Stretching Time

Researching Collections. Temporal Morphologies and Transformation of Matter

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Clemens Winkler, Christian Stein, and Object Space Agency (eds.), *Stretching Materialities*.
https://doi.org/10.53198/9783943253955-4

1. INTRO: COLLECTION OBJECTS AS EMBODIMENT OF TIME

Far from being static relics, objects in collections are constantly evolving, shaped by a variety of influences—from historical and cultural contexts and changing academic perspectives to wider socio-political and technological shifts. Their material decay reveals the enduring effects of time, environment, and human interaction, while archival and exhibition practices such as handling, conservation, and curation further transform them. Together, these processes continually redefine their meaning and function.

How these objects function as generators of knowledge is closely linked to these different constellations of time and matter. As Eilean Hooper-Greenhill explores in *Museums and the Shaping of Knowledge* (2003), objects in collections contribute to the ongoing construction and redefinition of knowledge through their interactions within cultural, disciplinary, and educational contexts. In this sense, as carriers of time and memory, their meaning is continually reconstituted through these processes and practices.[1]

At the same time, conservation efforts strive to suspend the natural flow of time by concealing decay and degradation to create an illusion of timelessness. This approach has been described as »stripping things of their relationship to time,« a strategy that ultimately proves to be unsustainable given the dynamic nature of materiality (Burström 2011, 125).

Building on these ideas and my own personal research interest, the exhibition section *Stretching Time* at Tieranatomisches Theater (TA T) emerged from collaborative practices → Stretching Practices, 55 as part of a shared research effort to explore how collection objects embody and reveal the passage of time and the dynamics of material transformation. The exhibition space became a veritable laboratory where interdisciplinary collaboration was not only presented but actively practiced. Researchers, curators, and artists from fields as diverse as art history, design, computer science, geology, anthropology, architecture, dance, and materials science came together to push the boundaries of their respective disciplines. They explored how to make the interplay of objects, space, material, and time tangible, and how to engage with the active matter of our environment in ways that transcend traditional disciplinary silos.

1 Objects circulate and accrue meaning through their interactions within cultural, disciplinary, social, and educational contexts, see Appadurai 2007. For how the practice of exhibitions is involved in the construction of knowledge, see Lehmann-Brauns, Sichau & Trischler 2010.

During the exploratory phase of the exhibition-in-the-making, university collections became a key focus—not only because they were more accessible during the COVID period but because they offered a unique conceptual perspective. Unlike static museum displays, these collections are not passive archives but active sites of knowledge production.[2] They transform abstract notions of time, activity, and passivity into tangible learning experiences. Used in teaching and research, they serve as dynamic resources rather than historical artifacts, bridging past and future while continuously shaping knowledge in real time—a characteristic that can be called »presentness« (Hennig 2015, 120–122). They embody a hybrid of temporal concepts, with the balance between these temporal layers to be determined for each collection.

This perspective shaped our fieldwork as we explored university collections firsthand. In multiple visits, both individually and as a research group, we engaged with the Späth Arboretum, the Geological-Geomorphological Collection, → Intermezzo 4, 235 and the Zoological Teaching Collection. We also examined the dust collection at the Museum für Naturkunde Berlin as part of our joint research. → Stretching Practices, 210 This fieldwork ultimately informed the subsequent investigations in the exhibition space.

2. EXPLORING THE COLLECTIONS: LAYERS OF TIME IN THE SPÄTH ARBORETUM

My journey into the temporality of collections began with a research visit to Humboldt University's Späth Arboretum. To explore how university collections embody different temporal structures, I had several in-depth conversations with Thomas Janßen, head of the collection. His insights shed light on the delicate balance between activity and passivity in botanical collections, revealing how they navigate the interplay between preservation, dormancy, and reactivation.

At the Arboretum, collections are divided into dynamic living specimens and carefully preserved materials. As Janßen explained, »the living collections are constantly changing and need constant care, so time is an ever-present factor.«[3] Every tree, flower, and seasonal change in the garden bears witness

2 Cf. te Heesen 2008, 489. Also see Brüning & Raulff 2021.

3 Interview with Thomas Janßen, conducted 21 February, 2024. All following quotes from Dr Thomas Janßen are taken from this interview.

to nature's ongoing cycles of growth and decay. In contrast, the preserved collection—including resin-embedded specimens, herbarium sheets, and seed archives—appears more stable. Yet, as Janßen explained, even the most apparently static specimens are inscribed with time. Resin-embedded specimens, for example, designed to preserve plant material in a permanent state, are themselves subject to the passage of time as the preservative resin cracks, air bubbles form within, and the material may become yellow, darker, or brittle over time (fig. 1).

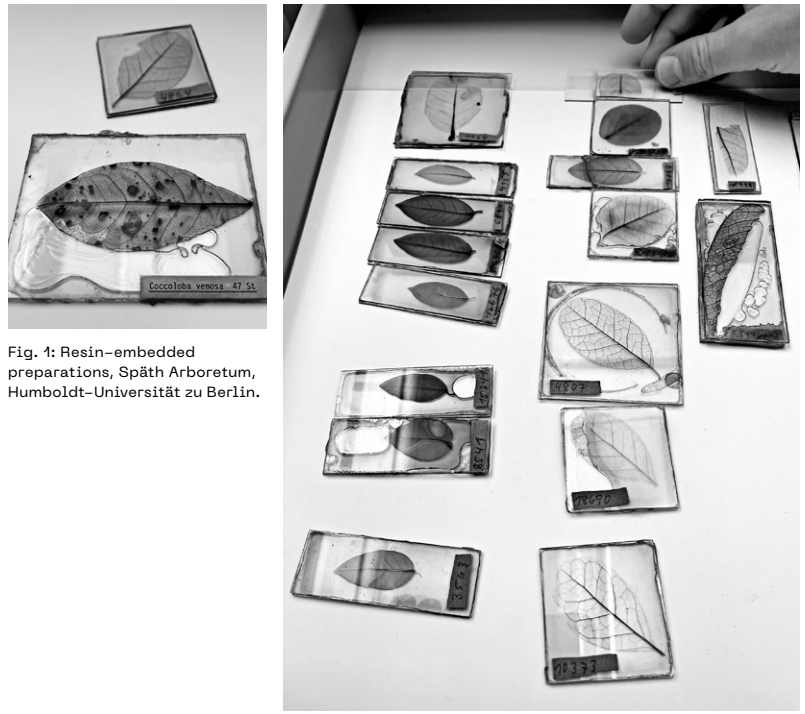


Fig. 1: Resin-embedded preparations, Späth Arboretum, Humboldt-Universität zu Berlin.

The chosen conservation technique, designed to arrest decay and to meticulously preserve its historical and scientific value, ultimately reveals the impossibility of truly freezing time.[4] The subtle changes in the resin are not just signs of decay; they are active records of time that encapsulate the interplay between forces of nature and human methods of preservation.

The herbarium sheets extend this narrative of temporality. On the one hand, they slowly change over time: colors fade, textures dry out, and the delicate structures of flowers and leaves deteriorate. On the other hand, they record time in two ways: each sheet shows not only a dried specimen but also a detailed label with critical data—who collected the plant, where, and when, preserving the moment it was collected. This

4 This is a common problem in collections. Another example is animal hides and skins, where certain chemicals, originally designed to stabilize their structure, can cause them to decompose more rapidly over the years.

information creates a timeline that helps researchers track long-term shifts in phenology and flowering patterns—key indicators of environmental changes such as global warming—and serves as a bridge between past conditions and scientific inquiry into our future as Earth's inhabitants (Primack et al. 2021).

Freezing as Conservation: Passivating Biological Activity

A key method for archiving these morphological and temporal details for future study is cryopreservation. As Janßen emphasized, »herbarium specimens must be periodically frozen to stop biological activity, especially to prevent infestation by pests such as insects.« This preventive practice—temporarily »passivating« the material to preserve its scientific value—illustrates the paradox of conservation: objects are preserved by interrupting natural processes, but this intervention is itself cyclical and must be repeated over time (fig. 2).

Fig. 2: Refrigerating of herbarium sheets, Späth Arboretum

Cooling and drying have long served as fundamental cultural techniques for preserving organic and inorganic materials alike. Across historical periods and scientific disciplines, these processes have been used to halt decay, stabilize matter, and extend the longevity of objects, whether in food storage, archival preservation, or museum collections. Rather than stopping change altogether, which would imply total passivity, these techniques slow down and regulate natural processes such as decay, degradation, or transformation. One could call it a controlled form of activity—managing the passage of time rather than eliminating it. By intervening into the ways in which materials age or remain stable, these techniques make time tangible and manipulable, transforming it into something that can be actively shaped through conservation practices.

At TA T, refrigeration as a method of slowing down natural time is one of the defining historical layers, and it shaped my approach to the site. In the past, horse carcasses were stored there and their preservation was prolonged by refrigeration. As a result, preservation techniques and the slowing of time played a central role in my study of the university's collections. Although refrigeration was not directly present in the exhibition space, and only conceptually through the slowing down and stretching of time, it remained a core idea throughout my curatorial work.[5]

5 This resurfaced for instance in workshops like *The Power of Water* with curators in 2023.

Dormant Time: The Potential Energy of Seeds

Another layer of temporal complexity is found in the seed collection, which Janßen described as »incredible time capsules.« Seeds represent a unique state of *passive activity*: Although dormant, seeds are imbued with the potential for life. They contain all the necessary genetic information, waiting for the right conditions—moisture, temperature, or chemical signals—to awaken them. Moreover, the shape of each seed, despite its passive state, embodies an ingenious strategy for active dispersal—whether by wind, animal fur, or digestion (fig. 3). As Janßen noted, this duality makes seeds a powerful symbol of both the past and the future. Moreover, this duality is emblematic of the collection as a whole—a mixture of latent potential and ongoing activity that unfolds over time.

Fig. 3: Examples from seed collection, Späth Arboretum

Seeds hold the memory of past ecological conditions while carrying the potential for renewal, linking preservation with cycles of reactivation. As Janßen noted, some seeds in the Arboretum's collection are stored for future research or exchanged with other botanical institutions, forming a global network. This oscillation between dormancy and activation parallels the shifting relevance of many collections in the academic world, where value and attention fluctuate with research priorities and scholarly trends. For example, some parts of the Arboretum, such as a cabinet with a GDR-era wood collection, remain undocumented and unresearched but are preserved for their potential future importance.

The Späth Arboretum is a space of constant transformation, where objects shift between states of activity and passivity, preservation, decay, and renewal. The interplay between natural growth and controlled conservation in this environment has deeply influenced my understanding of temporality within university collections and laid the conceptual groundwork for *Stretching Time*.

3. MORPHOLOGIES OF TIME: EXPLORING THE GEOLOGICAL COLLECTION

This tension between conservation and transformation took on an entirely different scale in the Geological-Geomorphological Collection. Here, time was no longer measured in seasons or decades but in millennia, recorded in the very structure of the rocks. As Jeffrey Cohen (2015, 2) observed, »stone is primal matter, inhuman in its duration.« The shift from botanical to geological collections also meant a shift from the controlled interventions of conservation science to the broader planetary forces that shape materials over deep time, such as plate tectonics, glacial movement, and erosion. How do rocks, like seeds, store time? How does weathering reveal the hidden activity of matter? And what role does human intervention play in accelerating or disrupting these cycles, especially in the Anthropocene?

Research conducted through numerous visits and conversations with geologist Mohsen Makki, head of the collection, revealed that stones are—despite their apparent immobility—far from inert. → Intermezzo 4, 235–243 Instead, they are incredibly active materials that are fundamental to life on Earth. In vast temporal cycles imperceptible on human time scales, they are in constant motion, forming, eroding, and reforming.

In discussions with the Object Space Agency (OSA) group about the temporal dimensions embedded in the Geological Collection, it quickly became clear that a selection of stones should form the centerpiece of the TA T display case, seamlessly connecting with other parts of the exhibition. This choice resonated with Natalija Miodragović's concept of »Leaking Stones.« → Stretching Spaces, 174 Moreover, the collaboration opened up the possibility of integrating meteorites from the Geological Collection, thus expanding the view of the finiteness of matter on Earth in our curatorial concept. Clemens Winkler's exploration of atmospheres and gaseous matter revealed further intersections: his understanding of the exhibition space as an interwoven, experimental ecosystem—where his cloud responds to visitors' vapors—corresponds to the slow weathering of stones, a process driven by moisture but unfolding imperceptibly slower than aerial transformations. → Stretching Practices In addition, we sought to engage more holistically and corporeally with the materiality and temporality of the stones. This led to a close collaboration with Studio Above & Below, who created a geological VR environment for Christian Stein's exhibition section. → Stretching Virtuality Developed in collaboration between Mohsen Makki and myself, this immersive environment deepened the sensory experience of geological time and transformation.

Fig. 4: Installation view

The selection of stones for the exhibition was made following numerous visits to Mohsen Makki and in close collaboration with him. We were guided by the question how to make the passage of time tangible—allowing visitors to trace the marks of wind, water, and geological pressure across their surfaces.

Sediments of Time: Weathering as a Conceptual Nucleus

Weathering emerged as the central conceptual thread in the exhibition segment, shaping both the selection of objects in the display cases and the broader investigation into time's material manifestations (fig. 4). The exhibition explored how weathering acts as a sculptor of geologic form, shaping rocks through interactions with atmospheric forces, climate, and biological processes. Over millennia, wind, rain, snow, and plant life have inscribed time on the surfaces of rocks, leaving distinct patterns, textures, and colors that reveal their history of transformation.

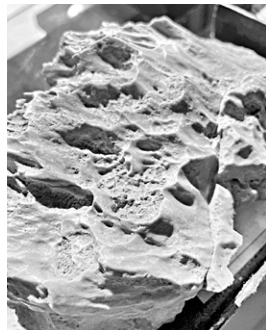


Fig. 5: From left to right: (a) Display case shelf »Morphologies of Time« showing different forms of weathering, such as (b) solution weathering by wind and rain, specimen found in Langenburg am Rhein, collected by Albrecht Penck, 1893

It is an active process that gradually transforms matter, producing distinct morphologies that reveal the passage of time.

Many of these morphologies were displayed in the display case, illustrating how different weathering processes create unique geologic forms (fig. 5a). One rock bore the marks of wind abrasion, its smooth surfaces and sharp edges shaped by the direction and intensity of airborne sand particles (fig. 6c). Another showed the dual effects of rain and wind, with an initially rough texture formed by prolonged exposure to water, only to be polished later by sustained dry, sandy winds—a process spanning thousands of years and reflecting changes in climate. → Intermezzo 4, 242

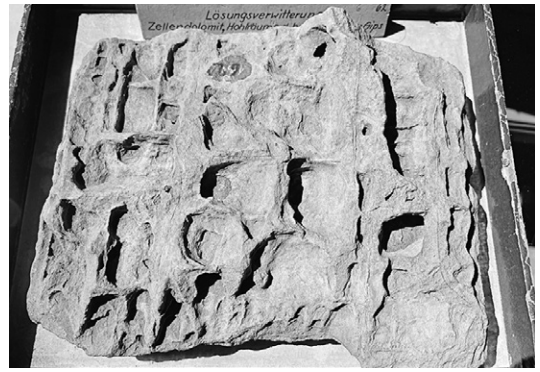
Other specimens in the collection showed evidence of chemical-biological weathering, where traces of plant roots and ancient worms from the Jurassic period remained imprinted in the stone long after the organic material had disappeared (fig. 6b). Another sample showed the effects of freeze-thaw cycles, where snow and meltwater had etched deep grooves into the rock (fig. 6a).

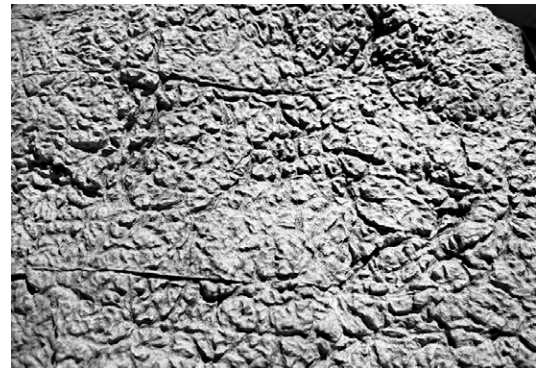
Weathering also alters a stone's color, leaving mineral signatures that chronicle environmental changes. ❑ Exhibition, fig. 8, 128 Depending on climatic conditions and a rock's chemical composition, its surface may take on deep reds from iron oxidation, pale yellows from water exposure, or dark patinas from prolonged organic interaction. Time is painting itself onto the geologic record, creating a colorful visual archive of environmental history.

By showcasing these morphologies of time, the exhibition emphasized weathering as a central force in geology—one that not only breaks down matter but also actively reshapes it. This perspective underscores why weathered rocks are key elements in geological collections, not only for their scientific value but also for the narratives they reveal about Earth's deep time and ongoing transformations. Weathering plays such a crucial role in geology that it directly influences collection strategies, shaping acquisition decisions in the Humboldt collections.

Weathering challenges conventional notions of temporality. It is not only a geophysical phenomenon but also an ecological, political, and cultural process that reflects the passage of time in ways shaped by human intervention.[6] As Holzhey and Wedemeyer (2020, XIII) argue, the effects of environmental catastrophes are already being registered, making weathering not just a slow geological transformation but an active marker of planetary change. In this sense, weathering is not just about erosion—it is also about persistence, a way of experiencing time that leaves traces in both natural and cultural landscapes.

6 For an extended discussion of the concept of »weathering« see Holzhey & Wedemeyer 2020





By presenting and incorporating these processes, the exhibition invites visitors to see weathering as more than just decay—it is a dynamic inscription of time onto material form. The display case thus presents not just geological specimens but sediments of time itself, embodying the slow rhythms of global transformation.

Fig. 6: More forms of weathering: (a) solution weathering by ice, snow, and meltwater, (b) chemical–biological weathering, etched by plant roots, and (c) weathering through wind abrasion

Anthropogenic Rocks: Entangled Temporalities of Humans and Stones

Stone time and human time are increasingly intertwined, as human activity has significantly altered the Earth's surface. Through industrialization and urbanization, humans have created anthropogenic soils and rocks, transforming landscapes on an unprecedented scale. These man-made geological formations—some of them highly toxic—serve as unintended archives of human influence.

Berlin's soils and those of other cities act as repositories of urban development and industrial history (fig. 7). New soils are created by overlaying the natural soil with substrates of anthropogenic or technogenic origin. These soils have new and unique chemical and physical properties and are classified differently than natural soils.[7]

7 These human-altered soils, such as those displayed in the exhibition, are currently being studied as part of an ongoing research project by Mohsen Makki.

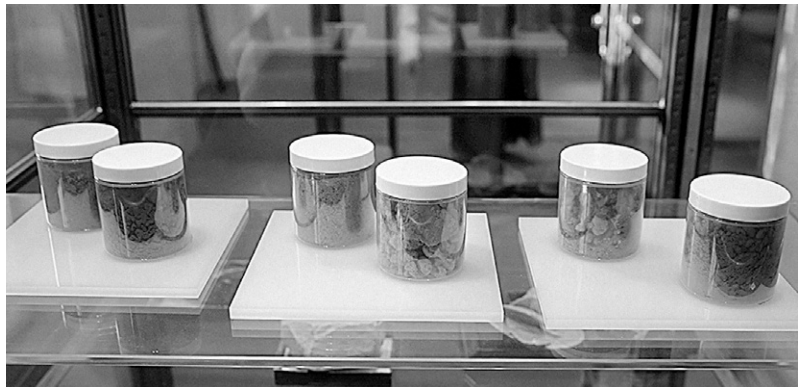


Fig. 7: Soils of Berlin

A historical perspective on anthropogenic soils is provided by a selection of different medieval slags (fig. 8). Since the Bronze Age, over 6000 years ago, humans have inadvertently created new types of solid rock as waste products of metal, iron, ceramics, and glass production. While these materials resemble naturally occurring rocks, their chemical composition often contains hazardous substances, such as arsenic and cadmium, that can leak into the environment when in contact with water. As part of these anthropogenic formations, the exhibition featured a volcanic rock from Iceland that–though visually indistinguishable from industrial slag–was formed naturally and contains no toxic compounds.

These materials emphasize the deep entanglement of natural and human-made geological processes. Just as wind, rain, and tectonic forces shape the landscape, industrial activity and urbanization have introduced new layers of geological

Fig. 8: Slags from Medieval Ages

transformation. By including anthropogenic rocks in the exhibition, we expanded the concept of weathering to include the material legacies of human intervention. This connection between humans and stones becomes even more apparent when their temporal markings serve as a lens through which we can explore the future.

Matter-Morphosis: The Potentiality of Cracks and Growth from Decay

Stones exist in a perpetual state of transformation, undergoing slow but continuous cycles of formation, erosion, and regeneration–what might be called »matter-morphosis.« During these processes, time marks stones with cracks caused by geological movement or climate change.

When stones crack, water is allowed to seep in and widen the fractures. Changes of climate, rainfall, and warmth gradually seal the cracks over time. This process reveals the stone's potential for self-healing, as geochemical or mechanical processes eventually close the cracks over millions of years (fig. 10).

Fig. 9–10: Samples from the shelf »No Decay without Growth.« Left: Calcite; right: Alpine limestone with wrinkled folds

Conversely, cracks in the inner layers of the Earth can become a protected space for the growth of new stones. Within rock cavities or deep underground in crevices, minerals such as crystal desert roses or calcite emerge, demonstrating that in the world of stones, there is no decay without growth (fig. 9). More than an act of erosion, weathering is also an act of creation, highlighting nature's continuous cycle of transformation.

Cracks do not only promote growth and repair but also allow interactivity with and adaptation to environmental changes, as the example of lichens shows. Their filamentous hyphae metabolize fissures, penetrate the rock, and intricately weave biochemical compounds between the solid base and the airy atmosphere. This ability of lichens to capture ephemeral matter represents a potential for forging new relationships with resources and initiating new material cycles.

Cracks were central to the conceptual framework of our exhibition, acting as a magnifying glass that revealed many aspects of the interplay between matter and time. Every crack in an object, every fine line that crosses an object's surface tells a story, carrying the weight of history and marking its journey through time. Cracks in objects evoke memories and invite us to imagine the moments that led to their creation: accidental drops, natural aging, the forces of nature that shape fractures, and practices of conservation, storage, and display.

Cracks do not only signify the passage of time but also manifest a sense of openness and potentiality.[8] They suggest that the object's story is far from complete, like a branching tree with divergent paths. Each crack invites us to consider alternative trajectories, encouraging our imagination to speculate about what the object might have witnessed or experienced. As we project ourselves into its narratives through our own memories and experiences, we weave stories and associations that intertwine with the textured surface created by those cracks.

Formed over millions of years, each rock holds interstellar memories. The cracks on the surfaces of these geological objects act as windows into the past, revealing the transformative forces that have shaped the stone, our planet—and our galaxy. These silent witnesses embody planetary forces, geological activity, and tectonic shifts. Geologists decipher these cracks, for example on an erratic boulder, carried by glaciers during the Ice Ages, to understand its long journey through changing climatic conditions.

Cracks hint at future transformations and hold an epistemic potential, offering untapped information and hidden narratives. They also remind us of impermanence, emphasizing our fleeting presence in the face of geological time. Cracks open irreversible spaces of possibility that are unique and unrepeatable. They encourage reflection on our relationship with Earth, especially in times of crisis, and our potential impact on its future.

Cracks not only trigger interventions such as repairs, they also embody their own agency within the dynamic interplay between the object and surrounding activities and practices. Consequently, cracks can be seen as disruptive elements, disturbances in the dialogue between objects and humans—or perhaps they are better understood as a language through which the object communicates with us as we study potential futures of objects and spaces and their agencies.

By considering the cycles of renewal in stone and its inherent potentiality, we can gain deeper insights into the broader implications of conservation techniques. Material objects, whether natural or man-made, exist in a continuous cycle of change, decay, and renewal. The act of conservation, however, interrupts this cycle by stabilizing and immobilizing materials, thereby limiting their potential for transformation and constraining possible future developments. The degree to which conservation regulates these possibilities depends on the material itself. Restoration, on the other hand, seeks to reconstruct a lost state, to preserve a specific narrative – not only for individual objects but also for the architecture of public spaces such as museums. The choices we make regarding restoration, renovation, and reconstruction reflect our interpretation of what should be preserved and how memory is formed.

In essence, restoration limits the possibilities of different pasts, while conservation limits the possibilities of different futures. Both practices extend beyond the material object and influence how we understand history, culture, and identity.

The self-healing capacity of geological materials challenges traditional conservation narratives that seek to halt change. Conversely, *Stretching Materialities* highlighted how matter is never static. Cracks, often associated with fragility, can also be sites of renewal, demonstrating that preservation and transformation are intertwined.

By making these slow processes visible, the exhibition encouraged visitors to rethink stones as active materials—dynamic participants in Earth's evolution rather than passive relics of the past. This perspective raises broader questions for conservation: instead of striving for absolute stability, could we learn from geological processes, embrace change and transformation rather than simply resist them, and more closely align ourselves with the dynamic processes found in nature?[9]

The Power of Water: Rethinking Temporality and Conservation

Inspired by observations in the Arboretum and the Geological Collection, water emerged as a powerful metaphor and material agent for understanding temporality in my research for and during the exhibition. Beyond its role in geological self-repair of cracks, it became a central focus within the broader exhibition framework, particularly in the exploration of conservation techniques.

8 The transformative potential of cracks is also reflected in discussions on their performativity within theater studies; see for example Hartung 2023.

9 For this approach in conservation see DeSilvey 2017.

10 For more details, especially in relation with university collections, see Samuel 2024.

The Power of Water, a workshop originally planned to accompany the exhibition but postponed due to the impact of COVID-19, was rescheduled for June 2023. ❑ Process, fig. 15, 276 This workshop explored the transformative power of water—not only as a natural force shaping landscapes and weathering rocks but also as a conceptual lens for understanding processes of temporal immobilization and material transformation. The »Objektlabor« at TA T was an ideal setting for the workshop, as it had previously hosted Anna Kubelík's installation → Intermezzo 1, 61 —a performative sound artwork that responded to the fluctuating humidity levels in the space. ❑ Exhibition, fig. 9, 130

The interplay between water and conservation has long been a subject of inquiry, particularly within the field of conservation science. Since the eighteenth century, scholars have debated the relationship between water and material stability over time, recognizing its paradoxical role as both a destructive and regenerative agent.[10] Seemingly so ordinary and ubiquitous, water is the only element that exists simultaneously in all states of matter on Earth, its properties remaining central to both natural and human interventions into material conservation. Research continues to explore how water can be used to stabilize, restore, or modify materials in a controlled manner.

Fig. 11–12: Experimentation during the workshop *Power of Water* at Objektlabor of TA T, June 14, 2023

Throughout the exhibition research for *Stretching Time*, conservation science played a crucial role in uncovering hidden material transformations. While the study of material activity draws from a variety of disciplines, the field of conservation itself is often conspicuously absent from these discussions, despite its core mission of slowing or halting material change. Conservators accumulate invaluable tacit knowledge about how to slow down natural processes, effectively »freezing« time in collection objects, and how materials respond to time and environmental forces, knowledge that was made tangible through this hands-on workshop. Designed as a physical engagement with conservation practices, the session introduced participants to the practical applications of water in conservation treatments, with interactive demonstrations and experiments that allowed visitors to explore water's role in shaping, preserving, and even transforming matter (fig. 11–12).

The water workshop extended the exhibition's exploration of the dynamic interplay between time, matter, and conservation, ensuring that its themes kept resonating long after the exhibition closed. It underscored the crucial role of fluidity in shaping our perceptions of temporality within collections and for cultural techniques.

4. THE DISPLAY CASE AS EXPLORATORY RESEARCH APPARATUS

Upon entering TA T, visitors were greeted by large metal display cases—historical objects in themselves, dating back to the nineteenth century, when museum practice sought to protect objects from visitors. Then, as now, display cases were conceived as safeguards, quarantining fragile specimens from human breath, touch, body heat, and airborne particles. This strategy, rooted in the idea that visitors posed a threat to objects, has persisted as a museum standard, reinforcing the separation between viewer and exhibit.

Since one of our central research questions was how to make the dynamic processes of materiality—such as the weathering and transformation of stone—tangible in the exhibition space, it was a logical step to explore how the display case itself could be reimagined as a tool for this exploration. Due to restrictions concerning those geological objects on loan for the exhibition, it was not possible to open all display cases completely. However, we chose to leave them partially open, transforming the cases into an interactive starting point—one that encourages dialog and inquiry rather than mere observation (fig. 4).

The Haptic Box and Hands-On-Station

To challenge and expand the concept of the display case, a Haptic Box was inserted into it, turning it into an exploratory

research apparatus—a dynamic interface between objects, curatorial research, and visitor interaction rather than presenting a passive display case.

The idea for the Haptic Box grew out of research in the University's collections, where both the Späth Arboretum and the Geological Collection highlighted the essential role of tactile knowledge in scientific inquiry. In the Arboretum, touch, smell, and even taste enhance learning—whether handling seeds or feeling the textures of herbarium specimens. Similarly, in geology, tactile engagement is fundamental; as Mohsen Makki pointed out, specimens are meant to be held, traced by hand, and sometimes even tasted to identify mineral compositions. → Intermezzo 4, 238 This shared reliance on sensory perception in both fields reinforced the importance of hands-on engagement for making material transformations and temporal layers tangible.

Fig. 13: Haptic Box explored by a visitor. Design of the box: Colin Marc

By reaching into the Haptic Box, visitors engaged directly with the materials on display without seeing them first, shifting the focus from visual perception to tactile exploration. The box invited them to »touch time«—to experience the effects of time on matter through the textures of sediment grains in eight different sizes, mirroring the tactile methods geologists use to analyze rock formations. This sensory approach challenged the primacy of vision and offered a haptic encounter with the processes of weathering and material transformation (fig. 13).

The Hands-On Table, installed next to the display case, provided an experimental space for visitors to actively explore weathering processes (fig. 14–15). By handling dolomite and limestone, visitors could explore the different textures that natural processes have created over time. Applying a 10% hydrochloric acid solution to the stone surfaces then triggered a reaction that simulated the effects of rainfall, condensing centuries of weathering into seconds. This interactive station encouraged hands-on experimentation, allowing visitors to experience geological transformations firsthand, whether using the provided specimens or their own stones brought in for testing.

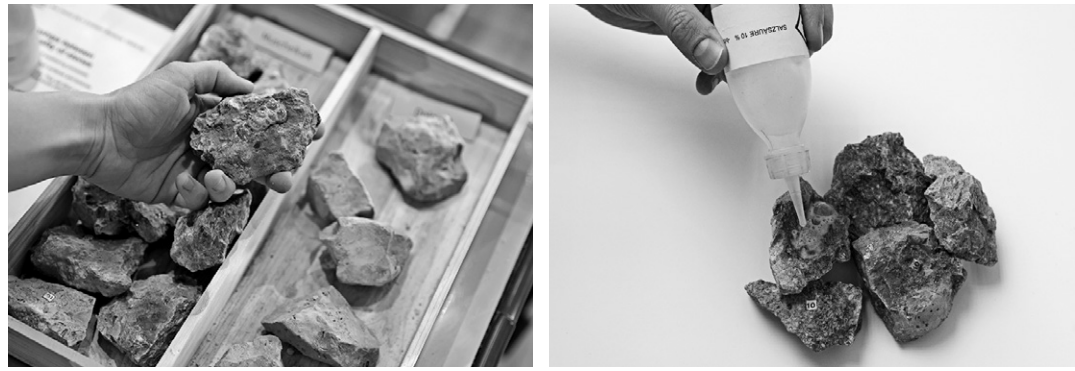


Fig. 14–15: Hands-on-station

By opening the display case—physically and conceptually—we disrupted the traditional boundaries between conservation and interaction, between passive display and active experimentation. However, it was equally in the act of closing the case that a transformation occurred: by enabling visitors to experience touch before sight, the display case became a »feel case,« shifting from a barrier of separation to a space of sensory exploration. This dual gesture of opening and closing reinforces the exhibition's core question: how can material objects embody and reveal the passage of time?

As a site of material storytelling, the conceptually expanded showcase also played a central role in our mediation program, fostering engagement with the deep connections between materiality, time, and human experience, such as Kaaren Beckhof's engagement with stones in her performance using rock flour. → Intermezzo 5, 357 Visitors engaged with themes such as the vastness of geologic time in contrast to human temporality, and the ways in which stones—often perceived as inert—carry narratives and personal memories through their formation and transformation. Small enough to fit in a pocket, stones are among the most common souvenirs, collected from places of significance and imbued with personal meaning.

Virtual Encounters with the Active Materiality of Stone

In addition to the physical and haptic explorations, the exhibition extended this sensory engagement into the virtual realm. The »entrance« to this world could also be found on the Hands-on Table via a small plate with a stone and the inscription »You can enter this stone in the basement of our Virtual Elevator.« → Stretching Virtuality Through the Virtual Elevator, visitors were able to experience the sensation of »stepping into« the dense mass of a stone—the same stone that was physically present and available to touch at the Hands-on Table. This immersive experience allowed them to move through the interior of the stone's structure, encountering its layers, fractures, and densities from an impossible, greatly magnified perspective. By digitally expanding the stone's microcosm into a walkable environment, the Virtual Elevator transformed a seemingly solid, passive object into an active landscape, revealing the intricate materiality hidden beneath its surface.[11]

11 The design of the visual representation of the inner materiality of the stone was created in collaboration with the Max Planck Institute of Colloids and Interfaces, Department of Biomaterials, in Potsdam.

Fig. 16: Still from *Geological Performers*, VR experience by Studio Above & Below, 2021

Through the Virtual Elevator, visitors also entered *Geological Performers*, a VR experience by Studio Above & Below they designed based on insights into weathering processes and stone surfaces that I gathered from Makki during the research phase of the exhibition (fig. 16). ❑ Process, fig. 12, 274 Functioning as an immersive time capsule, it allowed visitors to experience the dynamic changes of weathering on stone surfaces and offered an alternative perspective on geologic time—to witness the slow, imperceptible transformations that typically unfold over millennia, compressed into an interactive, dynamic

experience. Walking around the VR space, the generative forms and changes of the digital materials of the virtual stones were constantly evolving, inspired by Berlin's weather. → Stretching Virtuality, 92 External real-time weather data entered the virtual indoor space and transformed into parameters such as movement, speed, forms of computer graphics, and cracks in the digital stones.

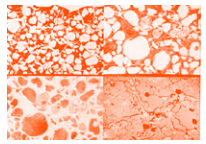
Crucially, because touch is fundamental to geological knowledge, this virtual experience also required haptic engagement. To activate the interaction, visitors picked up a stone tracker—a 3D-printed replica of the desert rose displayed in the case. ❑ Exhibition, fig. 20, 140 Holding this print, they navigated the VR space, approaching digital stones whose textures, structures, and patterns constantly evolved according to wind, humidity, and temperature fluctuations outside the exhibition space. By merging tactile engagement with real-time environmental dynamics, this experience highlighted the active materiality of stone and offered an intuitive way to feel and interact with the passage of time, making the invisible forces of planetary change tangible and perceptible.

5. EXHIBITION AS PROCESS AND RESEARCH

From the moment visitors entered the exhibition, it was clear that this was not a static display but an evolving process. As researchers and curators, we deliberately abandoned the conventional position of presenting finished results or settled theories. Instead, we exposed not only our research but ourselves—embracing a state of openness that made us vulnerable to critique, dialogue, and transformation.

This approach shaped the way visitors engaged with the exhibition. Rather than passively consuming information, they often came with questions, insights, and even their own expertise. The exhibition became a space of exchange, where visitors actively contributed to discussions, suggested new perspectives, and even suggested ways to expand the project. These interactions influenced the exhibition itself, reinforcing its experimental nature and its role as an ongoing research process. Some of these visitor-driven impulses led to concrete additions

during the course of the exhibition, including the integration of two key contributions: Rochus Blaschke's scanning electron micrographs of weathered stones and Lena Dues's installation. → Intermezzo 2, 107 → Intermezzo 4, 247



Rochus Blaschke's scanning electron micrographs, some of the first detailed enlargements of weathered stones made in Europe in the 1980s, revealed microscopic landscapes of erosion and transformation. ❑ Process, fig. 20, 281 These images provided a striking visual record of how stones are dynamic sites of interaction between biological and mineral processes.

A key discovery in these images was the presence of biofilms—dense microbial colonies that form on stone surfaces. These microorganisms do not simply settle on the stone; they actively interact with it, secreting acids and enzymes that break down mineral structures. Over time, these biological interactions contribute to surface pitting and degradation, demonstrating that weathering is not just a mechanical or chemical process but also a biological one. Beneath the biofilm, the crystalline structure of the stone remains visible but altered—showing that the stone surface itself is in a constant dialogue with its environment.

Blaschke's work also highlighted the concept of stones as breathing entities. Metabolic processes of these microorganisms produce CO_2, which reacts with water to form a weak acid that further etches the stone. This symbiotic relationship between biological life and geological materiality transforms stone surfaces into living, responsive systems—challenging the perception of stone as static or lifeless. The micrographs capture weathering as both a destructive and generative force, where decay and growth occur simultaneously: as minerals dissolve, new crystalline formations can emerge, reshaping the stone's surface over time. Blaschke's images offer a rare glimpse into the hidden life of stones, where microscopic processes shape geological materials as profoundly as wind, water, and tectonic forces.

Dues's installation *Auturgy of Carbamide* expanded the discourse on self-organizing material systems and the fluid boundary between organic and inorganic matter. → Intermezzo 2, 108 Two glass cylinders and a Petri dish filled with a saturated carbamide solution formed a laboratory-like composition. Over time, carbamide crystals grew independently, formed by the climatic conditions of the exhibition and the shape of the glass container, rendering material transformation tangible. The material became an active participant, a subject rather than an object of the exhibition, raising questions of agency, authorship, and creation: Who or what is active or passive?

12 See Döring 2021 and Bjerregaard 2020.

This perspective on material agency was explored in the event *About Microbes, Stones, and Orbits* where Dues engaged the audience in a conversation about crystallization as a fundamental geological process, linking it to both the desert rose and the calcite in the display case, revealing surprising parallels between mineral growth and microbial activity. By incorporating urea, commonly known as carbamide, *Auturgy of Carbamide* underscored that the supposed divide between animate and inanimate nature is not fixed but fluid. This exchange challenged fixed distinctions between life and matter, revealing their dynamic interplay, showing how stone, crystal, and microbes are in constant flux, actively shaping and being shaped by their environment.

CONCLUDING REMARKS

Despite the growing trend among major institutions to present science in a »laboratory« setting and to emphasize process,[12] exhibition spaces are still rarely conceived and used as active sites of research and collaborative inquiry. Our exhibition attempted to do just that.

Stretching Materialities was not merely a display of artifacts but a dynamic research process—a collective exploration in which each collection object, experiment, and interaction probed into the deeper, often hidden activities within objects and spaces. By bridging disciplinary boundaries, the exhibition challenged conventional notions of how we perceive and interact with matter, time, and the complex histories embedded in objects.

Our concept of a research exhibition aligned to a certain extent with Simon Sheikh's (2013, 40) idea of an exhibition as a »place for enacted research«—being not just a »vehicle for the presentation of research results (…) but a site for ongoing research around formats and thematic concerns of the exhibition,« emphasizing the exhibition space as an activated site of inquiry rather than a passivized display.

The *Stretching Materialities* exhibition was conceived as a living, evolving space that embraced the uncertainties and complexities inherent in the research process. Inspired by the concept of »doubt« as a critical force in scientific inquiry—an approach advocated by Marjan Doom (2020) in *Museum of Doubt*

and exemplified by Ghent University Museum—our exhibition was rooted in the often hidden processes that drive both scientific and artistic practices. Doom (2020, 13–28) suggests that exhibitions of university collections should cultivate an atmosphere of doubt, embracing vulnerability and prioritizing the asking of questions over providing definitive answers, with a focus on process rather than final outcomes. Rather than offering a linear narrative, the exhibition invited visitors to engage with the research process itself—to witness experiments unfolding in space and how the act of exhibiting becomes an active, participatory process.

However, if one looks into the history of exhibitions for conceptual antecedents, models, or inspiration for our exhibition, the 1970s offer productive insights. The late 1960s and 70s present a transformative period in exhibition making, marked by a shift away from traditional, didactic displays to more experimental and participatory approaches. Exhibitions during this period began to challenge the passive role of the viewer, inviting them to participate in the creation of meaning. This era saw the rise of interdisciplinary and multimedia exhibitions that blurred the boundaries between art, science, and technology and encouraged visitors to engage with the material world in new and imaginative ways.

A pivotal but often overlooked exhibition from this period is *Welt aus Sprache* (1972) at the Akademie der Künste in Berlin, which exemplified this shift. Integrating semiotic theories into its design, the exhibition transformed signs and symbols into physical and sensory experiences. Far from being passive observers, visitors engaged actively with the materiality of language through various media. This emphasis on sensory interaction created a dynamic space where knowledge was not simply transmitted but co-created through experience.

The exhibition intertwined sensory exploration with analytical reflection, particularly through the »Pentagon of the Senses,« where touch, smell, taste, hearing, and sight were treated as distinct sign systems. Interactive stations such as wine tasting, spice boxes, and tactile experiments allowed visitors to engage with non-audiovisual perceptions, which they then translated back into language. Our Haptic Box closely parallels the design and conceptual approach of the »Tastkasten« in *Welt aus Sprache*, both reinforcing a feedback loop between individual sensory experience and collective interpretation.

This interplay between embodied experience and critical reflection was at the heart of *Stretching Materialities*. Like *Welt aus Sprache*, the exhibition invited engagement, making visitors co-creators in the process of knowledge production. Both exhibitions challenged conventional distinctions between observer and object, revealing that materiality—whether language's, matter's, or the body's—is something to be experienced firsthand. By integrating multi-sensory engagement, these »feel-hear-shows«—structured around tactile, auditory, and visual experiences—redefined the exhibition space as an evolving site of interaction, transformation, and reflection.

The central goal of *Stretching Time* was to reconceptualize materiality as inherently active—constantly in flux and inseparable from time. As a collective, research-driven project, the exhibition functioned as an experiment in knowledge exchange, challenging both curators and visitors to rethink the interplay between time, material, and space. It invited them to explore not only how we engage with and shape materialities but also how these materialities in turn shape our understanding of time, space, and change.

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