critical raw material

C CARTOPOLOGICAL R REFLECTIVE M MAP

Cartography merges cartographic techniques with anthropological perspectives to better represent the complexity of our living environment.

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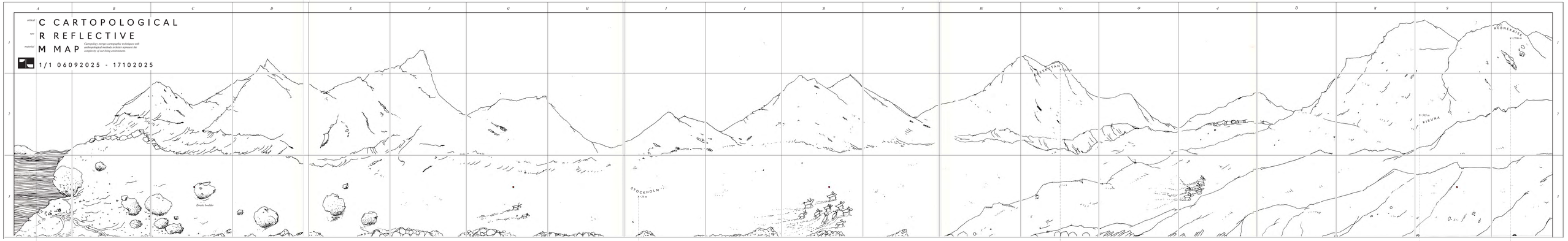


INGWAZ SAGE

What if stories are not just tales of the past, but maps that help us navigate the future? The weather forecast promised a warm and sunny weekend, mid-September in Stockholm. A perfect weekend to undertake our first fieldwork trip, all around Lake Mälaren. Quite early on Saturday morning and not long after having left Stockholm, we passed by the Bronze Age carvings of Hemsta, near Enköping. We couldn't choose a better place to start this weekend and weren't the only ones admiring this place early in the morning. Another visitor welcomed us and warmheartedly told us about the carvings and the related story of Ingwaz: a hero who travelled across the sea from the south-east, bringing with him the knowledge of the seasons. We are around 1500 BCE, contemporaneous with Odysseus' voyages and other great sagas that let human destiny in the hands of the cosmos. These ancient stories remain timeless, where do we find wisdom, and how do we return with it to our people? Later Swedish rulers, for sad, claimed descent from Ingwaz, grounding their authority in a story of cosmic order and responsibility.

WOVEN VOICES OF THE SAMI

Some days later, at the Nordiska Museet, we saw an extensive overview of Nordic history, with attention to the Sámi and other Indigenous communities. Among the works on display, Johan Turi's evocative depictions stood out: clean, simple and beautiful visual testaments of Sámi life, resilience, and their knowledge of the landscape.

At the Moderna Museet, this perspective found another expression in the art of Britta Marakatt-Labba. Her works left a lasting impression: delicate in form, too, yet strong and insistent in voice. In them we glimpse worlds stitched together by relations: humans, animals, ancestors, ancient generations, birch forests, and sacred landscapes, all woven into the same fabric. Her stories remind us that we are not separate from nature but intimately part of it.

THE IRREPLACEABLE KNOWLEDGE OF INDIGENOUS PEOPLES

Today, as the UN make clear, indigenous knowledge is essential to preserving biodiversity and designing meaningful adaptation strategies. The IPCC's report Climate Change (2023) emphasised that mobilising Indigenous and local knowledge is critical for reducing risks and developing solutions that are not only technical, but also ecological and cultural. Indigenous communities, who collectively steward roughly 80% of the world's remaining biodiversity, consistently demonstrate that long-term care for land and life can safeguard resilience in ways 'modern' governance has often overlooked.

MYTHS AS STRATEGY

Once, stories in the form of religion held large groups of people together, enabling coordinated action on a massive scale. As Yuvarat Yuval Noah Harari argues in Sapiens (2014), it is precisely our ability to think abstractly and create shared myths that sets us apart from other animals. Contemporary institutions, from corporations to nations, still rely on stories of gods, nations, money, or human rights. This capacity for collective imagination has always been central to our survival.

Today, the challenge may be to develop new stories and rediscover older ones; stories that help us think and act together in the face of planetary change. Not myths of endless growth or human dominance, but narratives that weave us back into relationship with land, waters, other animals, and future generations.

Apart from what we gained from our findings in and around Stockholm and sources as mentioned above, ancient and indigenous narratives teach us another lesson: survival requires us to think beyond our immediate needs. Ingwaz' travels beyond the horizon not to conquer, but to return with wisdom for his people. Sami cosmologies remind us that humans live in relation to animals, ancestors, and future generations. Both perspectives suggest that endurance comes not from short-term fixes but from cultivating balance across time and space.

SO, WHAT IF?

Seen from this angle, the crisis we face cannot be solved by technical measures alone. Whether that means pouring concrete into higher dams, building barriers against rising seas or mining ever more 'green' metals to extract rare earth elements for use in smartphones, cars, wind turbines and weapon systems (involving deeper excavations, larger volumes of waste, and even the relocation of entire communities). Such efforts may protect our current western lifestyle for a while, but they do not ask the harder questions: How do we live? What do we value? What kind of relationships do we nurture with the living world around us?

Perhaps the deeper challenge is not one of engineering, but of wonder and imagination. What if the maps and plans we make today could help us trace pathways toward other ways of living and dwelling: ways that honour the past, care for the present, and leave space for futures beyond our own lives?

THE LANDSCPAE ANSWERS

At first, we saw Sweden's landscape simply as scenery. But as we travelled and tried to understand, it became something else: it turned into time made tangible. The land itself tells us stories that stretch far beyond human memory. Nowhere is this more visible to us than in the traces left by the glaciers: the slow, steady rebound of the earth after the crushing weight of ice, the tilt of lakes and rivers adjusting to a rising landmass, the gentle hills marking where the ice once retreated.

Even on the smallest scale, the story continues. Scratches on a granite outcrop, barely noticed at first glance, turn out to be marks of glaciers that moved with patient force across the land thousands of years ago. We read these lines as signatures of duration, reminders that landscapes are not fixed, but alive and always in motion.

Inside the gallery, the crowd pressed close and absorbed in Tuttlejuh's photographs of shopping malls, offices, amusement parks, and other spaces where Swedes of the 1990s was slowly remade into a consumer society. His images are witty, absurd, and melancholic, yet also sharp critiques of capitalism's encroachment into everyday life. What struck us was the visitors' devotion: each detail studied with care, as if the images spoke of a past that had been left behind. And yet, the very logic of consumption Tuttlejuh exposed remains unchanged. The rare earths mined today, promoted in the stylish ads on our way to the exhibition, sustain the same habits of consumption pictured in his work thirty years ago.

What if we could look at the landscape with the same attention we give to Tuttlejuh's photographs: seeing not just scenery, but a record of resource extraction, human impact, and choices that bind us to the same cycle? His critique is not just historical; it is still urgently relevant.

We tried to look differently: to see the hills, lakes, carvings and scrubland not as static features, but as evidence of relationships between people and place, past and present. The Bronze Age carvings at Hemsta, the Sami duodji of Johan Turi's embroideries, mountains and reindeer stride alongside the Aldar, the forerunners who have watched since the beginning and who gaze toward futures still unfolding. Landscapes are not backdrops but active participants in the story of survival.

Perhaps this is the lesson that ancient carvings, glacial traces, and Indigenous cosmologies converge upon: to endure, we must learn to read the world as a living map—one that does not separate humans from nature but ties us into a web of relations across time and space. To look at Sweden's landforms with this gaze is to recognise not only what has been, but also what might still be possible.

ABOUT THE MAP

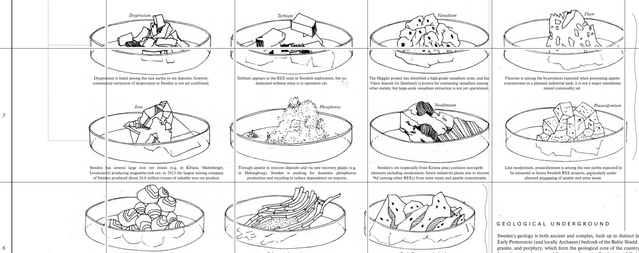
This cartopological map has been made by spending time in the urban and natural landscapes of Stockholm. The map does not try to offer a complete or final picture. It does not impose a single truth, nor does it point a finger at what is right or wrong. It can't. It should be used as a tool for contemplation gathered along the way. Layers of time and space layered side by side. Precisely in its incompleteness and carefully selected fragments, the map opens space for unexpected connections, where unusual stories meet and new narratives for the future can take shape.

The map roughly depicts Sweden as if seen from the Baltic to the left, the south of Sweden; one third across, Stockholm; to the far right, the vast northern landscapes with Kiruna and Sweden's highest peaks. Around Stockholm we focus on Lake Mälaren, the city's reservoir, where water rests for 10–15 years before reaching the tap. Here, too, questions arise. As Stockholm grows and the climate changes, is this still the right place for a drinking water reservoir? Perhaps it is time to imagine other futures and consider ways of building higher walls, we might learn to see as Britta Marakatt-Labba stitches: worlds held together not by force, but by relations: humans, waters, animals, ancestors, and futures woven into the same fabric.

This map is an attempt to layer scale and time. It brings together snowy summits and Mälaren's waters, but also the thick ice that once covered Scandinavia, the slow, steady rebound of the earth beneath the weight of glaciers, and the flows of Ingwaz flew into the imagery of Britta Marakatt-Labba, and both extend into the city's present urban and industrial activities.

We hope this map, like sagas and embroideries, may reveal relationships between people, land, and futures not yet visible, and invites to think and act beyond narrow human needs that risk undoing the very worlds we depend on.

Rather than providing solutions, our work in Stockholm unfolds as an invitation: to wonder, to question, to listen more closely to the landscape, and to imagine how stories: ancient, indigenous, and yet to be told might guide us through uncertain waters.



Dysprosium is listed among the rare earths in ore deposits; however, commercial extraction of dysprosium in Sweden is not yet confirmed.

Terbium appears in the REE suite in Swedish exploration, but no dedicated terbium mine is in operation yet.

The Högtjält project has identified a high-grade vanadium zone, and the Vikan deposit (in Jämtland) is known for containing vanadium among other metals; but large-scale vanadium extraction is not yet operational.

Fluorine is among the byproducts expected when processing apatite concentrates in a planned industrial park; it is not a major standalone mined commodity yet.

Sweden has several large iron ore mines (e.g. in Kiruna, Malmberget, Leveäniemi) producing magnetite-rich ore; in 2017 the largest mining company of Sweden produced about 26.8 million tonnes of saleable iron ore product.

Through apatite in tailings deposits and via new recovery plants (e.g. in Helsingborg), Sweden is pushing for domestic phosphorus production and recycling to reduce dependence on imports.

Sweden's ore (especially from Kiruna area) contains rare earth elements including neodymium; future industrial plants aim to recover Nd (among other REEs) from mine waste and apatite concentrates.

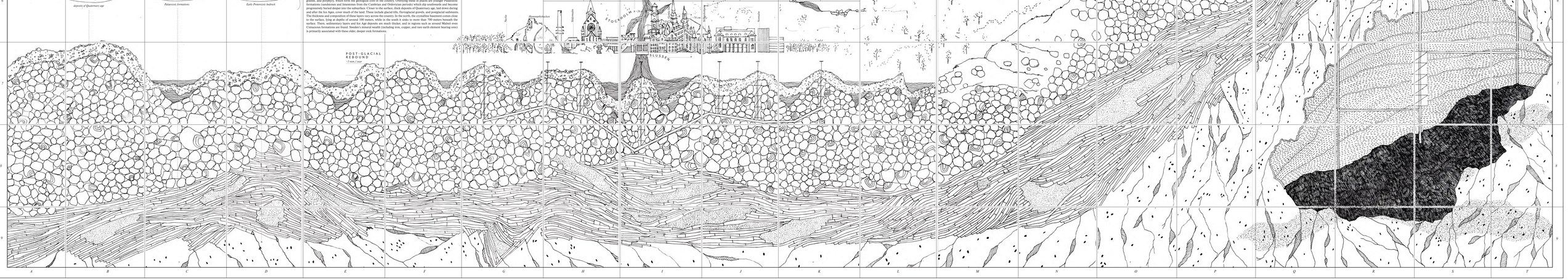
Like neodymium, praseodymium is among the rare earths expected to be extracted in future Swedish REE projects, particularly under planned prospecting of apatite and mine waste.

CRITICAL RAW MATERIALS

A list of 34 CRMs (Critical Raw Materials) was published in the Annex II of The Regulation proposal COM (2023) based on the Study on the Critical Raw Materials for the EU (2023). Several of these appear to be potentially minable in Sweden.

GEOLOGICAL UNDERGROUND

Sweden's geology is both ancient and complex, built up in distinct layers beneath the surface. At its foundation lies the Early Proterozoic (and locally Archean) bedrock of the Baltic Shield: very old crystalline rocks such as gneiss, migmatite, granite, and porphyry, which form the geological core of the country. Overlying these in places are younger Paleozoic sedimentary formations, including limestones, shales, and sandstones, deposited in shallow seas and now tilted and progressively buried deeper into the subsurface. Closer to the surface, thick deposits of Quaternary age, laid down during and after the Ice Ages, cover much of the land. These include glacial tills, fluvioglacial gravels, and postglacial sediments. The thickness and composition of these layers vary across the country. In the north, the crystalline basement comes close to the surface, lying at depths of around 100 meters, while in the south it sinks to more than 500 meters beneath the surface. There, sedimentary layers and Ice Age deposits are much thicker, and in regions such as around Malmö even Cretaceous formations are found. Sweden's mineral wealth (including iron, copper, and rare earth element bearing ores) is primarily associated with these older, deeper rock formations.


POST-GLACIAL REBOUND
~5 mm / year
STOCKHOLM
x -20 m
LAKE MÄLAREN
BUSSEN
Mälaren rock springs
Hammarbyhöjden
Mälaren
Hammarbyhöjden
Stockholm
Lake Mälaren
Stockholm
Lake Mälaren
Stockholm
Lake Mälaren