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Nuclear (Geo)Political Ecologies: A Hybrid Geography of Chinese Investment in Namibia's Uranium Sector

Meredith J. DEBOOM

Abstract: Namibia's Husab uranium mine is the Chinese government's largest investment in Africa to date. This article develops a theoretical framework of hybridity to analyse the (geo)political and ecological implications of China's rising global influence in uranium mining. Drawing on multiple-methods fieldwork, the article explains how Husab has resuscitated Namibia's uranium industry and facilitated the political goals of both Chinese and Namibian leaders. Husab's materialisation of "South–South solidarity," however, also appears to be deepening the marginalisation of minority communities near uranium mines. Far from paradoxical, this uneven distribution of benefits and costs is as intertwined with nuclear geopolitics as it is with the materiality of uranium mining.

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Keywords: Africa, China, mining, postcolonialism

Meredith J. DeBoom is currently a PhD candidate in the Department of Geography and the Institute of Behavioral Science at the University of Colorado at Boulder. Beginning in Fall 2018, she will be an assistant professor of Geography at the University of South Carolina. Her research analyses the politics of natural resource extraction and development in southern Africa. She is particularly interested in how Africans are engaging with extractive frontiers, such as marine mining, and in geopolitical transitions, including China's rising influence.

E-mail: <meredith.deboom@gmail.com>

Introduction

Chinese investments in Africa's extractive industries have significantly increased over the past decade. Political and media reactions to these investments have often taken binary form. Supporters have praised Chinese investments as examples of "South–South solidarity" and "development opportunity" that strengthen Africans' agency in choosing development, political, and trade partners. Detractors, by contrast, have portrayed these investments as "resource grabbing" by the Chinese government and as signifying the rise of China as a "neocolonial" power. Moyo (2009), for example, argues that Chinese involvement is distinct from Western involvement due to China's emphasis on mutual benefit. As a result, China's rising influence increases Africans' power to set their own development priorities. Melber (2011) agrees with Moyo that China's approach differs from that of the West but contends that China's goals are similarly exploitative. Both analyses echo broader debates in the academic and policy communities over the implications of China's rise as a world power for issues ranging from human rights to trade.

While generalist analyses are useful for considering how China's rise affects the global distribution of power in broad terms, they provide fewer insights into how rising Chinese investment is affecting Africans in particular national and subnational contexts. Fieldwork-based research, such as that by Bräutigam (2009), Dobler (2007), and Carmody (2011), identifies a more convincing middle ground by illustrating how complex, contextual factors shape the implications of these investments for Africans ranging from political elites to small-business owners. This article¹ follows the model of these fieldwork-based analyses. Specifically, I use a place-based approach to evaluate the (geo)political and ecological implications of rising Chinese influence in Namibia's resurgent uranium sector.

I draw on the political ecology, science and technology studies (STS), and postcolonial studies literatures on hybridity to analyse how

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Chinese investments are challenging and reinforcing the distribution of mining-related benefits and costs in Africa at local, national, and global scales. My use of hybridity is threefold, reflecting the technical and material senses of the term as well as its more representational use. In biology, hybridity refers to a mixture or composite (Hermesen and Ramanna 1976). I use hybridity in this sense to evaluate two features of Chinese investments in Namibian uranium mining: the first, drawing on STS, is the simultaneously human and non-human nature of uranium mining and nuclear geopolitics; the second is the specific state–state ownership structure of the Husab uranium mine. This model, I argue, may become more common with China’s rising global influence. Husab’s joint government ownership structure makes it a hybrid of Chinese and Namibian state-owned enterprises (SOEs) as well as a physical manifestation of the rhetoric of “South–South solidarity” frequently used by Chinese and African political leaders. Although the mine’s ownership is unequal, with 10 per cent Namibian government ownership versus 90 per cent Chinese government ownership, I explain how this hybrid ownership structure benefits both states by reinforcing each as the trustee of development for their respective societies.

My final use of hybridity engages postcolonial theory to complicate Namibian and Chinese government arguments that the Husab mine offers “mutual benefits” for the Chinese and Namibian people in addition to their respective states. Politicians affiliated with Namibia’s ruling SWAPO party argue that Husab is the epitome of “South–South solidarity” and a key step in Namibia’s post-independence economic liberation from Western and South African domination. Husab, these officials claim, signifies the commitment of the Namibian and Chinese governments to mutual development on behalf of their respective nations. My analysis indicates that the mine indeed significantly benefits the Namibian and Chinese governments. The distribution of benefits and costs among the Namibian and Chinese populations, however, is far more uneven and reinforces existing inequalities in the broader realm of nuclear (geo)political ecologies. Husab is thus a postcolonial hybrid that signifies both the empowerment of the Namibian state in the global political economy of uranium and the deepening of historical inequalities associated with uranium extraction. It simultaneously challenges historical exploitation

and reinforces that very exploitation, particularly for Namibian minority communities living near uranium mines.

The analysis demonstrates the value of a hybridity framework for understanding the implications of China's rising influence in countries like Namibia. In addition to complicating our understanding of the (geo)political ecology of uranium extraction, I argue that this framework of hybridity can help us move beyond binary understandings (e.g. "development opportunity" versus "neocolonialism") of what China's rise means for the world.

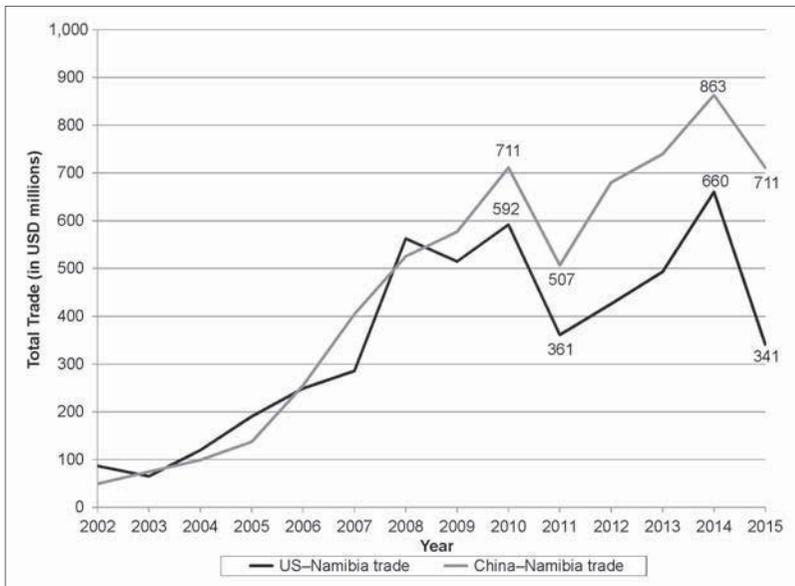
China–Namibia Relations and Chinese Investments in Namibian Uranium

Several Namibia-focused scholars and activists have critically analysed China–Namibia relations over the past decade. This research includes Dobler's (2007) fieldwork on how Chinese merchants are shaping trade patterns and social relations in northern Namibia and his more recent (2017) analysis of historical China–Namibia ties, Melber's (2017) analysis of China's "all-weather" friendship with Namibia, and several reports by Namibian non-governmental organisations, including Jauch and Sakaria (2009). Namibia has received relatively little attention, however, in the popular China–Africa literature, excluding a case study of Chinese migrants in Namibia in French's (2014) *China's Second Continent* and a recent feature on China–Namibia relations by Larmer (2017) in *The New York Times Magazine*. The lack of attention to Namibia–China relations is particularly stark compared to Chinese investments in African resource producers such as Zambia (Carmody 2011), Sudan (Carmody and Taylor 2010), and Angola (Corkin 2013). The lack of popular attention is likely related to Namibia's small population of 2.5 million, its relative political stability since its 1990 independence, and the recent nature of major Chinese resource investments in Namibia, all of which have kept it out of the global limelight. It is almost certainly not due to a lack of Chinese influence in Namibia.

China is Namibia's fastest-growing trade partner and investment source. As shown in Figure 1, US–Namibia trade was double China–Namibia trade in 2002. Today, China–Namibia trade is more than double US–Namibia trade, having increased tenfold between 2003 and 2010 alone. In 2015, a representative of the Chinese embassy in

Namibia estimated that there were more than 50 Chinese companies in Namibia, generating over 1 billion USD in annual revenue (Anonymous 1 2017). Although small Chinese businesses operate in Namibia’s construction and retail sectors (Jaunch and Sakaria 2009), China’s largest individual investments in Namibia are in the mining sector (Sherbourne 2013). These investments include the 4.6 billion USD Husab uranium mine, the Chinese government’s largest single investment in Africa to date.

Figure 1. China and US Trade with Namibia (2002–2015)



Source: China–Africa Research Initiative 2017.

Chinese investments in Namibia’s uranium sector over the past 10 years have put Namibia on track to become the world’s second-largest uranium producer by 2020 (Anonymous 3 2014). As recently as late 2003, though, the outlook for Namibia’s uranium sector was starkly different. Although Namibia has been a globally significant producer of uranium since 1976, the end of the Cold War, the decommissioning of nuclear weapons stockpiles (and resultant enriched uranium supply glut), and the aftermath of the Three Mile Island and

Chernobyl accidents depressed uranium prices throughout the 1980s and 1990s (WNA 2016). By 2001, uranium had reached an all-time low of 7 USD per pound. Low prices, combined with Namibia's relatively high production costs, brought its uranium industry to the verge of collapse just a few years into the new millennium. Even the Rössing mine, then the world's largest, announced in 2003 that it would end its Namibian operations in 2007 due to falling prices.

Rössing's announcement proved premature. By 2004, rising Chinese demand had catalysed a bullish uranium market. Price speculation related to concerns about air pollution and carbon dioxide emissions from coal plants in China and elsewhere put further upward pressure on the uranium market (Power, Mohan, and Tan-Mullins 2012: 197). Uranium prices increased from 10 to 135 USD per pound between 2003 and 2007, triggering a veritable "uranium rush" (Conde and Kallis 2012: 596). New exploration projects increased global reserves by 15 per cent between 2005 and 2007, and Namibia was no exception. Its Ministry of Mines and Energy granted nearly 60 new uranium-prospecting and uranium-mining licences, representing a quadrupling in investment, between 2004 and 2011 alone (MME 2010). In 2006, Paladin Energy's Langer Heinrich mine in Namibia became the world's first conventional uranium mine to open in two decades. By 2012, Namibia was the world's fifth-largest uranium producer (Conde and Kallis 2012).

Beyond China's influence on global uranium prices, private and state Chinese investments directly contributed to Namibia's boom. In 2004, Rio Tinto's Rössing mine became the first Western-owned mine to directly export uranium to the Chinese government. In 2008, China's state-owned Aluminum Corporation of China (Chinalco) deepened this relationship by purchasing a 12 per cent stake in Rio Tinto. This investment was followed by the 2008 establishment of a uranium exploration subsidiary by the state-owned China Uranium Corporation Ltd (SinoU). Chinese private companies followed the lead of Chinese SOEs. In 2010, for example, the Sichuan Hanlong Group conglomerate acquired an 18 per cent stake in the Australian-owned Marenica Energy mine.

Increased production in Namibia and elsewhere was not without consequence for the uranium market. By February 2011, oversupply had reduced uranium prices to 72 USD per pound. The oversupply situation worsened in the wake of the March 2011 Fukushima nuclear

disaster in Japan. By 2014, uranium prices had tumbled 60 per cent to nearly 30 USD per pound. In addition to losing Japan as an export market when its 50 nuclear plants went idle, Namibia's entire mining sector contracted by 10 per cent in the year after Fukushima. Uranium prices have dropped in subsequent years, hovering around 15–25 USD per pound as of late 2017. When the uranium price dips below 40 USD per pound, more than half of the world's uranium mines, including all of Namibia's mines, operate below the break-even point (WNA 2016). Exploration and development projects have been halted in Namibia and around the world, with few signs of an imminent recovery.

Namibia's situation would seem to be particularly dire in this global context. Its uranium deposits have unusually low concentrations relative to mines elsewhere and do not occur in combination with other valuable minerals, as in South Africa's gold-bearing ores (WNA 2016). As a result, Namibia's uranium mines operate at higher costs than those in Canada, Kazakhstan, and elsewhere. Yet, Namibia's uranium industry has not dried up. In fact, after steep declines in 2012 and 2013, the sector is now growing. This paradox is explained by the strategic post-Fukushima influx of Chinese investments. In January 2014, China National Nuclear Corporation (CNNC) Overseas Uranium Holding Ltd acquired a 25 per cent stake in Paladin Resources' Langer Heinrich mine, making it possible for the new mine to continue production despite below-break-even prices. Even more importantly, China's state-owned China General Nuclear Power Corporation (CGNPC) took advantage of low prices in 2014 to begin construction on the Husab mine. After describing my theoretical framework, data, and methods in the subsequent sections, I analyse the implications of Husab and of Chinese investments in Namibian uranium through the lens of human–environment hybridity, ownership hybridity, and postcolonial hybridity.

Data and Methods

This analysis draws on two years of fieldwork in Namibia between May 2011 and January 2017. I collected data through participant observation, focus groups, interviews, and textual analysis. These methods helped me to identify formal, informal, and lived discourses and experiences of uranium mining and Chinese investment. Textual data

included private and state media, official statements, stakeholder and company documents, and archival research. Participant observation included guided visits to mining sites and Chinese investment projects. I also attended mining- and development-related gatherings, including meetings of Namibia's Chamber of Mines, the 2015 Forum on China–Africa Cooperation (FOCAC), and the 2015 China–Africa Development Models Seminar.

I analysed texts and transcripts using NVivo software, which facilitated coding the content for patterns and themes across data types and sources. I initially used an open call for focus group participants but found focus groups among previously aligned groups (see Gamson 1992 and Kitzinger 1994) to be more successful. These more naturally occurring groups relied less on my interventions, and post-focus group evaluations revealed that they more closely mirrored conversations that participants might have with colleagues and acquaintances. I conducted semi-structured interviews with representatives from the foreign and domestic mining industry, the government, and civil society, as well as with ordinary citizens. While I recorded most interviews with government officials, who often employed official talking points, I relied on notes in other cases to increase participants' comfort. Interviews lasted from 10 to 90 minutes and were designed to begin by talking around potentially sensitive topics to build participant comfort. While local assistants helped me recruit and coordinate participants, I conducted all interviews and focus groups myself.

Towards a Postcolonial Hybrid Geography

Merriam-Webster defines a hybrid as “something heterogeneous in origin or composition” (2017). Social scientists have used the concept of hybridity to challenge binary categories since at least the 1980s, when actor-network theorists like Bruno Latour and John Law began to complicate human/non-human entanglements. For Latour (1993: 10), the categorisation of nature and society as “two entirely distinct ontological zones” is central to modernity itself. Instead of assuming that humans are the world's primary actors, STS scholars like Callon (1984) argue that non-human actants, ranging from scallops to weeds, shape outcomes in ways that cannot be controlled or predicted by humans alone. While actor-network theory (ANT) provides valuable

insights into nature–society relations, its attention to inequality and structure has been identified as less developed by political ecologists who view power relations as central to environmental debates (Lave 2015). For these scholars, endowing non-humans with agency

does not seem appropriate for capturing the dynamic properties of “non-living natures” such as landfill leachate, acid mine wastes, or groundwater flow – biophysical properties that are not living, but which have a dynamic that entangles them with other beings and things in ways that give them political life. (Bakker and Bridge 2006: 11)

Recent beyond-human and post-human investigations and new materialist analyses have addressed this gap by demonstrating how ANT’s versatility for engaging with the non-human can be integrated into political ecology’s emphasis on power relations. Attention to materiality does not require sacrificing attention to power relations, as Swyngedouw (2004), Robbins (2007), and Guthman (2004) have all demonstrated.

My first engagement with hybridity builds on the contributions above to evaluate how uranium mining’s material and human characteristics combine to shape its (geo)political ecology. This use of hybridity specifically reflects political ecologists’ and STS scholars’ use of the concept to analyse how “the material and the social intertwine and interact in all manner of promiscuous combinations” (Thrift 1996: 24, cited in Whatmore 2002: 4). Examples of these human/non-human hybrids range from microbe/human assemblages (Ingram 2007) and genetically modified foods (Blok and Jensen 2011) to pets (Haraway 2003) and fossil-fuelled democracy (Mitchell 2011). Augmenting STS theorisations of human/non-human hybridity with political ecology’s focus on power relations ensures that analyses of human/non-human entanglements do not overlook how structures shape outcomes.

Hybrids need not be limited, however, to the human/non-human interface. Postcolonial theorists have also engaged with hybridity, using the term to challenge dualisms like coloniser/colonised (Bhabha 1994), West/Rest (Hall 1992), and ruler/ruled (Bayart 1989). I use hybridity in this second sense to evaluate the Husab uranium mine as a material hybrid that complicates simple distinctions between the Namibian state and the Chinese state. Beyond the mine’s composite ownership, I argue that the mine’s joint ownership struc-

ture offers mutual benefits to both the Namibian and Chinese governments. In this way, its benefits align with the “mutual aid” rhetoric frequently promoted by Chinese and African political leaders.

My final engagement with hybridity, however, complicates interpretations that Husab’s hybrid ownership and shared state benefits entail a full break with historical patterns of exploitation. Postcolonialism interrogates hybridisation and colonialism alike as processes that are necessarily contingent and multidirectional. Comaroff and Comaroff (1997), for example, use hybridity to analyse the simultaneous absorption and rejection of a coloniser’s culture. Mbembe (2001) uses postcolonial theory to critique assumptions that colonialism spread purely through coercive violence. Instead, he argues that colonialism was transnationally implemented, with the colonised exercising degrees of agency (albeit limited) in its implementation. Using hybridity in this second postcolonial sense makes it possible to similarly complicate contemporary China–Africa relations. It facilitates the deconstruction of binary thinking that evaluates China–Africa relations as solely exploitative or universally liberating. Instead, again following Mbembe (2001), postcolonial hybridity makes it possible to evaluate how contemporary China–Africa relations may liberate some who were formerly exploited (such as officials of the Namibian state) while deepening and/or reinforcing the exploitation of others (such as Namibian minority communities living near uranium mines). These three understandings of hybridity – as human/non-human mixture, as state–state ownership and beneficiary composite, and as simultaneously breaking with and deepening historical relationships of exploitation – facilitate the subsequent analysis.

Human–Environment Hybridity: Implications of Rising China for Uranium Geopolitics

Recent scholarship in political ecology has called for investigating how resources are discursively and materially securitised within political economies (Peluso and Vandergeest 2011). Uranium is a quintessential hybrid human/non-human resource whose securitisation has historically been a high global priority. As the 51st-most abundant element in the Earth’s crust (tied with tin), uranium is approximately 40 times more abundant than silver. It is widely distributed, albeit typically at very low concentrations. Its distinctiveness lies not in its

rarity but instead in the key physical property – radioactivity – that endows it with social life. Its radioactivity is in turn given meaning through the social construction of what Hecht (2009) refers to as “nuclearity,” or the “apparently immutable ontology [that] has long distinguished nuclear things from non-nuclear things” (Hecht 2009: 897). Uranium’s intertwined material properties and social meaning have made it one of the world’s most important commodities in war and security. Today, that importance is being extended through its role in climate change mitigation via intensified use of nuclear power in China and beyond. The distribution of the benefits and costs of this production, however, has shifted significantly since the dawn of the nuclear age in 1945.

While global South countries such as Namibia, the Democratic Republic of the Congo, and Niger have exported uranium for decades, Cold War uranium extraction was concentrated in Western countries such as the United States, Canada, and Australia, and Soviet states such as Kazakhstan and Russia until the 1970s. The United States was the world’s largest uranium producer from 1953 to 1980, with its peak production occurring in 1960 (Finch et al. 1973). Like the role played by nature-exporting states in the development of capitalism (Coronil 1997), uranium-exporting states in the global South were essential to the development of nuclear technologies but were deemed fundamentally separate from the nuclear geopolitics in which Cold War powers were engaged (Hecht 2012). Per this logic, Namibia was a producer of uranium, but it was not a nuclear state.

By the 1970s, however, the United States, Australia, and Canada faced growing public pressure over environmental and health concerns related to uranium mining, nuclear weapons testing, and nuclear energy generation (Conde and Kallis 2012; Hecht 2012). At the end of the Cold War, the United States responded to these concerns by passing the 1990 Radiation Exposure Compensation Act, which required awarding 100,000 USD to uranium miners diagnosed with cancer or respiratory disorders. Australia responded to similar criticisms by implementing a nearly 25-year ban on new uranium mines that was only recently lifted. With domestic production declining, former major producers such as the United States began to implement the import-dependent sourcing model long used by former colonial powers such as France. These transitions effectively transferred the burden of uranium production from the global North,

where most uranium is used, to the global South, where safety and environmental regulations are less constraining. This process continues today. Despite this new sourcing model, though, the separation between nuclear and non-nuclear countries identified by Hecht (2009) remained in place. As late as 1995, the United States did not consider Namibia to be relevant to discussions of energy security, even though it produced nearly 10 per cent of global uranium that year (MME 2010).

Uranium geopolitics shifted again on 11 September 2001, as Western governments became increasingly concerned with the possibility of terrorist groups and “rogue” states acquiring nuclear fuel. Despite pressures to reduce Western reliance on strategic foreign resources in the early 2000s, officials in the United States and Australia prioritised securing global South uranium sources over accepting the risks of re-intensified domestic extraction. The push to secure global South uranium sources did not, however, increase the relative power of exporting states. Without an OPEC-like cartel, uranium-exporting countries have instead been subjected to growing surveillance and intervention by uranium importers. The 2003 Niger yellowcake scare ushered in a new era of US intervention to secure uranium networks (Hecht 2012). In Namibia, this included stationing semi-permanent US security officials at the Rössing uranium mine, in which the Iranian government owns a 15 per cent stake, after a uranium theft was reported. As over 30 per cent of Rössing’s uranium is destined for US markets, its Rio Tinto owners had little choice but to comply.

Uranium geopolitics are shifting yet again today with three interconnected developments: China’s increasing global influence, its rising domestic living standards, and its industrialisation-fuelled environmental challenges (Power, Mohan, and Tan-Mullins 2012). Coal supplies 73 per cent of China’s domestic energy demand (WNA 2017a). In response to growing domestic concerns over pollution and carbon emissions, China’s leadership has prioritised reducing energy-related pollution in recent years and aims to reduce 2020 carbon emissions by 40 to 45 per cent from 2005 levels (*Financial Times* 2016). Uranium’s “clean energy” potential makes it essential to China’s continued pursuit of industrialisation and improved living conditions for its population without worsening air pollution. Furthermore, nuclear energy supports China’s rebranding as a global energy leader,

supporting its geopolitical status as a rising world leader. Nuclear and renewable energy sources are now expected to provide 95 per cent of the 420 Gigawatt electrical (GWe) of generation capacity that China will add by 2020 (WNA 2017a). Construction of at least 21 additional nuclear power facilities will increase China's nuclear power capacity from 31 GWe in 2016 to an anticipated 150 GWe by 2030 and 400 to 500 GWe by 2050 (WNA 2017a). It aims to have 110 reactors in operation by 2030, compared to 37 today (Larmer 2017). The associated increase in China's uranium needs is anticipated to make it the world's second-largest uranium consumer after the United States by 2020 (Anonymous 2 2015).

The implications of this shift in uranium geopolitics may extend beyond Namibia, where China began to challenge the historical dominance of South African, British, American, Australian, French, Japanese, and Canadian interests in Namibian uranium mining in the first decade of the twenty-first century. China's rise as a nuclear energy power may even challenge the nuclear/non-nuclear binary described by Hecht (2009). In April 2017, Swakop Uranium, the China–Namibia partnership that owns the Husab mine, submitted initial plans to Namibia's Ministry of Mines and Energy for a nuclear power plant in Namibia (Kaira 2017). Current Namibian president Hage Geingob first expressed interest in such a plan in 2014 when he toured China's Dayawan Nuclear Power Plant, which is managed by Swakop Uranium's parent company, CGNPC. If a Namibian nuclear power plant is approved, it would become only the second nuclear energy power station in Africa after South Africa's Koeberg Nuclear Power Station, which was commissioned in 1984. Like China, African countries face rapidly escalating demands from their populations for energy provision. While future population pressures will play a larger role in increasing demand in Africa than in China, African countries and China face a similar need to increase living standards and support industrialisation without aggravating air pollution and climate change problems. Namibia's relative stability and uranium resources make it well-suited for Africa's second power plant, but it may not be the only African nuclear power plant proposed in partnership with the Chinese government. If further plans emerge and are implemented, China's rise as a nuclear energy power could challenge the power differential that has long separated African uranium exporters from the nuclear powers of the world.

Hybrid Ownership and Hybrid Benefits: The Husab Uranium Mine

Husab is the world's fifth-largest primary uranium deposit and is expected to become the world's second-largest uranium mine when it reaches full production in 2018. It will produce an estimated 15 million pounds of uranium over a 20-year lifespan. Including construction costs, CGNPC's investment in Husab is expected to exceed 4.6 billion USD (Anonymous 3 2014). This makes Husab both the largest single Chinese government investment project in sub-Saharan Africa to date and the largest-ever post-independence investment in Namibia. Unlike most mines in sub-Saharan Africa, Husab's ownership structure is entirely state-based. Operating under the Swakop Uranium moniker, the mine is owned 90 per cent by CGNPC and 10 per cent by Epangelo, Namibia's state-owned mining company, inaugurated in 2008. This hybrid ownership structure makes Husab a materialisation of the rhetoric of "South-South solidarity" that Chinese and African actors often use to characterise their relationships.

Reflecting its dual state ownership structure and the "mutual aid" rhetoric often employed by Chinese officials to describe China-Africa relationships (Strauss 2009), Husab's benefits are also hybrid. For the Chinese government, as noted above, Husab is an opportunity to secure a consistent uranium source to fuel its nuclear power ambitions and to reduce domestic carbon emissions and pollution. It also presents an opportunity to sell future uranium on the world market despite China's limited domestic supplies. In July 2014, CGNPC established the UK-based CGN Global Uranium Ltd to facilitate future Husab uranium sales. This outlet provides CGNPC with a hedge. If uranium prices rise dramatically or if China's nuclear power development plans change, CGNPC can sell Husab's uranium on the world market. In the meantime, and with uranium prices near record lows, Husab enables CGNPC to inexpensively increase its uranium stockpiles. If prices rise, CGNPC will be able to sell Husab's uranium at a premium while using its uranium stockpiles to fuel its domestic nuclear power plants.

The 90/10 ownership structure of Husab may suggest that the Chinese government is its primary beneficiary. Yet, despite its mere 10 per cent stake, the Namibian government may be deriving even greater benefits from Husab than the Chinese government is. As

mentioned previously, the mine has played a key role in staving off collapse for Namibia's uranium industry. Husab will singlehandedly double Namibia's uranium output and provide an estimated 700 million USD in yearly government revenues through Epangelo (Anonymous 4 2015). This amount is roughly equivalent to 20 per cent of Namibia's total export revenue and 5 per cent of Namibia's GDP. Husab will also help the Namibian government diversify its sources of mining revenue, which has historically come primarily from just two companies: the Namdeb diamond-mining partnership with DeBeers and the Rössing uranium mine. A uranium industry representative with whom I spoke at the 2014 Chamber of Mines conference was hopeful that Husab's opening would enable the uranium industry to finally experience the "political might" long enjoyed by Namibia's diamond industry (Anonymous 5 2014). Husab's CGNPC ownership should also provide a consistent export market in an industry that has been notoriously unpredictable in the past decade.

Husab's greatest benefit for the Namibian government, however, may lie in the opportunity it presents to increase the state's direct role in mining. Namibia's pursuit of this increased state role follows the precedent set by China itself in using its SOEs as a tool of both industrialisation and the consolidation of state power. Beyond revenue and access to uranium, Husab is an opportunity for elites in both countries to secure their statuses as the trustees of development and national interest. Both governments rely on resources – Namibia for export earnings, China for industrialisation – to support their domestic economies and provide political legitimacy for their ruling parties. As Africa's fourth-largest exporter of non-fuel minerals, Namibia's government is particularly dependent on mining, which provides nearly 60 per cent of its export earnings. As elsewhere in Africa, each of Namibia's mines is a

site of intense investment and state-aided control [...and] a linchpin of the economy that provides the state with the much-needed revenues that in turn affect the credibility and legitimacy of the state. (Ramutsindela 2013: A1)

Reflecting the importance of mining in Namibia's economy, its ruling SWAPO party has long used mining as a tool of political power. Since the end of the first decade of the 2000s, though, the Namibian government has sought opportunities to play a larger ownership role in Namibia's mining industry. In March 2009, the government allo-

cated 200,000 USD to establish a state-owned mining company called Epangelo. Epangelo translates as “government” from Oshiwambo, Namibia’s most commonly spoken first language. Erikki Nghimtina, then minister of mines and energy, explained Epangelo’s establishment by noting that

with changing dynamics in the global mining industry our thinking on the role Government plays with respect to the management and exploitation of resources have [sic] gone through an evolution. [...] in dealing with other countries we learned how their state mining enterprises [...] play a significant role in the development of their mining industries and their ability to generate significant revenue for their fiscus. (*The Namibian* 2009)

Nghimtina later identified the state-owned mining entities of China, Angola, and Russia as inspirations for Epangelo.

Both Namibian and Chinese officials have reinforced China’s role as a development model for Namibia. SWAPO officials commonly frame China as a trusted partner in Namibia’s development and, in the words of Deputy Parliament Speaker Loide Kasingo, as a “true and loyal friend of the Namibian people” (*Namibia Economist* 2012: 1). In addition to the Chinese government’s support for Epangelo’s ownership stake in Husab, rhetoric of friendship also stems from Namibian officials’ seemingly genuine support for China’s development model, which prominently featured mining SOEs in the pursuit of industrialisation and growth (Power, Mohan, and Tan-Mullins 2012). In October 2015, I attended “The Development Path: China–Africa Development Models Seminar” in Namibia during the lead-up to the FOCAC in Johannesburg, South Africa. The day-long event was jointly sponsored by the Chinese Embassy and the University of Namibia and attracted approximately 250 attendees, primarily youth. During his opening address, Chinese ambassador to Namibia Xin Shunkang proclaimed that for,

66 years, under the leadership of the Communist Party of China, the Chinese people have been striving with bold innovation and practice and have found the best development path for our own [...]. [...] China is now the second-biggest economy, the first [leading] trading [country] with [the] largest foreign reserve, and the third-biggest investing country in the world. China’s overall national strength and state leadership realised [this] historic leap

forward. [...] China is proud to support Namibia on its own development path.

Namibian officials have echoed this state leadership argument to both justify an increased Namibian state role in mining and to portray China as a loyal partner whose investments are motivated by a commitment to mutual development. After receiving a courtesy call from outgoing Chinese ambassador Xin Shunkang in March 2016, Namibian president Hage Geingob stated that he wished to “challenge all other colleagues from the international community to emanate [sic] what and how the Chinese friends are showing and helping us in many ways” (*Xinhua* 2016). A Namibian economic development official reinforced this message, explaining to me that working with China on a development project is like working with an older cousin who, “although you may feel he is better off, he does not look down on you. He is your comrade and cares for your ideas” (Anonymous 7 2015). References to comradeship are common in Namibian officials’ portrayals of China and frame both the Chinese and Namibian states as trusted providers of development.

Namibia’s shift toward state-led extraction is part of a broader trend toward resource nationalism and “neo-extractivism” across Africa and Latin America (Burchardt and Dietz 2014). In Namibia, this shift has been materially facilitated by Chinese investment in the uranium sector. Beyond the Chinese government’s role as a model for state-led extraction, Husab’s hybrid ownership structure has catalysed Epangelo’s growth from a 200,000 USD start-up to a major player in Namibia’s mining sector. Drawing on the example of China, Namibian officials have identified increased state ownership in the mining sector through Epangelo as the crucial link between mining and broad-based development for the Namibian people.

Political ecology scholarship on the politics of knowledge helps to explain how and why mining has come to be understood as key to Namibia’s development. In addition to shaping how knowledge is circulated and applied, political actors are entangled in the production of knowledge itself. As a result, “ideas about proper resource use (or, indeed, about what constitutes a resource in the first place) are themselves the products of particular sociocultural histories” (Nadasdy 2011: 130). As in many postcolonial states, the Namibian state’s legitimacy is derived in large part from its efforts to promote development (Cooper 2002). Prior to independence, SWAPO framed mining

as antithetical to development. This meant that there was no such thing as “proper” resource use; mining was inherently exploitative.

Since independence, though, SWAPO has pursued a development model focused on industrialisation and economic growth (NPC 2004). Today, SWAPO officials frame economic growth through mining as essential for reducing Namibia’s 51 per cent unemployment rate, approximately 50 per cent poverty rate, and world’s third-highest level of income inequality. As long as mining produces economic growth, SWAPO can characterise mining as a driver of development without losing its political legitimacy. To counter rising concerns over inequality associated with foreign investment in recent years (De-Boom 2013), SWAPO leaders have repurposed Namibia’s *Vision 2030* planning document to justify an increased state role in mining. *Vision 2030* broadly states that the government must ensure that “Namibia’s mineral resources are strategically exploited and optimally benefited.” The plan argues that, through strategic government management, mining will “provide equitable opportunities for all Namibians to participate in the industry, while ensuring that environmental impacts are minimised,” and claims that mining investments “are made to develop other sustainable industries and human capital for long-term national development” (NPC 2004: 43). By reframing “proper” resource extraction as one defined by the state playing a key role, Namibian officials have redefined the relationship between mining and development. Unlike mining under the apartheid regime, mining under the SWAPO government is no longer inherently exploitative. Instead, it can be a driver of economic liberation.

Husab’s greatest hybrid benefit, then, lies less in its ownership structure and more in its reinforcement of the political legitimacy of both the Namibian and Chinese states. For the Chinese state, uranium from Husab will reinforce the Chinese government as the provider of higher living standards for its people and, at the same time, as the provider of improved health and global leadership through reduced air pollution and lowered carbon emissions. For the Namibian government, Husab reinforces the state as the critical link to ensure Namibian resources are used for the broad-based development of the Namibian people. An official at Namibia’s Ministry of Mines and Energy told me during an interview that projects like Husab will enable the Namibian government to achieve its goal of “extracting more value from natural resources so as to finance government and

thus make possible the lifting of the Namibian people out of poverty” (Anonymous 6 2015). When I pressed the official on the connection between increased government revenue from mining and poverty reduction, he replied, somewhat bewildered, that “government *is* the people. As government benefits, so the people are beneficiaries.” While the 90/10 ownership of the Husab mine may suggest that the Chinese government is benefitting the most from the arrangement, SWAPO officials have gleaned additional benefits from Husab by using it to reinforce the Namibian state as the trustee of mining-led development.

Postcolonial Hybridity: The Local Costs of State-Led, Uranium-Based Development

Husab’s hybrid ownership challenges the historical geopolitics of uranium mining and nuclear power while providing hybrid benefits to both the Namibian and Chinese states. Beyond these benefits, Namibian and Chinese officials have also framed the mine as providing broad-based development to Namibians in the spirit of “South–South solidarity.” Officials frame these benefits as accruing at both the national level, through the increased government revenue described above, and the local level for communities located near the mine. During his 2015 FOCAC address, Namibian president Hage Geingob declared,

The mine was opened in a desolate area characterised by barren hills and mountains amongst which a modern highway has been built, leading to life. This mine has brought meaning and purpose to the life of previously unemployed Namibians. (Geingob 2015)

Chinese representatives with whom I spoke made similar arguments. One Husab representative was particularly excited to share the company’s corporate social responsibility (CSR) programmes with me, including training programmes in China for select Namibian employees. Husab is just one example of the growing emphasis that Chinese companies are putting on CSR (Tan-Mullins 2014). “This project will make the community better,” the representative told me. “And Namibians are involved at all the levels. Our vice president is himself a Namibian!” (Anonymous 8 2014). Other representatives noted the poverty of local livelihoods, which primarily consist of artisanal min-

ing, subsistence agriculture, and livestock herding. Both Namibian and Chinese officials emphasised that Husab will bring local communities into the formal wage economy. A Windhoek-based Namibian government representative claimed the mine would create 10,000 permanent jobs for Namibians. This would be a significant improvement for an area he characterised as “jobless”: “There is nothing to do. The people must surely want better” (Anonymous 9 2015).

Despite this rhetoric, the benefits and costs of increased uranium mining in Namibia are unequally distributed. In fact, the very transition to state-led, resource-based development that the Husab mine is facilitating – and that SWAPO leaders cite as key to broad-based development – may harm rather than benefit the Namibians most affected by intensified uranium mining: those working in the mines and living in nearby communities. Like the postcolonial hybrids theorised by Mbembe (2001), Husab’s challenge to exploitative historical mining-ownership structures may further exploit the very communities the mine is proclaimed to benefit. Furthermore, because Epangelo’s involvement in Husab strengthens the state’s legitimacy as the provider of mining-led development to Namibians, alternative understandings of what uranium extraction means for development may increasingly be rendered “extremist” or “marginal” to national political debates.

As noted previously regarding human/non-human hybridity, uranium is not only a geopolitical commodity. It is also a material resource, the extraction of which has physical implications. The costs of intensified uranium mining in Namibia are shaped by these material realities. Uranium is nearly twice as dense as lead. In low concentrations, as in Namibia, it is exceedingly difficult and expensive to extract (WNA 2017b). According to the World Nuclear Association (2016), concentrations of 2 per cent or higher are classified as “high grade,” while concentrations between 0.1 per cent and 2 per cent are “low grade.” Ores classified as “very high grade,” as in Canada, have concentrations of 20 per cent or higher. Namibia’s mines, by contrast, are classified as “very low grade,” with typical concentrations at or below 0.01 per cent. At approximately 100 uranium parts per million (ppm), Namibian concentrations are closer to granite, which has uranium concentrations of three to five ppm, than to high-grade ores, which have uranium concentrations of approximately 20,000 ppm. Due to these low concentrations, Namibia’s uranium mines require

far more water for extraction than mines elsewhere (Mudd and Disendorf 2008; Conde and Kallis 2012). Water requirements are aggravated by the open-pit design of Namibia's mines. Open-pit mines are preferred when uranium deposits are close to the surface, as in Namibia, because they have lower levels of radon gas than underground mines. Unfortunately, they also produce far more dust than underground mines, particularly in the desert environment where Namibian uranium mining occurs. The unusually high volumes of water required to extract Namibian uranium and suppress dust significantly reduce regional aquifers (Wippel and Suchanek 2009).

Without Chinese investments, Namibia's environmentally precarious and relatively inefficient uranium industry would almost surely have ended in the wake of the Fukushima market collapse. Its mines have been operating at below break-even for nearly a decade. The combination of high-cost production due to Namibian uranium's low concentrations, expensive environmental limitations (e.g. water scarcity, high-dust environment), and low global prices should have spelled the end for the industry. Chinese investment has forestalled this demise, with implications for miners and local communities.

Dangers for nuclear industry employees are typically associated with downstream radiation leakage or nuclear meltdowns (Hecht 2009). This can lead us to overlook the dangers of uranium extraction. The material characteristics of Namibian uranium combine with natural-social environments to produce risks that are embodied by miners. In addition to the airborne transmission of radon gas, radioactive particles, and heavy metal residues associated with open-pit mines, the chemical leaching process used to extract uranium in Namibia can release further radon gas and carbon dioxide (Brugge, de Lemos, and Oldmixon 2005). Chemical leaching entails spraying acid over extracted ore to separate the uranium and produce yellowcake for fuel-grade stock. The resulting heaps contain heavy metals and radioactive elements (Mudd and Disendorf 2008). The need for heap leaching is itself shaped by the material characteristics of Namibian uranium; it is the cost-saving measure (versus traditional milling operations) that makes Namibia's low-concentration deposits viable. Despite these dangers, mines are not subject to the strict employee safety regulations applied to nuclear power plants, because mine employment is classified at exposure levels below 100 mSv (millisieverts) (Conde and Kallis 2012).

Furthermore, reflecting a nuclear geopolitics of knowledge that centres on uranium's users rather than its producers, technologies to monitor miners' safety are far less advanced than those at nuclear power plants (Hecht 2012). Geiger counters, for example, are not suited to accurately account for the unequal spatial distribution of risks within a mine. The workers at highest risk were overwhelmingly black during apartheid in Namibia, and they will likely be Namibian rather than Chinese employees in new mines such as Husab (Anonymous 10 2014). The risks of long-term, low-level radiation exposure, as occurs in individuals who work in uranium mines for upwards of 30 years, are also understudied (EPA 2016). The International Commission for Radiological Protection notes that it is scientifically reasonable to assume that the incidence of cancer and/or hereditary disorders rises in proportion to increasing exposure, even at levels below 100 mSv (Wrixon 2008). Testing for long-term exposure requires expensive and painful bone sampling that is rarely covered by employee health services. Due to the extended time over which exposure effects emerge, it is difficult to directly link cancers, liver damage, chemical toxicity, and respiratory disorders to uranium mining, particularly in communities characterised by contributing health factors such as poverty and inadequate nutrition (Hecht 2009). While average poverty rates in the Erongo region, where uranium mining occurs, are low relative to the rest of Namibia, poverty in Erongo has a more unequal spatial distribution than elsewhere in the country. Erongo's poverty is concentrated in the rural communities, most with minority populations, that surround Namibia's uranium mines (Ministry of Finance 2008).

Uranium mining's health and environmental effects extend to nearby communities. Soil naturally contains trace amounts of uranium that can be transmitted to humans through contact, inhalation, or diet, but homes near mines have significantly higher levels of carcinogenic radon gas exposure (EPA 2016). Namibians who rely on locally grown and raised crops and livestock face the greatest risks. Heavy metals and radioactive residues produced during extraction, leaching, and processing can also contaminate groundwater and surface water (Conde and Kallis 2012). Acidic tailings with known carcinogens have been identified near all active Namibian uranium mines (Wippel and Suchanek 2009). Because heavy metal residues and decayed radioactive elements produced during open-pit mining

are stored in ponds, they can also be lifted into the air with high winds and inhaled by humans and livestock. Airborne transmission risks are particularly high in the windy local desert environment. Exposure is greatest for residents who are unable to seal their homes from windstorms, including those living in informal or indigenous shelters.

Namibia's Topnaar minority group, as also identified by Conde and Kallis (2012), is one example of a population that faces heightened environmental (desert-dwelling) and social risks (livestock-herding livelihood, indigenous shelters vulnerable to dust) from intensified uranium extraction. The Topnaar have little representation in national government and rely on livestock herding, which increases their exposure to uranium-associated air and water pollution. Uranium mining's water requirements have decreased the water available for their drinking, cooking, agriculture, and livestock needs (Anonymous 11 2015). While Namibia has stricter environmental regulations for mining than many African states, Topnaar representatives indicated that their mining-related concerns often go ignored (Anonymous 12 2014), and compensation for damages is rare (Anonymous 10 2014). In dismissing the concerns of Topnaar communities, Namibian officials argue that uranium mining is a necessary element of the state's efforts to boost employment, reduce inequality, and catalyse development among proximate communities like the Topnaar (Anonymous 13 2015).

Postcolonial scholars such as Mbembe (2001) use hybridity to highlight the complexity of exploitation in both formal colonialism and the postcolonial experiences that follow. Intensified uranium mining in Namibia, funded by Chinese investments and demand, has made it possible for the Namibian government to challenge historical mining-ownership patterns by playing a more direct ownership role in the industry. This situation, however, may result in the further exploitation of minority populations such as the Topnaar, who are already marginalised in the global and national political economy. Moreover, by reinforcing the Namibian state as the provider of development for the Namibian people, projects like Husab may perversely make it more difficult for communities like the Topnaar to challenge mining-as-development or to pursue alternative forms of development for themselves. Characterising the Husab mine as "neocolonial" exploitation by China is an overgeneralisation given the challenge Husab

poses to historical uranium geopolitics and mining-ownership patterns. It is equally clear, however, that, far from overturning all forms of mining-related exploitation in the spirit of “South–South solidarity,” Husab may deepen historical inequalities associated with uranium mining at the subnational level. The framework of hybridity, influenced by postcolonialism, STS, and political ecology, makes it possible to analyse both these complexities and their (geo)political ecological implications across multiple scales.

Conclusion: The Implications of Rising China for Nuclear (Geo)Political Ecologies

With full operations still months away, it is unclear how the Husab mine will affect Namibia’s development trajectory at national or subnational scales. Mining is a notoriously low-employment sector. The more than 10,000 promised jobs associated with the mine may or may not come to fruition. If they do come to fruition, they may or may not be permanent or employ Namibians (who may lack the technical skills necessary for higher-level positions). What is clear, however, is that there is much at stake materially, ecologically, and politically in association with China’s rising influence in Namibia’s uranium sector.

The framework of hybridity, itself made hybrid through a combination of scholarship from postcolonialism, STS, and political ecology, provides a useful theoretical lens for analysing the complex implications of China’s rising influence in Namibian uranium and beyond. As a hybrid of the human and the non-human, uranium is endowed with multi-scalar and multi-actor meanings. For China, it is a means to solidify both its geopolitical and domestic power by addressing the pollution problems associated with its rapid growth – without sacrificing the pursuit of increased living standards and industrialisation. For Namibia’s SWAPO leaders, it is a revenue generator that is consolidating the political legitimacy of the state as the provider of mining-led development. For local communities, it is the materialisation of a politics of knowledge that prioritises economic growth above, or even at the cost of, alternative development aims such as health and environmental sustainability. While uranium mining and its associated problems long predate Chinese investments in Namibia, Chinese investments have almost certainly saved the indus-

try from collapse. Chinese investments in uranium are also facilitating the improved bargaining position of the Namibian state in the global economy – and perhaps even a future in which Namibia is a nuclear state in addition to a uranium-exporting one. At the same time, however, these investments appear to be deepening the exploitation of the very communities proclaimed to be their greatest beneficiaries.

Like its increased role in uranium mining in Namibia, China's global rise challenges simplistic binaries between the social and material, the exploiter and the exploited, and the postcolonial state and the coloniser. The theoretical value of hybridity for analysing uranium mining is also valuable for analysing the (geo)political ecological implications of China's rising global influence. This hybrid framework can help us move beyond binary understandings (e.g. "development opportunity" versus "neocolonialism") of what China's rise entails for Africans. Providing an important antidote to framings of Africans as powerless victims of first the West and now China, postcolonial conceptions of hybridity also help us to better understand projects such as Husab as two-way engagements in which many actors have degrees of agency. As Robertson (2015) argues, nature and natural resources are "not simply the surface on which state strategy plays out, but [...] an active and internal part of these strategies" (Robertson 2015: 457). It is likely that the Namibian government is not alone in using China's rise to increase its power, political-economic options, and political legitimacy. While these new relations with China may not always fundamentally change exchange patterns, they do, as Melber (2011) argues, open up new political opportunities for African leaders. As predicted by Bryant and Bailey (1997), however, the multi-scalar distribution of costs and benefits associated with China's growing influence is unequal across multiple scales. In the case of Namibia, this distribution may ultimately deepen rather than reduce inequalities that predate Chinese investment while simultaneously increasing the power of the historically marginalised Namibian state and facilitating the rise of a non-Western global power. Like the fundamental contradiction of nuclearity identified by Hecht (2012), which separates the benefits of nuclear power from individuals and communities essential to its production, this situation need not be paradoxical. Instead, through the lens of hybridity, we can use these contradictions to better understand the complex (geo)political ecological implications of China's rising global influence.

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