshop of Joseph Koó

Joseph Koó



My parents brought me up with indigo dyeing and blue-printing and next to my job as a graphic designer the craft has been with me ever since.

The workshop was founded by my grandfather in 1921, in Steinberg, Burgenland. Some years ago I took over my father's company and today I run it together with my partner Miriam Schwack.

Apart from the traditional knowledge it is our desire to keep the craft alive in our time. We consider the design of new printing models and patterns, the cooperation with art universities, fashion schools and young designers as an important and creative part of our work.

It was a great pleasure to work with the students of the textile department of the University of Applied Arts Vienna in the project 'Dyeing techniques of the prehistoric textiles from the salt mine of Hallstatt – analysis, experiments and inspiration for contemporary application'. The refreshingly unconventional contact with rising young artists in the field of indigo dyeing was interesting and enriching for me.

As it was the purpose of the FWF project to revive the historical practice of dyeing with woad and indigo in our time, I prepared a vat with natural indigo from South India for the art projects of the students. Our blue-prints are produced in permanent vats, that go back partly to stocks of indigo of my father and my grandfather.

Also exciting was the visit we paid to Mrs. Anna Hartl at the University of Natural Resources and Life Sciences Vienna (BOKU), who grew and processed woad, our original indigo plant, and dyed with it according to historical techniques.

Original Indigo Blaudruck
Koó
Steinberg

Joseph Koó
Neugasse 14
A-7453 Steinberg, Austria
www.originalblaudruck.at



Joseph Koó and Anna Hartl with the drying woad balls at the University of Natural Resources and Life Sciences Vienna. (Photo: T. Niedermüller)

Joseph Koó with Christina Dörfler at printing experiments with the so-called 'Papp'. In places where the Papp, a resisting paste, was applied, the fabric is not dyed blue, so the result is a white pattern on a blue background. (Photos: C. Dörfler)

Joseph Koó and Miriam Schwack in front of their workshop. (Photo: J. Koó)

Adapters

Debora Däubl

Debora Däubl's work represents a convergence of many paths of development that originally drew on two sources:

- The sizable textile find labelled Halltex 31 – six pieces of material with felled seams and piping along the outer edges, which indicate that this could have been an article of clothing;
- Animal representations on various objects found at Hallstatt, such as those on the sheet-bronze work pictured below.

After experimenting with the original basic forms and with construction models, varying both size and materials, Däubl expanded her stock of available forms and thus her creative range by serially reproducing individual parts. She played with creative ideas on the human body and in three-dimensional space, variously combining elements and adapting them to a changing context. An exploration of possibilities. Construction and deconstruction. And, in the end, a new focus: the transitory form.

This fun with forms in transition culminates for Debora Däubl in a series of little horses, which she visualizes in various combinations with other objects and stacked one on top of the other in larger, composite figures. In the exhibition, she puts these movable elements at the visitors' disposal, inviting them to manipulate and use them according to their fancy. Stack-forms – form and lack of form, definite form and yet an open system.

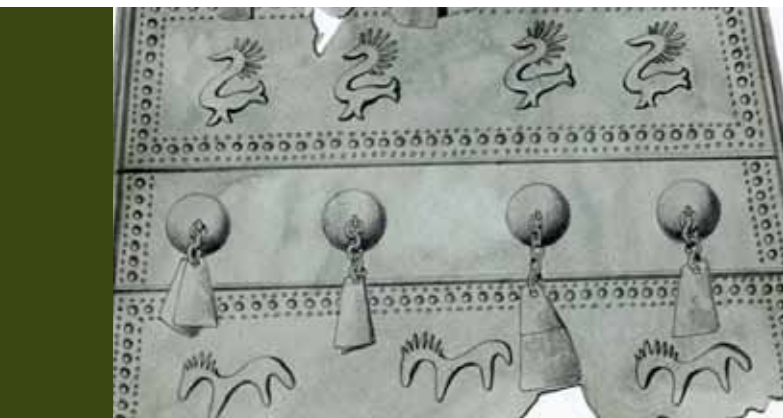
Däubl's approach to her work is characterized by playfulness, the multiplication of forms and a careful search for links, relationships and balance.

Taking up space and giving space – two alternating tendencies which she negotiates playfully.

Debora Däubl is studying textile design (director of studies: B. Putz-Plecko) and design, architecture and environment (director of studies: J. Skone) in the art education programme of the University of Applied Arts Vienna. She also teaches textile skills and handicrafts at the Phönix Realgymnasium in Vienna.



Top: woollen twill fabric. Middle: two elements of clothing (felted wool) of the same size as the Iron-Age cloth pieced together from textile finds from the salt mines at Hallstatt. Bottom: experiments with elements of clothing. (all Photos: D. Däubl)



Inspiration: sheet-bronze work with animal representations, burial site, Hallstatt. (Photo: A. Rausch/NHM Vienna)



Inspiration: large cloth pieced together from Iron-Age finds from the salt mines at Hallstatt, Halltex 31. (Photo: A. Rausch/NHM Vienna)



Large photo: production of stack-horses. (Photo: A. Moser); Insert (top) masking with material dyed with indigo; (bottom) sewn model. (Both photos: D. Dürbl)



Urban Seed: air-filled object; experiment in collaboration with the Modul experimenteller Hochbau TU (committee for experimental construction, Vienna University of Technology), 2010. (Photo: R. Ivancsits)

University of Applied Arts Vienna

The University of Applied Arts Vienna counts among the most active and innovative art schools of Europe and is one of the richest in traditions.

The “Angewandte” is home to more than 2,000 students of various ages presenting a great variety of background and experience; many come from other European countries and from countries outside Europe.

Their respective departments of study provide them with stimulating, professional environments for individual development and ample opportunity for collaboration on group projects of various formats.

At the heart of the learning experience is the development of each individual’s artistic expressivity and skill as well as theoretical and conceptual reflection on the creative process.

The University regards itself as a place of free artistic and scientific expression, a forum for open debate and a laboratory for the development of artistic visions destined to have social impact in the present and the future.

The project presented here exemplifies the very different kinds of collective work and research that can be carried out in collaboration with partners from outside the University. Interdisciplinary and cross-disciplinary work gives rise to interesting synergies and innovative impulses.

The University departments involved in the present project were, on the scientific level, the Department of Archaeometry and, on the artistic level, the Textile Department in collaboration with the Department of Textile Technology.



The Giant Cloud. La Biennale di Venezia, Carnevale dei ragazzi; production: experimentone 2011. (Photo: D. Aschwanden)

di:'angewandte

Universität für angewandte Kunst Wien
University of Applied Arts Vienna

Textiles – free, applied and experimental artistic design

All students and graduates taking part in this project have a study background in textiles – art, design, styles and also art education.

The study of textiles as an academic discipline focuses on textile analysis, new applications and the transmission of knowledge concerning textiles in relation to fashion, art, design, everyday culture, architecture and technology.

As an artistic medium, textiles have both free and applied uses: as technical-functional material, a communicative element of design; as a means of self-portrayal and an important component of our material culture; as an ideal example of combination and interconnectivity.

The aim of the study is to enable the student to develop a sound, reflective approach to the practice of the arts, to the practice of design, as well as the necessary scientific competence, a critical mind and the ability to communicate ideas and visions.

Multi-media, interdisciplinary and cross-disciplinary projects with various partners provide support in defining individual priorities and in creating particular professional profiles.

Cross-cultural cooperation on projects with international partners – including an increasing number from non-European countries – is embedded in diverse social contexts and thus provides all participants with ample opportunity for expanding their range of experience, thought and activity.

Julia Cristofolini, Larch-clad, 2011. (Photo: Gudarz Moradi)



Contact

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tex II

Textil – freie, angewandte und
experimentelle künstlerische Gestaltung

Textiles – free, applied and
experimental artistic design

Head: Univ.Prof. Barbara Putz-Plecko

Dragan Jeremic, Dressur (dressage), 2007/08

Department of Archaeometry

The main competence of the Department of Archaeometry (head: *ao. Univ.-Prof. Dipl.-Ing. Dr. Bernhard Pichler*) lies in the fields of ceramics (*Univ.-Lector Dr. Roman Sauer*), textiles and dyestuffs (*AProf. Dr. Regina Hofmann-de Keijzer*), metal and metal corrosion (*Prof. Bernhard Pichler*), and dating methods (*AProf. Dipl.-Ing. Rudolf Erlach*). These research activities are embedded in numerous projects – both national and international (various European projects). Scientific investigations are performed for diploma thesis and dissertations of students from the University of Applied Arts Vienna.

Technical support for artists

Aside from investigations the motto “Technical support for artists” has always been featured prominently. Two quotations from the start (1888) of the University of Applied Arts Vienna emphasize this principle:

‘§ 59 As an educational institute the laboratory has the task to provide the students of the School of Applied Arts with the chemical and technical know-how they will need in their future employment and to offer them materials, means and instructions for their education in all curricula.

§ 73 Therefore all discussions about technically important substances must have the direct goal to allow forthwith an explanation of technical procedures and to enable the characterisation of arts and crafts products.’

Quotations from the guidelines of the School for Applied Arts of the Imperial Royal Austrian Museum for Art and Industry (Decree of the High Imperial Royal Ministry for Culture and Education, August 21st 1888, Rule 16.957), published by the Imperial Royal Museum, 1888.

The cooperation with students, which started in the 1980s, at first comprised a course in Industrial Design and was expanded continually. The interdisciplinary dialogue promotes the conversion of artistic ideas and enhances the deployment of new materials.

Some examples

The ‘rusty surface’ of the sliding doors of the cupboard unit (designer *Ing. Roman Hegenbart*, University of Applied Arts Vienna, Metal Technology) in the office of Rector *Dr. Gerald Bast* was recreated using a recipe modified by Professor Bernhard Pichler (2011). In 1995 Professor Bernhard Pichler contacted *Univ.-Prof. Hans-Peter Degischer* of the Technical University Vienna, in order to obtain information about the use of foamed aluminium. As a result of this discussion a foamed aluminium sculpture was made that was awarded to the Scientist of the Year 2007 (designer *Mag. des. ind. Philipp Aduatz*, University of Applied Arts Vienna).

Cooperative projects

Of the national and international institutes that have been partners for decades, those important for the current projects are:

- Cultural Heritage Agency of the Netherlands, Amsterdam
- Prof. Dr. Ernst Pernicka, Eberhard Karls-University Tübingen and Curt-Engelhorn Centre Archaeometry, Mannheim
- Austrian Archaeological Institute, Vienna
- Natural History Museum Vienna, Department of Prehistory
- Dr. Barbara Plankensteiner, Museum of Ethnology Vienna
- Blaudruckerei Koó, Burgenland



‘Rusty surface’ (cupboard unit) in the office of Rector Gerald Bast, University of Applied Arts Vienna (Photo: © Stefan Olah)

Ephesus, Terrace Houses (Photo: © ÖAI, M. Steskal)

Award for the ‘Scientist of the Year 2007’, designed by Mag. des. ind. Philipp Aduatz

University of Natural Resources and Life Sciences Vienna (BOKU) Institute of Organic Farming

The staff scientists of the Institute of Organic Farming conduct research in organic agriculture in three working groups (Soil Fertility & Cropping Systems, Transdisciplinary Systems Research, Knowledge Systems & Innovations) and give lectures on these topics, e.g. in the Master programme Organic Farming. The institute is equipped with a laboratory, and cultivates fields of BOKU's experimental station under organic farming conditions. Furthermore the cooperation with organic farms is a crucial aspect.

The **Working Group Knowledge Systems and Innovations (AGWI)** recognizes organic agriculture as a system of mutually interacting ecological, social, economic and cultural components. Research focus is on knowledge and practices of the actors in this system. The attitudes and beliefs on which the practices are based, the knowledge transfer and the innovation processes coming from this system are investigated.

The AGWI conducts research on these topics mainly in small-scale agricultural systems in rural, urban and peri-urban areas in Austria, Europe and different countries worldwide, e.g. in research projects, dissertations and master theses, as well as in the university curriculum.

Examples of research topics of AGWI:

Topic Knowledge systems & experiential knowledge

The experiential knowledge (also "local knowledge", "traditional ecological knowledge"), its transmission and transformation is examined, e.g. in the fields of homegardens, intercropping, heirloom varieties and traditionally cultivated plants, use of wild plants, soil, weather and climate.

Topic Innovations & change processes

The innovation processes in organic agriculture are studied, as well as their significance for small farmers and for regional development. Examples of this topic are: organic farmers' experiments and innovations, regional farmers' networks, standards and control systems, Fair Trade, Slow Food, organic textiles and natural dyestuffs.

Working Group Knowledge Systems and Innovations

Head: Ao. Univ.-Prof. Dr. Christian R. Vogl

Institute of Organic Farming

University of Natural Resources and Life Sciences Vienna

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www.nas.boku.ac.at/oekoland.html



Various research projects on the topic natural dyestuffs and eco-textiles have been carried out at the Institute of Organic Farming. (Photo: A. Hartl)

Cultural Heritage Agency of the Netherlands (RCE)



Cultural Heritage Agency
Ministry of Education, Culture and Science

The Cultural Heritage Agency of the Netherlands (RCE) is a department of the Ministry of Education, Culture and Science (OCW) and has its headquarters in Amersfoort, the Netherlands. The RCE is responsible for the care of cultural heritage in the Netherlands focused on the preservation of monuments and historical buildings, archaeology, natural landscapes and objects of art and culture. The RCE has 329 permanent staff and 20-50 contract researchers, students and interns.

The Sector Research Movable Heritage of the RCE is organised according to general conservation issues, such as evaluation and development of treatment methodologies, analytical and documentation technologies and strategies, risk assessment and preventive conservation, conservation of contemporary art and materials, analysis and technologies of paintings, conservation strategies for paper and archival collections, etc.

The Sector Research Movable Heritage has developed several studies on art-historical objects and precious artworks, such as paintings of Rembrandt, Van Gogh, Mondriaan and many others. In addition, the sector studied extensively (archaeological) textiles, focusing on the dye and mordant analysis and the condition of the fibres. This sector is hosted in Amsterdam, in the Atelier Building, shared with the Rijksmuseum Amsterdam and the Faculty of Conservation of Cultural Heritage of the University of Amsterdam. The RCE currently participates in European projects, such as CHARISMA, POPART, Europeana, WreckProtect and is responsible for the continuation of the former European project INCCA.



The Atelier Building opposite to the Rijksmuseum Amsterdam. (Photo: RCE)

The Natural History Museum Vienna

Opened in the year 1889, the NHM is one of the most important natural history museums in the world, with approximately 30 million exhibits and over 550,000 visitors in 2011. Its earliest collections were assembled over 250 years ago. Famous and unique exhibits, such as the 25,000-year-old figurine Venus of Willendorf, Steller's sea cow, extinct for more than 200 years, giant dinosaur skeletons, and Maria Theresia's gemstone bouquet consisting of 2,000 diamonds are highlights of a visit to the 39 rooms of the museum, bringing an encounter with natural history to life.

The research departments of the NHM employ around 60 scientists who work on basic research projects in widely diverse areas of the earth, biological, and human sciences. This makes the NHM an important knowledge centre for public issues and one of the largest non-university research institutions in Austria.

The Department of Prehistory houses one of the largest archaeological collections in Europe, including many world-class finds. Research is concentrated on Palaeolithic times, the Hallstatt and Celtic periods, and various eras of the Early Middle Ages.

Further information: www.nhm-wien.ac.at



*The world-famous Venus of Willendorf.
Large mammal hall, showing rare specimens including the
skeleton of the extinct Steller's Sea Cow. (Photos: NHM Vienna)*



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Background: Brigitte Zaussinger, Grabtuch (shroud). (Photo: Peter Hoifß)

Back cover (top): Drying of woad pigments (*Isatis tinctoria*). (Photo: A. Hartl)
Back cover (bottom): Iron-Age woven cloth with dogtooth pattern, from the salt mines at Hallstatt, Halltex 67. (Photo: NHM Vienna)

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colours of Hallstatt



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