

# UNIVERSITY OF TWENTE.

## Mining Matters: Coloniality and Sustainable Technologies in Changing Climates\*

27-28 November 2023

U Parkhotel Enschede, De Veldmaat 8, Enschede

Workshop convenors:

Andreas Weber, Sandra Calkins, Boelo Schuur, Arjan Dijkstra, Esther Turnhout

*\* This international and transdisciplinary workshop is funded by  
the Climate Center of the University of Twente.*

The current push to move away from fossil fuel reliance and invest in sustainable energy technologies like wind turbines or electric automobility is key to reach climate goals. While cutting emissions by phasing out fossil fuels is crucial, the transition to sustainables has stoked global competition for the required raw materials, such as nickel, cobalt, rare earth elements. If continued unchecked, this risks reproducing historically unequal colonial core-periphery relations, with rather powerful nations and companies extracting resources in formerly colonized areas in Africa, South America and Asia. This workshop examines these relationships and their materializations through the lens of coloniality, interrogating how different actors and agencies, disciplinary histories, bodies of expertise and knowledge as well as resource materialities contribute to, contest and perpetuate extractive injustice. We bring together scholars from a variety of disciplinary locations, such as STS, history, anthropology, geography, chemistry and geology, and working in diverse regional contexts, i.e. EU, Africa, South America, and Asia, to debate issues connected to underground extraction. In view of our aspiration to critically interrogate (neo)colonial patterns, we ask in particular how green imaginaries of sustainable energy transitions in Europe play out in other world regions? What lessons can we derive from considering earlier patterns of resource making, extraction and circulation? What roles did/does chemical and lay expertise about the underground play? And how do futures of underground extraction align with climate goals and concerns for environmental justice?

### Program

Monday, 27th November 2023		
Time	Session	Content
10:00-10:30		Coffee & Registration
10:30-11:00	<b>Opening</b> (Andreas Weber/ Sandra Calkins)	

11:00-12:30	<b>Deposits &amp; Global Flows</b>  <i>Chair:</i> Andreas Weber	<ol style="list-style-type: none"> <li>1. Farabi Fakhri, <i>Pertamina and the Limitations of Oil Decolonization</i></li> <li>2. Merdeka Agus Saputra, <i>The queer political ecology of the seabed plumes in Indonesian seabed mining</i></li> <li>3. Maite van den Borre, <i>The nationalization of the Union Minière du Haut-Katanga: a turning point in Belgian-Congolese relations</i></li> </ol>
12:30-14:00	<b>Lunch</b>	
14:00-15:30	<b>Extractive Relationalities &amp; Temporalities</b>  <i>Chair:</i> Esther Turnhout	<ol style="list-style-type: none"> <li>1. Anne-Isabelle Richard, <i>Eurafrican resources, plus ça change?</i></li> <li>2. Senna Middelveld, Andreas Weber &amp; Kornelia Konrad, <i>Histories repeating or newly emerging futures? Topological dynamics of past and emerging hydrogen futures</i></li> <li>3. Marieke Meester, <i>Resisting extractivism through participation?</i></li> </ol>
15:30-16:00	<b>Coffee Break</b>	
16:00-17:00	<b>KEYNOTE LECTURE</b> Andrew Barry, <i>Chemical Geography and Coloniality</i>  <i>Chair:</i> Sandra Calkins	
17:00	End	
18:30-20:30	Dinner at U Parkhotel (only speakers & co-authors of papers)	

Tuesday, 28th November 2023		
Time	Session	Content
9:00-10:30	<b>Chemical Matters</b>  <i>Moderators:</i> Boelo Schuur & Andreas Weber	<ol style="list-style-type: none"> <li>1. Esteban Quijada-Maldonado, <i>Extractive metallurgy in Chile: the impact of foreign technologies for more sustainable mining</i></li> <li>2. Cristobal Bonelli, <i>Lithium ion batteries and the Zero "Omissions" Targets: Re-activating energy transitions beyond the Electromobility Project</i></li> <li>3. <i>Q&amp;A and Discussion</i></li> </ol>
10:30-11:00	Break	
11:00-12:00	<b>KEYNOTE LECTURE</b> Sabine Luning, <i>Digging Deeper: Moralities of Scale and Politics from Below</i>  <i>Chair:</i> Sandra Calkins	

12:00-13:00	<b>Lunch</b>	
13:00-14:30	<b>Colonial hauntings</b> <i>Chair: Kate Sammler</i>	<ol style="list-style-type: none"> <li>1. Isaac Oluoch and Michael Nagenborg, <i>Geographic representation: humanitarian mapping and data citizenship</i></li> <li>2. Sarah Rose Bieszczad, <i>(Un)doing societally relevant research of the deep sea: The case of the inevitability of deep sea mining (online)</i></li> <li>3. Frank Veraart, <i>Sustainability Trade-offs in the Netherlands' Entangled Modernization (STONEM) – Concepts of the research project</i></li> </ol>
14:30-15:00	<b>Coffee Break</b>	
15:00-16:00	<b>CLOSING ROUND TABLE</b> <i>chair: Sandra Calkins &amp; Andreas Weber</i> <ul style="list-style-type: none"> <li>• Sabine Luning</li> <li>• Esteban Quijada-Maldonado</li> <li>• Farabi Fasih</li> <li>• Cristobal Bonelli</li> <li>• Alexandria Poole</li> </ul>	
16:00	End	

## **Abstracts**

### **KEYNOTE 1**

#### **Chemical Geography and Coloniality**

*Andrew Barry (University College London)*

In this paper I dwell on a field of inquiry that has no institutional existence: chemical geography. The idea of chemical geography, proposed by the British chemist William Jackson Pope in 1918, was explicitly linked to colonialism. In his formulation, chemical geographical knowledge was instrumental for empire in the struggle for the control of extractive resources and chemical elements, which were then thought to be naturally distributed. In an era when the planetary distribution of elements and resources is recognised to be unnatural, yet colonial relations of extraction persist, I address the question of how it is possible to rethink the idea of chemical geography.

### **KEYNOTE 2**

#### **Digging Deeper: Moralities of Scale and Politics from Below**

*Sabine Luning (Institute of Cultural Anthropology and Development Sociology, Leiden University)*

The lecture analyses 'the vertical turn' in the anthropology of resource extraction by focusing on the politics of knowledge of the underground in subterranean extraction. It outlines how distinctions between the geological and the social, and between the human and non-human feature in debates on climate change and social justice. It subsequently foregrounds moral and technical hierarchies underpinning the contrast between 'large-scale' and 'small-scale' mining. Specific mining terrains exemplify historical and spatial entanglements of mining operations at different scales and how these are shaped by colonial histories and technological innovations. The focus will be on gold mining, but we will also draw out features that may be relevant for minerals, such as cobalt, which play a key role in debates on the energy transitions in Europe.

## **Papers**

### **Pertamina and the Limitations of Oil Decolonization**

*Farabi Fakh (Universitas Gadjah Mada Yogyakarta, Indonesia)*

The Indonesian national oil company, Pertamina, was created in the mid-1960s as an institutional innovation in the effort to nationalize the oil industry from its colonial roots. Under its entrepreneurial head, Ibnu Sutowo, the company developed and expanded new contractual relationships with smaller oil companies, mainly from the United States. By the early 1970s, the company had emerged as the largest corporation in Asia outside of Japan by increasing significant foreign investments into the oil sector. Indonesia had become a forefront of technology innovation in the field of offshore and LNG projects. Yet, Pertamina almost went under in 1975 due to debt accumulation and corruption. The company never regained its prominent international position and has since been eclipsed by other national oil companies, such as Petronas of Malaysia. The paper discusses the institutional limitations that had been embedded in the colonial oil industry and the difficulty of changing those institutional arrangements, normative values and processes. It argues that strategies regarding knowledge and technology, financing, state-participation/politics and geography all played a part in limiting the possibilities of decolonization. The interconnectedness between technology/knowledge, business and politics emerged during the colonial period. The article tries to understand why decolonizing these assemblages was a difficult process and to what extent Pertamina succeeded and failed in this regard.

### **The queer political ecology of the seabed plumes in Indonesian seabed mining**

*Merdeka Agus Saputra (Alfred Wegener Institute (AWI), Germany & Helmholtz Institute for Functional Marine Biodiversity (HIFMB) at the University of Oldenburg, Germany)*

From Dutch and British East Indies, international tin market intervention to blue growth initiatives, these top-down geopolitical approaches occlude how seabed plumes caused by offshore tin mining defy the temporal and spatial remit of mining operations, change sea color, and lead to existing seabed conflict and violence in Indonesia. Offering a new engagement with these fine particles in the ocean, this article integrates queer trans science studies, feminist geopolitics, and ocean social scholarships in queer political ecology to think about the queer temporality, materiality, and spatiality of the seabed plumes, to understand their queer nature. The queer nature here is broadly meant to describe the convergence of material and political agency, deviating from the existing material/political agency duality discussion. This article draws from fieldwork on and off Bangka and Belitung Islands, a significant site of seabed mining. This work illustrates how the queer nature of the seabed, and its material excesses such as plumes, pushes back on the notion of a future ecological disaster, sustainable blue sea color and economic growth in blue growth initiatives, and death/life dichotomy in seabed extraction, obscuring environmental justice problems. In this way, this article unfolds a political understanding of how the seabed plumes play a queer role in marginalizing benthic habitats and, simultaneously, disrupting offshore extractivism. This article encourages (queer) political ecology scholarships to illuminate how benthic non-humans matter in current benthic interventions.

### **The nationalization of the Union Minière du Haut-Katanga: a turning point in Belgian-Congolese relations?**

*Maite van den Borre (Utrecht University) & Bram Bouwens (Utrecht University)*

In 1966, the Congolese assets of the Belgian company *Union Minière du Haut-Katanga* were nationalized in Congo, causing a rupture in Belgo-Congolese relations. Many academic works have been published on both Congolese colonial history and the UMHK but the role of the UMHK in the postcolonial period has not been analyzed as much. Through analysis of documentation from the archives of the *Société Générale de Belgique*, the *Union Minière* and Umicore, this thesis examined the negotiation process set up as a result of the nationalization. It showed that the nationalization was not

only a breaking point but also the occasion for a reform of the economic dependency relations between Congo and Belgian companies. The renewed cooperation that emerged shows that although the goal of the nationalization was economic sovereignty, Congo was still largely dependent on its former colonizer in terms of economic development. Yet the importance of this nationalization should not be underestimated. Through the nationalization, Congo highlighted its political independence and demonstrated that Congolese sovereignty could no longer be restricted. Also, the nationalization took place in an era characterized by tensions between former colonies and colonizers, making this research a contribution to the history of postcolonial economic relations around the world.

### **Eurafrican resources, plus ça change?**

*Anne-Isabelle Richard (Leiden University)*

The idea of Eurafrika that was in vogue for much of the first half of the 20<sup>th</sup> century, suggested that Europe and Africa are complementary and interdependent continents. Resources played a pivotal role in Eurafrika ideas, ranging from raw materials to irrigation and hydropower projects. This talk will address how Europeans, and Africans, conceived of Eurafrika ideas and used them for their own purposes. It will then show how current discussions on the European Green Deal and the resources necessary for the energy transition provide an echo of early 20<sup>th</sup> century projects.

### **Histories repeating or newly emerging futures? Topological dynamics of past and emerging hydrogen futures**

*Senna Middelveld (University of Twente), Andreas Weber (University of Twente), Kornelia Konrad, (University of Twente)*

The goal to reach climate-neutrality in 2050 is central in the European Unions' endeavour to reduce emissions. For this reason green hydrogen production is portrayed as a desirable way forward to decarbonize the European chemical and fuel industry. Even though green hydrogen production seems like a sustainable alternative, this transition requires a lot of renewable energy to power water electrolysis. As part of this broader vision, governments and private stakeholders in the Netherlands, Germany, the UK and Namibia look for the 'responsible' exploitation of renewable energy and the production of green hydrogen and/or its derivatives. In order to shed light on this globally entangled and evolving dynamic, this paper uses a topological approach to analyse geographies of hydrogen futures and how these futures have implicitly embedded histories of colonialism. By making these histories explicit, we illustrate how past colonial dynamics percolate in 'envisioned sustainable futures' as they have been developed over the last ten years. Next to an in-depth analysis of hydrogen futures (e.g. as they are expressed in policy documents or newspaper articles), this paper also examines the envisioned role of the ports of Rotterdam, in the Netherlands, and Lüderitz, in Namibia, as exemplary hubs which are envisioned to bind industrial and other sites of hydrogen consumption and production on a global scale together. By approaching hydrogen futures as topologies, this paper argues that no clear boundary between colonial pasts and envisioned hydrogen futures can be drawn.

### **Resisting extractivism through participation?**

*Marieke Meesters (Meerstens Institute, Amsterdam)*

*Posthumanist Participation* explores how participation in natural resource management can resist extractivism. Extractivism refers to the political economy that turns materials into resources for maximum revenue. Extractivist regimes have thrived by exploiting those who fall de facto outside of the domains of the white, male, able-bodied (or humanist) human. Traditional participatory procedures rarely address this sacrifice logic and hence fail to resist extractivism. To unsettle the foundational underpinnings of this extractivist logic, posthumanist participation challenges dominant

understandings of the human as a liberal individual as well as understandings of resource materialities as exploitable inert objects, and reconceptualizes humans and materialities as effects of their relations. Instead of seeing participation as located only in practices assigned as such, this approach considers participation to be multiple and decentralized, performative, material and political, and situated in problematic humanist legacies. Drawing on practices of gas and salt mining in the Dutch Wadden Sea area, I explore how distinctions between (various types of) bodies are enacted, how they are substantiated and fortified, how the bodies can participate in shaping worlds, and how bodies can become more affective and therefore capable of actions that can resist extractivism.

**Extractive metallurgy in Chile: the impact of foreign technologies for more sustainable mining**  
*Esteban Quijada-Maldonado (University of Santiago de Chile)*

Chile is one of the world leading copper and lithium producers and an important actor in producing other metals like molybdenum, rhenium, gold, silver, etc, and in the last years, many initiatives have been initiated towards a more sustainable metal production such as: new sources of water, new sources of energy, new solvents, and so on. However, these initiatives are accompanying with bringing ideas, patterns, and technologies from EEUU, China and Europe. In this presentation a historical view of the Chilean metallurgy is given in terms of coloniality, how Chile is facing climate change in the mining sector nowadays and what it is expected for the near future.

**Lithium ion batteries and the Zero “Omissions” Targets: Re-activating energy transitions beyond the Electromobility Project**

*Cristobal Bonelli (University of Amsterdam)*

This presentation tackles the project of electro-mobility and lithium ion batteries as entailing a particular way of making chemical abstractions; as a particular *metachemistry* that embraces electromobility as the panacea for emissions reduction. My aim is to show how such a *metachemistry of electromobility* also generates various *omissions*, each with its own silenced and urgent importance. My understanding of omissions is inspired by the work of Alfred Whitehead (1925), notably his attempts to generate modes of surveillance over the modes of abstraction that, in each era, take on a predatory power that can render invisible that which they omit. Building on this, I show how the lithium-ion battery can be understood as a form of *metachemistry* in which processes of energy decarbonization are reduced to the insertion, *intercalation*, of lithium ions into layered structures within batteries cell. If, in the battery, it is the chemical reaction that can be reversed again and again inasmuch chemical energy can be turned into electricity, here I propose a different kind of reversal: a form of *metachemistry* that illuminates how lithium works in concert, in relation to other chemical substances which are also protagonists, even if they do not necessarily *move*. In doing so, and inspired by a chemical realization stemming from the dialogue between a team of anthropologists and a battery-expert chemist collaborator, I mobilize the chemical concept of *intercalation* as an analytical instrument capable of bringing to the fore the fixed protagonists of the electromobility project, which are often omitted by the *metachemistry* at stake in net zero emissions ‘transition management’. As analytical instrument, *intercalation* opens the black box of the batteries towards scenarios that undo the legitimacy of the omissions intrinsic to the *metachemistry of electromobility*, thus offering a way to cultivate vigilance over the modes of chemical abstraction with which our (capitalistic) era has been equipped.

**Geographic representation: humanitarian mapping and data citizenship**

*Isaac Oluoch (University of Twente) & Michael Nagenborg (University of Twente)*

In the last two decades, geographic information technologies have been increasingly deployed to the so-called Global South. These technologies have been utilised for monitoring, mapping and representing both urban and natural phenomena. Our current research project is focused on the

mapping of vulnerable communities that are living in 'slums' or informal settlements. While the mapping of these communities is usually framed in terms of understanding their sociodemographics, morphology as well as improving capacity building, there remain a number of ethical and political concerns which – in parts – are related to the continuation of colonial practices. These concerns include: Are those who are being mapped involved in the mapping process? Who eventually has ownership of the geographic data that is gathered and represented? And can the geographic data that is represented be used negatively against these communities? Such concerns are heightened by the fact that in most cases, the mapping of these communities is done predominantly by researchers from the Global North who may not often have much contact with these communities. In this presentation, we aim to assess the representationality of the geographic information used to map these communities. Where representationality here means considering notions of accessibility, participation and ownership in the process of humanitarian mapping.

### **(Un)doing societally relevant research of the deep sea: The case of the inevitability of deep sea mining**

*Sarah Rose Bieszczad (Leiden University)*

The fields in Ocean Science are being called on to find solutions to grand societal challenges, like climate change, food scarcity and the energy transition. The call upon the fields of ocean science corresponds to a larger shift in science policy towards societally relevant research, with funders asking for the potential relevance and impact for society. But what happens when potential solutions to these issues create tensions with other concerns, e.g., environmental conservation? Solutions to grand societal challenges are not uniformly agreed upon and may counteract each other. One such example is deep sea mining (DSM), which promises to supply the rare earth elements necessary for the energy transition, but whose harvesting methods threaten to damage a vast, potentially climate-relevant, but understudied environment. However, particularly within the scientific communities, most narratives around DSM regard deep sea mining as inevitable choosing to focus rather on *mitigation* and/ or "*sustainable exploitation*". Arguments around whether and how to engage fail to imagine other future outcomes (e.g., ones in which DSM is no longer inevitable). Through the case of DSM and the deep sea researchers that (dis)engage with this incipient industry, this talk will examine how researchers, called upon to be societally relevant, both navigate the tensions arising from potentially conflicting understandings of what it means to do societally and environmental relevant research and how they draw from certain, potentially contradictory, logics to produce coherent narratives around why to engaging with DSM. Using the concept of ambivalence (see Singleton & Michael, 1993), the talk will unpack their narratives to explore the presence of inevitability within them with the hope to better understand how certain imaginations of DSM futures come dominate and what this means for both deep sea research and environmental conservation.

### **Sustainability Trade-offs in the Netherlands' Entangled Modernization (STONEM) – concepts of the research project**

*Frank Veraart (Eindhoven University of Technology)*

In the Sustainability Trade-offs in the Netherlands' Entangled Modernization (STONEM) research project we want to highlight the sustainability effects of global trade commodities and the role of substitutes and global intra-regional competition. STONEM studies three interconnected issues. First it aims to understand the *commodification process* i.e., the development of (western) science and technologies that socially (re)constructed the natural environment in terms of technical characteristics and economic values. These methods opened up novel ideas for resource application and in connection with global exploration, moved resource extraction to places in the global south. This connects to debates about knowledge politics in the colonial era and beyond. The second issue is to

trace the actors in this *socio-technical construction of globally entangled supply chains*. For this we introduce the notion of system entanglers. Studying the localities and activities of entanglers will shed light on various types of actors and how these shaped sustainability issues, i.e. exchanges the economic, environmental and social relations, in the places they entangled in the resource supply chains. Entanglers changed and reframed application, production, and consumption practices on both ends of the supply chains. The third element central is to study is *how the development of these systems produced sustainability effects and trade-offs*, in and between global South regions and the Netherlands. This will show how gains and costs were historically distributed across time and space. The STONEM project aims to study these processes in supply chains of metals, and edible oils and proteins. In the paper the three described concepts will be illustrated with examples from the edible oils case. This also allows for a more in-depth analysis of **cross-system dynamics** as the production of edible oils originate from plantations, agriculture and fishing practices and the applications oils extended beyond the food industries into agricultural domains (animal fodder), the production of detergents and soaps, pharmacy, cosmetics products, and biofuels.

### **Short biographies**

**Andrew Barry** is Professor of Human Geography at University College London. He was originally trained in physics and chemistry and science and technology studies, and taught at Goldsmiths College, London, before becoming Professor of Political Geography at Oxford University. His previous books include *Political Machines: Governing a Technological Society* and *Material Politics: Disputes along the Pipeline*. He is currently working on two linked books titled *Chemical Geography* and *Critical Evidence*.

**Sarah Rose Bieszczad** is a PhD researcher at the Centre for Science and Technology Studies (CWTS) at Leiden University. Having a background and experience working in the field of chemistry, Sarah Rose got their first introduction to STS during their Master's studies in Vienna, where they became interested in alternative ways of *doing* science, Feminism & Queer STS, post-colonial STS, environmentalism, and activism. Growing up on the California coast, they always had a passion for the ocean and its conservation. Joining the project FluidKnowledge, which explores how evaluation shapes ocean science, Sarah Rose decided to focus on deep sea research and came to be fascinated/ frustrated by deep sea mining and how it is proposed as *the* solution to the clean energy transition. Outside of her project research Sarah Rose advocates for more ways of doing activism in and with STS, both through her work with WTMC (Dutch STS society) and EASST.

**Cristobal Bonelli** is an Associate Professor of Anthropology at the University of Amsterdam trained at the intersections of social anthropology, clinical psychology and science and technology studies (STS). Building upon his transdisciplinary background, Cristobal is continuously experimenting with, and learning from, different genres and disciplines, driven by the urgent need to develop further a transdisciplinary thinking concerned with both the environment and human thought and practice. He currently holds an ERC Starting Grant for the project 'Worlds of Lithium: A multi-sited and transnational study of transitions towards post-fossil fuel societies'. The project is an anthropological study of the replacement of fossil fuel transport, with a new fleet of electric vehicles powered by lithium-ion batteries. See [www.worldsoflithium.eu](http://www.worldsoflithium.eu)

**Maite van den Borre** graduated as a historian from Ghent University in 2021, after having written a thesis on the nationalization of the UMHK in Congo. Maite pursued a second master's degree in Global Studies and is currently a PhD student in the STONEM project. Maite's research focuses on exploring Sustainability Trade-offs in the Netherlands' Entangled Modernization, with a specific emphasis on global supply chains of metals and ores.

**Bram Bouwens** is a business historian and expert in histories of globalization at the Humanities Research Institute for History and Art History at Utrecht University. He also forms part of the STONEM



project team. The STONEM project studies how Dutch raw material imports (in particular metals and edible oils) have been affecting economic, social and environmental changes elsewhere in the world. STONEM investigates the commodification process of resources in conjunction with the development of global supply chains and their effect on sustainability in sites of extraction, production, consumption and depletion.

**Sandra Calkins** is an anthropologist of science and Associate Professor for Environment, Technology and Decolonial Knowledge at the University Twente. She works at the intersections of environmental anthropology, post-/decolonial STS and plant studies. She has co-directed an ethnographic project on hapticality in human-plant-relationships with the Botanic Garden Berlin. Her current book project deals with the biological sciences and plant research in a formerly colonial research station in Uganda. New work focuses on urban green infrastructures across African cities.

**Arjan Dijkstra** is a geologist interested in the sustainability and security of the supply of critical raw materials, i.e., the rocks and minerals from which we get the chemical elements needed for the energy transition. His research focus is on rare earth elements (REE, e.g. neodymium), cobalt, lithium and indium. He studies their distribution in the Earth, and the processes that form economic mineral deposits from which they can be extracted. He has a background in igneous petrology, geochemistry, tectonics and structural geology, and has held academic positions in Plymouth (United Kingdom), Neuchâtel (Switzerland), Perth (Australia) and Leicester (UK).

**Farabi Fakhri** is a lecturer in history and head of the Masters Programme in the Department of History at Universitas Gadjah Mada, Indonesia. He has been working on the decolonization of knowledge in the last couple of years by looking into the emergence of the Indonesian oil industry in the 1950s up to the 1970s. He has published a book titled *Authoritarian Modernization in Indonesia's Early Independence Period: Institutional Transition during the Early Independence Period, 1950-1965* (2020) by Brill. He is also currently working on the history of corruption and colonial normativity with Vrije Universiteit Amsterdam.

**Kornelia Konrad** is Associate Professor of Anticipation and Assessment of Emerging Technologies. She studies the role of anticipation in innovation, reaching from an analytical interest in the role of expectations, socio-technical futures and anticipatory practices in research, innovation and its governance, to intervention approaches, such as Constructive Technology Assessment. As one line of research in this, she has investigated socio-technical visions, expectations and hypes, policies, industry strategies, innovation systems and socio-technical pathways related to hydrogen and fuel cell technologies.

**Sabine Luning** is Associate Professor in the field of economic anthropology, infrastructure and sustainability at the Institute of Cultural Anthropology and Development Sociology, Leiden University. Her research focuses on large-scale and small-scale gold mining foremost in West Africa, e.g., in the NORFACE funded Gold Matters project. As core-member of the Leiden-Delft-Erasmus Centre PortCityFutures, she is involved in transdisciplinary collaborations doing research on infrastructure projects which aim to connect ports to 'hinterlands' in Africa.

**Marieke Meesters** is a Postdoc at the Meertens Institute (Amsterdam) where she analyses Dutch human-nitrogen relations and explores unconventional modes of researching/composting human manure. In her PhD research, she developed a feminist posthumanist approach to participation in the natural resources industries that stresses plurality, response-ability and just more-than-human relations. Central in her work is how academic research co-enacts the realities it ostensibly only describes, and how this brings with it responsibilities and opportunities for doing 'good' research.

**Senna Middeldveld** is postdoctoral researcher in the NWO/ECCM MVI Top-up project *Socio-technical pathways and material choices for a responsible electrification of chemicals and fuels*. Senna

investigates responsible pathways for electrochemical processes and electrolyzers to contribute to more sustainable 'green' chemicals based on electricity from renewables. In her work she does not only anticipate the future with diverse stakeholders, she also look into the recent past to better understand the imagined futures today. Next to closely collaborating with stakeholders, she also contributes to a life-cycle assessment of emerging electrolyzers and electrochemical processes to identify environmental and/or social hotspots in the value chain. Her project is funded by ECCM-MVI as a top-up project to the tenure track project 'Steering Dewetting of Thin Metal Films'.

**Michael Nagenborg**, Associate Professor for Philosophy of Technology (University of Twente), is focusing on the intersection of Philosophy of Technology and Philosophy of the City with a special emphasis on measuring and mapping urban spaces.

**Isaac Oluoch**, PhD candidate, working in the Philosophy Section of the University of Twente in the project FRAME-PRO. The project involves analysing the ethical and political implications of using geographic information technologies in the humanitarian mapping of 'slums' and informal settlements.

**Alexandria Poole** is an Assistant Professor of Environmental Philosophy at the University of Twente. Her primary research interests are developing urban environmental ethics, comparative environmental philosophy, and sustainability discourse at the intersection of technology and values. She incorporates post-colonial, environmental ethics, critical race theory and feminist critiques into her teaching and research.

**Esteban Quijada-Maldonado** is an Associate professor of Chemical and Bioprocess Engineering University of Santiago de Chile. His main motivation is the design, development and valuation of new green solvents which can be applied to separation technologies, especially, the selective separation and purification of valuable metal ions in hydrometallurgy. Esteban has developed many projects regarding metal solvent extractions for the recovery of molybdenum, rhenium, rare earth, copper, lithium, and cobalt/nickel using ionic liquids and lately hydrophobic deep eutectic solvents. Also, projects regarding the recovery of valuable organics via liquid-liquid extractions, developments of new microextraction techniques for the capture of persistent pollutants, and the development of technologies for the greywater treatment and reuse. Esteban is head of the Laboratory of Separation Processes Intensification (SPI), in which currently postdocs, PhD students, master students and many undergraduate students develop their thesis.

**Anne-Isabelle Richard** is University Lecturer at Leiden University and editor-in-chief of *Itinerario. Journal of Imperial and Global Interactions*. Her work has addressed the colonial and global roots of European cooperation in the interwar period. She is currently involved in two projects. One examines the idea of Eurafrica from African perspectives. The other examines regional universities Europe, Africa, and the Caribbean in the post-45 period. She is the co-editor-in-chief of *Itinerario, Journal of global and imperial interaction* and a member of the editorial board of *Monde(s)*.

**Kate Sammler** is Assistant Professor of Environmental Knowledge, Technology, and Sustainability. Kate is a political and human geographer with a background in physics and atmospheric sciences. Kate's research interests involve knowledge production in physical and biological sciences as well as how scientific categories are employed in political projects. Kate has a specific focus on oceanic and coastal spaces and resources. All of Kate's work include environmental justice perspectives -- considering diverse practices, anti-colonial critiques, feminist and queer theory and methods, and critical science and technology studies.

**Boelo Schuur** is Professor Separation Technology in the cluster Process & Catalysis Engineering at the University of Twente. Key research field is sustainable separation engineering, including both development of new and innovative, more sustainable separation processes for existing chemical operations, and enabling completely new separations. In that last category, biorefinery applications

and circular economy applications are key topics. This includes recovery of volatile fatty acids from fermented waste water and downstream conversion into high value chemicals, extraction of lipids from microalgae, and downstream fractionation of pyrolysis oils. In several occasions, the use of innovative technologies such as stimuli responsive materials for smart separations helps making these complex separations possible and more sustainable.

**Merdeka Saputra** started his academic journey as a marine biologist, focusing on fish reproduction in his bachelor's at Universitas Airlangga, Indonesia. While he studied the impact of heavy metal pollution on fish reproduction in the Gresik Sea, Indonesia, he began to be curious about how the regulatory intervention failed to reduce the toxic substance in the sea. Such curiosity reoriented him to continue his master's in marine governance environmental policy at Wageningen University and Research (WUR) in the Netherlands. During his master's, he grew his interest in how social practices and marine policy shape the mismatch lobster and crab fishery intervention in Indonesia. Such an engagement with the benthic ecosystem has further led him to work on a benthic geopolitics research project for his PhD at the University of Oldenburg. He seeks to understand how the human and non-human interface on the seabed can assist and resist the access of seabed uses, including seabed mining, undersea cables, and undersea pipelines in Indonesia. Thus, with his Ph.D. project, he tries to develop a benthic geopolitical way of thinking to include humans and non-humans (animals and non-animals) on the seabed to improve current benthic interventions.

**Esther Turnhout** is chair of Science, Technology and Society at the Section of Knowledge, Transformation & Society (KiTeS), University of Twente, The Netherlands. She is an interdisciplinary social scientist with expertise in science and technology studies, environmental studies and political science. Her research and teaching focuses on the interactions between science and lay, Indigenous and local knowledge systems, and on policy and governance for biodiversity and sustainability transformations. She has published numerous articles on the biodiversity science-policy interface and other topics in high impact journals and she is also the first author of the book *Environmental Expertise: Connecting Science, Policy and Society* with Cambridge University Press. She is editor in chief of the interdisciplinary journal *Environmental Science & Policy*. She plays several active roles in the Intergovernmental Panel on Biodiversity and Ecosystem Services (IPBES) and was an author of the IPBES Global Assessment of biodiversity and ecosystem services.

**Frank Veraart** is an Assistant Professor of history of technology at Eindhoven University of Technology (tenured). His areas of expertise include Modern and Contemporary History, Environmental Studies, History of Mobility, Spatial Planning and Computing. He studies how societal developments are influenced by technology and choices of actors. Currently Frank studies how international trade influences well-being and sustainability at places of excavation, production, and consumption. In this he focuses on the effects of the attribution of values to substances, the entanglement of regions by actors and its social, economic, and environmental contestations.

**Andreas Weber** is Associate Professor of Long-Term Development of Science and Technology. Andreas has a special research interest in colonial histories of science (in particular: natural history and chemistry) and technology with a regional focus on Indonesia. This includes research into how computational technologies are and can be used to contextualize digitized archives and collections (e.g. biodiversity heritage collections from former colonial areas). Andreas is daily board member and WP2 co-lead of HAICu (digital Humanities - Artificial Intelligence - Cultural Heritage), a large and multi-annual consortium project in the field of digital humanities (NWA-OCR, 2023-2029).