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introduction



Historicising Entanglements: Science, Technology and Socio- Ecological Change in the Postcolonial Anthropocene

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This special issue focuses on connected histories of science, technology and socio-ecological change in what we call the ‘postcolonial Anthropocene’. We used this term to guide the papers in this issue towards research questions that interrogate both human-nature relations and postcolonial relations, as entangled components of each inquiry. Of course, both constituent terms ‘postcolonial’ and ‘Anthropocene’ are contentious and much-debated, with diverse connotations and perceived implications to diverse readerships; using both together can be a risky business. We nevertheless chose to do so, because we felt that, both in historiography and in wider academic discourses, Anthropocene and postcolonial research perspectives have too often remained poorly connected – despite the growing number of scholars arguing that Anthropocene research must include postcolonial perspectives and *vice versa*. In this introductory essay, we begin by discussing specific lines of (postcolonial) Anthropocene scholarship we chose to connect to, before we specify this issue’s overarching research questions and introduce the context and content of the individual papers.

The ‘Anthropocene’ and its critiques

It has been over two decades since Paul J. Crutzen and Eugene F. Stoermer proposed the term ‘Anthropocene’ for the current geological epoch in the International Geosphere-Biosphere Programme IGBP newsletter (and soon after in a famous article in *Nature*). The term, informally in use since at least the 1980s, was intended to emphasise the ‘central role of mankind’ as ‘a powerful geological force’ changing the ‘systemic properties’ of the planet and the atmosphere.¹ Today (at the time of writing) geologists are still debating whether to accept the Anthropocene as an official subdivision of geological time. Meanwhile humanities and social science scholars of many stripes have also massively engaged with the Human Epoch as a geological as well as a cultural notion, based on their own (inter)disciplinary perspectives and concerns. Amongst those perspectives, we would like to highlight that many have lauded ‘the diagnosis of the Anthropocene’ as a decisive acknowledgement of ‘the public death of the modern understanding of Nature’, whereafter humans can no longer be regarded as operating in isolation from the ecologies in which they live.² This insight

¹ P.J. Crutzen and E.F. Stoermer, ‘The “Anthropocene”’, *IGBP Newsletter* 41 (2000): 17–18; P.J. Crutzen, ‘Geology of mankind’, *Nature* 415 (51) (2002): 23. For a history, see H. Trischler, ‘The Anthropocene: A challenge for the history of science, technology, and the environment’, *NTM Journal of the History of Science, Technology and Medicine* 24 (3) (2016): 309–35.

² J. Lorimer, ‘Multinatural geographies for the Anthropocene’, *Progress in Human Geography* 36 (5): 593–612, at 606. Also, D. Chakrabarty, *The Climate of History in a Planetary Age* (Chicago and London: The University of Chicago Press, 2021); G. Caluya, ‘Fragments for a postcolonial critique of the Anthropocene: invasion biology and environmental security’, in J. Frawley and I. McCalman (eds), *Rethinking Invasion Ecologies from the Environmental Humanities* (London: Routledge, 2014); A.S. Mathews, ‘Anthropology and the Anthropocene: criticisms, experiments, and collaborations’, *Annual Review of Anthropology* 49 (2020): 67–82; B. Latour, ‘Anthropology at the time of the Anthropocene: A personal view of what is to be studied’, in M. Brightman and J. Lewis (eds), *The Anthropology of Sustainability* (New York: Palgrave Macmillan, 2017), pp. 35–49; J. Lorimer, ‘The Anthro-scene: A guide for the perplexed’, *Social Studies of Science* 47 (1) (2017): 117–42. T.J. LeCain, ‘Against the Anthropocene: a Neo-materialist perspective’, *International Journal for History, Culture and Modernity* 3 (2015): 1–28.

inspired scholars to rethink interrelations between histories of science, technology and the environment.³ It also fostered, or resonated with, diverse initiatives towards collaboration across the natural sciences, social sciences and humanities to develop new knowledges informing the mitigation of the Anthropocene's ecological challenges – including new historiographical knowledges.⁴

However, and crucially, the proliferating use of the term Anthropocene has also met with substantial critique. We would like to emphasise two related critiques that are widely shared among historians, anthropologists and geographers. First, concerning human relations, natural science-initiated accounts of the Anthropocene have been much criticised for depoliticising history by presenting 'history as a contest between the human species as a whole and the planet, with societies as ignorant and passive masses who can only be guided by scientists and saved by green technologies', as Bonneuil and Fressoz bluntly phrased it.⁵ Research that universalises human agency tends to obscure differential human experiences, responsibilities and politics – some scholars therefore call such research an 'anti-politics machine'.⁶ Second, concerning human-nature relations, the critique

³ Trischler, 'The Anthropocene', 312.

⁴ R. Costanza et al., 'Sustainability or collapse: what can we learn from integrating the history of humans and the rest of nature?', *AMBIO: A Journal of the Human Environment* **36** (7) (2007): 522–27; E. Russell, *Evolutionary History: Uniting History and Biology to Understand Life on Earth* (Cambridge: Cambridge University Press, 2011); J.L. Caradonna (ed.), *Routledge Handbook of the History of Sustainability* (New York, NY: Routledge, 2018); S. Sörlin, 'Reform and responsibility – the climate of history in times of transformation', *Historisk tidsskrift* **97** (1) (2018): 7–23.

⁵ C. Bonneuil and J.-B. Fressoz, *The Shock of the Anthropocene. The Earth, History and Us* (London and New York: Verso, 2016), p. 13.

⁶ E.W. Krauss, 'Anthropology in the Anthropocene: sustainable development, climate change and interdisciplinary research', in H. Greschke and J. Tischler (eds), *Grounding Global Climate Change* (New York: Springer 2015), pp. 59–76; L. Ogden et al., 'The politics of Earth stewardship in the uneven Anthropocene', in R. Rozzi et al. (eds), *Earth Stewardship. Linking Ecology and Ethics in Theory and Practice* (New York: Springer 2015), pp. 137–57; J. Hope, 'The anti-politics of sustainable development: Environmental critique from assemblage thinking in Bolivia', *Transactions of the Institute of British Geographers* **46** (1) (2021): 208–22.

is that omnipresent *modernist* uses of the term Anthropocene do not transcend the nature-society dualism at all, but instead enact, reproduce and amplify human exceptionalism. Implicitly and often quite explicitly, such modernist Anthropocene scholarship attributes to ‘humankind’ the position of primal Earth-changer and, as a consequence, Earth stewardship to repair environmental harm done in the ‘Human Epoch’. Such unabashed anthropocentrism also echoes in historiographical debate of the Anthropocene; for example, the *History Manifesto* endorsed calls for (long-term) histories to assist humans in their role as responsible Earth managers – and was fiercely criticised by others arguing that such human exceptionalist thinking is part of the problem rather than the solution.⁷ Either way, the combination of over-emphasising and universalising human agency obscures how change on Earth emerges from complex, connected and situated interactions between a wide variety of human and non-human agents, and that such change may be distributed unequally across the earth. The world is not a ‘human species act’, as the term Anthropocene may portray it to be.⁸

These critiques elicited many responses. One prominent line has been to develop a range of alternative terms to the notion of

The classic is J. Ferguson, *The Anti-politics Machine: ‘Development’, Depoliticization and Bureaucratic Power in Lesotho* (Chicago: Chicago University Press, 1990).

⁷ J. Guldi and D. Armitage, *The History Manifesto* (Cambridge, Ma: Cambridge University Press, 2014), p. 69; Z.B. Simon, ‘History manifested: making sense of unprecedented change’, *European Review of History* **22** (5) (2015): 819–34; Z.B. Simon, *The Epochal Event: Transformations in the Entangled Human, Technological, and Natural Worlds* (London: Palgrave MacMillan, 2020).

⁸ D. Haraway et al., ‘Anthropologists are talking – about the Anthropocene’, *Ethnos. Journal of Anthropology* **81** (3) (2016): 535–64, p. 539. Also: D. Chandler, ‘The transvaluation of critique in the Anthropocene’, *Global Society* **33** (1): 26–44; Chakrabarty, *The Climate of History in a Planetary Age*; D. Haraway, ‘Anthropocene, Capitalocene, Plantationocene, Chthulucene: Making kin’, *Environmental Humanities* **6** (2015): 159–65; B. Latour, *Down to Earth: Politics in the New Climatic Regime* (Cambridge: Polity Press, 2018); A. Malm and A. Hornborg, ‘The geology of mankind? A critique of the Anthropocene narrative’, *The Anthropocene Review* **1** (1) (2014): 62–69; A. Blok and G.B. Jensen, ‘The Anthropocene event in social theory: On ways of problematizing nonhuman materiality differently’, *The Sociological Review* **67** (6) (2019): 1195–211.

the Anthropocene, which explicitly invite scrutiny of human and multispecies differential politics, including postcolonial relations. To mention but a few: the notion of *Capitalocene* presents, in the words of Moore, the world as a ‘multi-species assemblage, a world-ecology of capital, power, and nature’.⁹ The term *Plantationocene* takes inspiration from the study of colonial plantation systems and refers to the radical simplification of previously diverse living systems and their relocation elsewhere, and thereby producing life for value extraction. The Wastocene concept invites historians to scrutinise the embodied stratigraphy of power and toxicity with special attention to subaltern human and more-than-human communities; the notion of the Soyacene invites study of how soybean has mediated human and non-human lives especially in the last fifty years.¹⁰ Notions such as *Chthulucene* (derived from the Greek word *chthon* meaning earth) and *Planthroposcene* refer not to critical analysis of historical epochs, but to an ongoing attempt to deliberately shift the terms of encounter with Anthropocene-type-of-concerns for future modes of multispecies engagement.¹¹ Note that these are only some of the alternative ‘Big Words’ that have been proposed recently to guide research on today’s major social and environmental challenges in more critical and sensitive directions. Still, as observed by Haraway, the use of such terms comes with the risk of creating a Theory

⁹ J.W. Moore, *Anthropocene or Capitalocene? Nature, History, and the Crisis of Capitalism* (Oakland: PM Press, 2016).

¹⁰ D. Haraway, *Staying with the Trouble: Making Kin in the Chthulucene* (Durham, NC: Duke University Press, 2016); M. Armiero, *Wastocene: Stories from the Global Dump* (Cambridge: Cambridge University Press, 2021); C.M. da Silva and C. de Majo ‘Towards the soyacene: Narratives for an environmental history of soy in Latin America’s Southern Cone’, *Historia Ambiental Latinoamericana y Caribeña* **11** (1) (2021): 329–56.

¹¹ Haraway, ‘Anthropocene, Capitalocene, Plantationocene, Chthulucene’; J. Davis et al., ‘Anthropocene, Capitalocene, ... Plantationocene? A manifesto for ecological justice in an age of global crises’, *Geography Compass* **13** (5) (2019): e12438; B. Latour et al., ‘Anthropologists are talking – about capitalism, ecology, and apocalypse’, *Ethnos* **83** (3) (2018): 587–606. N. Myers, ‘From the Anthropocene to the Planthroposcene: Designing gardens for plant/people involution’, *History and Anthropology* **28** (3) (2017): 297–301.

of Everything at the expense of empirical study that takes historical contingency, specificity and situatedness seriously.¹²

Understanding socio-ecological entanglements in the postcolonial Anthropocene

This latter observation leads us to literatures highlighting and studying the historical, spatial, social and material situatedness of specific socio-ecological entanglements and changes, most notably historical and postcolonial Science and Technology Studies (STS).¹³ As such, this special issue approaches humans as diverse beings who are co-constituted by and act together with the (social, material, ecological) environments in which they live.¹⁴ This entanglement

¹² Haraway et al., 'Anthropologists are talking – about the Anthropocene', 550 and 651; C. Bos et al., 'Steering with big words: Articulating ideographs in research programs', *Journal of Responsible Innovation* 1 (2) (2014): 151–70.

¹³ S. Harding (ed.), *The Postcolonial Science and Technology Studies Reader* (Durham, NC: Duke University Press, 2011); J. Law and W. Y. Lin, 'Provincializing STS: Postcoloniality, symmetry, and method', *East Asian Science, Technology and Society* 11 (2) (2017): 211–27; A. Kumar et al. (eds), *Dilemmas of Energy Transitions in the Global South* (New York: Routledge, 2021); Ute Hasenörl, 'Histories of technology and the environment in post/colonial Africa: Reflections on the field', *Histories* 1 (3)(2021): 122–44; J. van der Straeten, 'The rhythms behind change. Historiography and the temporality of non-Western technological landscapes', *Technikgeschichte* 88 (2) (2021): 191–96.

¹⁴ Note also that in his 'Postcolonial Studies and the Challenge of Climate Change', Chakrabarty speaks of the postcolonial 'view of the human as the same everywhere ... endowed with ... anthropological difference'. This has received criticism from within postcolonial scholarship, and we follow the latter – work which recognises the emergence of difference without making the assumption of universality being hidden behind difference (e.g. D. Boscov-Ellen, 'Whose universalism? Dipesh Chakrabarty and the Anthropocene', *Capitalism Nature Socialism* 31 (1): 70–83; G. Caluya, 'Fragments for a postcolonial critique of the Anthropocene: invasion biology and environmental security', in J. Frawley and I. McCalman (eds), *Rethinking Invasion Ecologies from the Environmental Humanities* (London: Routledge, 2014); G. Jack, 'Advancing postcolonial approaches in critical diversity studies', in R. Bendi et al. (eds), *The Oxford Handbook of Diversity in Organizations* (Oxford:

has implications not only for our understanding of humans, their agency and power imbalances in the Anthropocene, but also for our understanding of what constitutes these humans' material and ecological 'environments'. It means we do not approach such environments as singular, not a 'One-World world' as geological and other natural sciences studying the Anthropocene would have it,¹⁵

Oxford University Press, 2015)). Postcolonial theorists' conceptualisation of human beings and their agency as being co-constituted by the environments in which they live draws upon both (older) STS work, such as actor-network theory (B. Latour, *Reassembling the Social: An Introduction to Actor-Network-Theory* (New York: Oxford University Press, 2005)) and on more recent new materialist work which has been spurred in part by the challenge of the Anthropocene (A.F. Conty, 'The Politics of nature: New materialist responses to the Anthropocene', *Theory, Culture and Society* 35 (7–8) (2018): 73–96). See, for example, the notion of trans-corporeality proposed by feminist critical theorist Alaimo, denoting that 'the human is always intermeshed with the more-than-human world, ... ultimately inseparable from "the environment"' (S. Alaimo, *Bodily Natures: Science, Environment, and the Material Self* (Bloomington, IN: Indiana University Press, 2010), p. 2).

¹⁵ M. De La Cadena and M. Blaser, *A World of Many Worlds* (Durham, NC: Duke University Press, 2018). This One-World world has been critiqued for creating a colonial divide between 'those who function within the OWW from those who insist on other ways of bringing a world into being, or "worlding"' (A. Escobar, 'Thinking-feeling with the Earth: Territorial struggles and the ontological dimension of the epistemologies of the South', *Revista de Antropología Iberoamericana* 11 (1) (2016): 11–32, at 21). Indeed, scholarship on indigenous protests against extractivism, such as Australian Aboriginal resistance to drilling (D. Danowski and E. de Castro, *The Ends of the World* (Cambridge, UK and Malden, Ma: Polity Press, 2016)) or Meswaki and Sioux resistance to the Dakota Access Pipeline (G. Giuliani, *Monsters, Catastrophes and the Anthropocene; A Postcolonial Critique* (Abingdon, Oxon and New York, NY: Routledge, 2021)) has powerfully brought the power and relevance of a plurality of locally-situated and (often) non-anthropocentric cosmologies to the fore, and contrasted these with those enacted through extractivist approaches. Other ways of worlding have not only been identified in scholarship on resistance against extractivism, but of course also in, amongst others, work on Indigenous worldviews on ecology and American Indian cosmologies, and on non-modern philosophies of life such as Buen Vivier. See, amongst many others, J.M. Beijer, 'Beyond hegemonic state(ment)s of Nature. Indigenous knowledge and non-state possibilities in international relations', in C. Geeta and S. Nair (eds), *Power, Postcolonialism and International Relations. Reading Race, Gender and Class* (London: Routledge, 2002).

but as multiple and possibly inequitable, arising together with the imaginations and practices of the humans who live in them. Indeed, and critically, understanding both humans and their environments as co-constituting each other helps to bring (post)colonial power relations and inequalities in the shaping of sited human-environment relationships to the fore. This resulted in the following question that guided the investigations of the papers published in this special issue: *which human-environment constellations emerged at the site(s) studied, how did they relate to one another, and what inequalities were embedded therein?*

Second, we approach this process of co-constitution in (post) colonial worlds as transnationally entangled.¹⁶ In particular, the papers in this special issue take the lead from two bodies of historical work in which such transnational entanglements feature particularly prominently, namely *histories of relations* and *relational histories*. The former constitute historical investigations of connections and relations between different sites and the ways in which these relations and sited socio-ecological dynamics co-constituted each other.¹⁷ These histories of relations predominantly approach diverse sites' histories from the perspective of a common logic (and, despite claims to the contrary, not seldom a European or global North-inspired one), and their attentiveness to multi-sited historical diversity has therefore been limited. In contrast, relational and connected histories investigate how regional histories may be at once highly geographically distant, diverse, specific and situated, yet neverthe-

¹⁶ A. Blunt and C. McEwan, *Postcolonial Geographies* (London and New York: Continuum, 2002).

¹⁷ R. Wenzlhuemer, *Doing Global History: An Introduction in 6 Concepts* (London and New York: Bloomsbury, 2020). On infrastructure, supply chain, and commodity circulation histories see e.g., A. Johnson, 'Europe without borders: Environmental and global history in a world after continents', *Contemporary European History* 31 (1) (2022): 129–41; L. Marques, 'Commodity chains and the global environmental history of the colonial Americas', *Esboços: histórias em contextos globais* 28 (49) (2021): 640–97; P. Högselius et al., *Europe's Infrastructure Transition: Economy, War, Nature* (London: Palgrave MacMillan, 2016).

less develop in mutual interaction.¹⁸ Such work may explicitly move against the archival grain, deconstructing the dominant narratives of archives and contemporary historical ‘sources’ that scholars use and contrasting these with the narratives of a wide diversity of voices.¹⁹ In both types of histories, relations are established through the travels of a wide variety of entities; in line with this issue’s grounding in postcolonial STS we particularly focus on (expert and lay) knowledges and technologies as phenomena that connect and co-construct geographically dispersed and locally situated socio-ecological histories. This resulted in the second question that guided the investigations of the papers published in this special issue: *what roles did science and technology, which often travelled between diverse locations across the globe, play in the emergence of and inequalities embedded in the diverse human-environment constellations identified in response to the first question?*

Contributions to this special issue

Crutzen and Stoermer offered the term ‘Anthropocene’ in order to inspire and empower the development of ‘a world-wide accepted strategy leading to sustainability of ecosystems against human induced stresses’; such ‘great future tasks of mankind’ in their words required intensive research efforts and the ‘wise application of the knowledge thus acquired’.²⁰ Critiquing such calls and research for their universalisation of humanity and the obscuring of differential experiences, responsibilities and politics, this special issue has sought to study situated and diverse engagements with socio-ecological

¹⁸ See S. Subrahmaniam, *Europe’s India. Words, People, Empires, 1500–1800* (Harvard: Harvard University Press, 2017).

¹⁹ A.L. Stoler, *Along the Archival Grain: Epistemic Anxieties and Colonial Common Sense* (Princeton and Oxford: Princeton University Press, 2009). We consider this important, amongst others, in view of providing room to diverse ways of understanding and living in today’s world(s), cf. A. Escobar, *Designs for the Pluriverse Radical Interdependence, Autonomy, and the Making of Worlds* (Durham: Duke University Press, 2018).

²⁰ Crutzen and Stoermer, ‘The “Anthropocene”’, 18.

change, guided by the two questions raised in the foregoing paragraphs.²¹ This effort has resulted in the following papers.

First, de Hoop and van der Vleuten study how human-environment constellations were variously articulated in scientific knowledge on palm oil sustainability in Southeast Asia and Europe since 1980. They ask how such research enacted a postcolonial politics of difference between Southeast Asia and Europe with regard to defining ‘sustainability’ problems and solutions. They observe that palm oil sustainability research originating from Southeast Asia foregrounded problems experienced and to be redressed within the region itself. By contrast, diverse strands of research lead by scholars from Europe variously framed migrant, smallholder and large-scale palm oil farmers in Southeast Asia as primarily responsible for causing and solving ‘global sustainability problems’, notably global deforestation and climate change. This ‘global sustainability’ discourse by and large acquitted European actors and markets from such responsibilities – even though these had long deforested their own territories, had played a major role in establishing palm oil cultivation,

²¹ The initiative sprang from a workshop in Lisbon in Autumn 2019, organised in the context of the Tensions of Europe programme *Technology and Societal Challenges 1850–2050* and its ‘Technology, environment and resources’ working group. For the broader programme: E. van der Vleuten, ‘Technology, societal challenges, and global sustainability history’, *Icon* 24 (2018): 34–52; E. van der Vleuten, ‘History and technology in an age of grand challenges: Raising questions’, *Technology and Culture* 61(1): 260–71. For the ‘Technology, environment and resources’ working group: M. Heymann et al. ‘Challenging Europe: Technology, environment, and the quest for resource security’, *Technology and Culture* 61 (1) (2020): 282–94; O. Sparenberg and M. Heymann (eds), ‘Resource challenges and constructions of scarcity in the 19th and 20th centuries’, Special Issue in *European Review of History* 27 (1–2) (2020): 243–369; C. Kehrt and J. Martin (eds), ‘Reconfiguring nature: Resource security and the limits of expert knowledge’, *Global Environment* 13 (3) (2020): 512–658; A. Åberg and F. Verlaar (eds), ‘Creating, capturing and circulating commodities: The technology and politics of material resource flows, from the 19th century to the present’, Special section in *The Extractive Industries and Society* 7 (1) (2020): 1–67; J. Daheur (ed.), ‘Extractive Peripheries in Europe: Quest for Resources and Changing Environments (Fifteenth–Twentieth Centuries)’, Special issue of *Global Environment* 15 (1) (2022): 7–147.

trade and use, and had constituted prime markets for most of the twentieth century.

Next, da Silva and de Majo's study of Southern Brazilian traditional populations known as Caboclos shows how a relationship of mutual dependence between people and their forests had been built up over centuries. This 'bio-anthropophagic' relationship changed dramatically when a new wave of settlers advanced westward in the early twentieth century, creating new human-environment constellations based on governments' and settlers' ideas about both the forest and its traditional populations. These ideas were prominently informed by the travels of both racial and eugenic theories and associated sanitation policies. Thus followed a rearrangement of the exploitation of natural materials – such as yerba mate or herbal medicines – based on new hierarchies. Local populations survived through astute strategies of incorporating exogenous values, giving rise to deep inequalities with respect to the ability to both materially and ontologically define one's one way of life.

Also located in South America, França de Oliveira and Zarilli's contribution analyses how the transformation of the Argentine pampas into an area of large-scale cattle farming went hand in hand with profound environmental, economic and demographic transformations. This included the incorporation of over forty million hectares of pampas into market-based agriculture and cattle-farming; the introduction of new animal and plant species as well as a range of modern agricultural technologies; new economic models of farming; and a substantial increase in the number of people living in the area. This paper demonstrates how these changes were mediated not only by the introduction of cattle and the early establishment of farms in the area in the sixteenth century, but also by transportation infrastructures whereby railroads connected the pampas to Argentina's ports, reconfiguring the landscape.

Next, Abazeed and Hafez investigate how cultural discourse co-constructed the Nile as a 'modern river' through an analysis of imaginaries and knowledges of rivers as represented in two different sets of writing: Egyptian renaissance writing by modernist Alī Mubārak, who hybridised a European education into his nationalist develop-

ment visions, and a set of travelogue diaries of orientalist European travelers writing for European audiences. Both cultural traditions harnessed modernist ideas, but did so in situated ways, using different vantage points, to remake the free-flowing River Nile and its people into a modern ‘hybrid entity’ drawing in multiple cultural and natural attributes.

Fotopoulos and Araposthatis highlight how explorations of hydrocarbons, regional visions and governing practices were historically co-constructed in the Eastern Mediterranean, with implications for who has access to Greece’s hydrocarbons. They argue that European and North American expertise on hydrocarbon explorations as well as various foreign exploration technologies and infrastructures were critical to encoding these power constellations in regional hydrocarbon development.

The final paper of the issue represents the tradition of investigating histories of relations and connections rather than relational histories: Veraart investigates how the development and travels of catalysis technologies, which enabled the production of margarine from a diversity of oils and fats, gave rise to a variety of new human-environment constellations at different sites across the world, through putative supply chain relations forged in colonisation contexts across Congo, the Dutch Indies and the Antarctic, between 1910 and 1940.

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