Icelandic Resource Landscapes and the State
Experiments in Energy, Capital, and Aluminium

James Maguire

Abstract

This paper offers an ethnographic perspective on the relationship between resource landscapes and the state in Iceland during a period of financial experimentation. In particular, it analyses a shift from the production of thermal water for local use to the production of electricity for the global aluminium market. This shift, the paper argues, is not merely a technocratic exercise in further resource extraction, it also indexes some of the tenuous connections between resource making and state making. The paper ends by offering a perspective on the recursive relationship between resource instabilities and instabilities within the state.

Keywords

capital, energy, earthquakes, landscapes, resources, the state, Iceland

Straddling the mid-Atlantic ridge, the rift zone along the constructive boundary between the American and Eurasian tectonic plates, Iceland is an eruptive, faulting, and fracturing island. It is a place where tectonic activity overflows and envelops the landscape, giving rise to an inspiring volcanic topography.[1] Eruptive fissures, spewing geysers, mossy green lava flows, and expansive glaciers are not uncommon sights, and form part of a panoply of forces that ignite the imaginaries of those who live and travel there. As a peripheral northerly nation, the Janus-faced ambiguity of both belonging and not belonging to the Western world has always affected Iceland (Isleifsson and Chartier 2011; Oslund 2011). Such ambiguity has been produced, in part, through eighteenth-century accounts of travel writers, scientists, and colonial administrators attempting to get to grips with the terrifying beauty of Icelandic landscapes – places that wrought both admiration and fear in the furtive imaginings of those cast to define the contours of what constituted civilisation.

Such post-colonial legacies still inflect the ways in which Icelandic landscapes are rendered today.[2] As an object of natural scientific

Anthropological Journal of European Cultures Volume 29, No. 1 (2020): 20-41 © The Author(s)
doi: 10.3167/ajec.2020.290103 ISSN 1755-2923 (Print) 1755-2931 (Online)

curiosity, this volcanic island has a long history of being performed as an experimental lab, a resourceful site for thinking and testing theories of global plate tectonic shifts (Oslund 2011: 44–45). At the same time, the rich corpus of Saga literature enacts landscapes in specifically cultural terms, playing out tension-filled stories of a newly settled community in a hostile and forbidding topography as they learn to negotiate with the many forms of 'other' that inhabit the same landscapes. As cultural resources, these landscapes are sites to think about settlement, community, and identity.[3] But it is in a more overtly nationalized political context that landscapes are rendered as hybrid cultural and natural resources, specifically as sites for examining, contesting, and reformulating colonial legacies of power.

Take Þingvellir in the southwest of the country. Variably translated as 'Parliamentary Plains' (Hálfdanarson 2000) or 'the ground for things' (Pálsson 2005), Þingvellir is a historical and political site of huge significance for Icelanders. It was home to what today would be called the settlers' first parliament, the Alþing, or general assembly, established in 930, not long after the first settlement of Iceland in 874. At that time Iceland was a society of farmsteads and the Alþing functioned as a sovereign legislature of a loosely federated farming society (Magnússon 2012): a site of law making and dispute settlement bound to this fractured volcanic landscape. This, what one could call, geopolitical landscape emerged as an object of reverence for nationalists during the campaign towards independence in the 1800s, and continues to be a place of gathering for the nation in times of political remembrance and celebration.[4] In varying contemporary accounts it is described as a sacred site, 'the heart of Icelanders'[5] that embodies both history and nature, two main sources of national pride in the country (Hálfdanarson 2002).

Icelandic landscapes, therefore, have long been, and continue to be, resourceful sites for thinking theory, contesting legacies, and performing the nation. But this is a sense of resource as a mode of giving expression to various forms of thought and action. There is, however, a conspicuous absence in scholarly literature of the liveliness of this eruptive landscape in which people live and rely upon to make their lives liveable. An absence, one could say, of the very forces and materialities that afford such semiotic productivity. This article writes up against this absence, making a move from landscapes as resources for cultural and political production towards the production of resources that have enabled liveability in the subarctic. It will do so by engaging with the lively materialities of these landscapes – the spewing,

explosive, phase-shifting forces that emanate from their subterranean zones.

Such an engagement is based upon two periods of ethnographic fieldwork, both of six months duration. In 2013–2014, I conducted fieldwork with geologists from Reykjavík Energy. Here I participated in their daily work routines as they sampled and analysed water and steam emanating from the geothermal wells of the Hellisheiði Geothermal Power Plant – itself situated within the Hengill volcanic zone in the southwest of Iceland. In 2014–2015, I lived amongst residents in Hveragerði – a small town in the vicinity of this geothermal power plant – who were, and continue to be, extremely alarmed at the production of anthropogenic earthquakes that have arisen in the wake of geothermal extraction.

The analytical framework that arises from this fieldwork is, therefore, less about the meanings that emerge from Icelandic landscapes through particular modes of rendering them as cultural, or natural, or political. Rather, the point is to offer an analysis of what it takes to make lively, turbulent landscapes into resources that produce various forms of liveability. The particular intervention that this article makes is to unfold the story of a shift from one articulation of volcanic landscapes (the production of thermal water for local use) to another (the production of electricity for aluminium smelting). This shift is not a mere technocratic state exercise of extracting more resources from the landscape, but indexes how the making and re-making of resources are also modes through which the state is constituted.

In the next section, I analyse the shifting constellations that have enabled the production of geothermal hot water resources; resources that have underpinned life in Iceland for the past one hundred years. Converting subterranean forces (magmatically heated rock and water, and pressure) into energy resources (thermal water) is both highly technical and highly political as varying actors intercede in hot water production to varying effects. The broader contours of the latter part of this story – the production of electricity – tells of a short, but intensive, period of experimentation with the Icelandic welfare state as cities, private enterprises, citizens, and state institutions embroiled themselves in practices of extreme finance capitalism. Transforming the Hengill volcanic landscape in the southwest of the country from a site of geothermal hot water production for local consumption to a site of electricity production for aluminium multinationals serves, thus, as an optic through which to think about the relationship between the Icelandic state and Icelandic landscapes through this period of

experimentation. In short, I argue that remaking these landscapes into a viable proposition for aluminium takes work; the work of reconfiguring the state through a particular reconfiguration of resources. The following sections ethnographically describe the processes through which such reconfigurations take place.

Aluminium in Iceland

Aluminium has a long history of energy extraction in Icelandic landscapes, a history that extends much further back than the development of the Hellisheiði Geothermal Power Plant in the Hengill volcanic zone. The first of these multinationals arrived to Iceland in the 1960s as part of the industry's aggressive search for cheap electricity to satisfy their global smelting demands. Their focus, at that time, was the development of electricity through hydro-electric sites.[6] Although Iceland had been producing geothermal hot water for several decades prior to aluminium's arrival, the scale of landscape intervention for electricity production – and its ensuing societal conflict – was significantly more extensive and destructive.

The industry's arrival also heralded a change in resource thinking and practice. The idea that the melt water from Iceland's numerous glaciers – which had hitherto 'flowed freely into the sea' (Jonsson cited in Skúlason and Hayter 1998: 36) – could be dammed and thus transformed into electrons for aluminium production was an unprecedented way for Icelanders to think and act within this historically harsh landscape. It indexed a shift from thinking about glaciers as both natural and cultural resources to emphasizing their resourcefulness in terms of energy abundance. The path to a stable future, in the imaginary of successive governments, lay not in the agricultural practices of cultivation, nor in the harvesting of the fish stocks, but in the utilization of glacial melt water as materially resourceful. Over the subsequent decades, ideas of societal progress and development became almost synonymous with energy extraction in Iceland. As the state searched for solutions to continuing rural de-population, aluminium smelting became the rhetorical panacea. As a place where 'modernist development' has always been considered 'slow' (Magnússon 2012), this period is often characterized as Iceland's first stage of infrastructural development; a late bloom attempt to catch up with the perceived progress of the rest of the industrialized world.[7] As we will see in section four, the second phase of infrastructural

development – connected to the production of electricity from volcanic landscapes – arises in the early 2000s as vast capital flows enter the country.

Making Liveability: Thermal Heat

The view from the sixth floor of Reykjavík Energy's geologically inspired head office[9] is impressive as snow stretches towards the horizon, stencilling out the boundaries between the tectonic landscape and the city. To the southeast lies the relatively new Hellisheiði Geothermal Power Plant in the Hengill volcanic zone, its operations made visible through the wafting emissions of condensate steam rising high into the atmosphere. To the west and north lies Reykjavík; a cityscape littered with small sleek silver hut-like objects, architecturally recognizable as geothermal wells. Reykjavík Energy is a municipal services company 94 per cent owned by the city of Reykjavík. It provides hot and cold water, sewerage, and electricity to the majority of Icelandic homes and businesses. It is also the owner and operator of the Hellisheiði Geothermal Power Plant. Bjarni, a geologist and CEO of Reykjavík Energy, points towards these many small wells that pump hot water to the city's residents and talks about the history and importance of geothermal energy to Reykjavík in particular, and to Iceland more generally.

At the start of the twentieth century the company was state owned and run, and Bjarni recalls its early mission: 'to provide clean drinking water to the rat-infested homes of the tiny town of Reykjavík'. He revels in telling me what he considers to be one of Iceland's greatest achievements; the supply of cheap and replenishable geothermal water to residents and businesses throughout the greater Reykjavík area (Jónsson 2010; Jónsson and Rastrick 2017). As Bjarni tells me this story, the Hengill volcanic zone emerges as a central actor in how the state has provided water from shallow wells in and around Reykjavík. The heat that emanates from the ground throughout the Reykjavík area is remnant heat of an older volcanic system, heat that has cooled down to present temperatures over huge timespans. 'Around 2.5 million years ago', Bjarni explains,

> the volcano now submerged in the bay at Reykjavík was situated at the Hengill volcanic zone, the present location of the new Hellisheiði Geothermal Power Plant, some 25 kilometres southeast. Rifting tectonic plates in this area have pushed apart at an average rate of one centimetre per year, and as such the land has moved like a conveyor belt in both northwesterly and southeasterly direction.

> As the plates spread, the land, volcanoes included, has been slowly transported to its current position, although disconnected from its originary volcanic heat source deep in the mantle. What once was an eruptive volcano at Hengill, has now become a cooled down matrix of rock, and it is the remnant heat emanating from this cooling rock that gave licence to the city's legendary first denizen, Ingólfur Arnarson, to name it smoky bay (Reykjavík).

Today, the temperatures are still warm enough to provide hot water, or geothermal heating, to the city's current residents. The 1920s brought the state's first successful attempt to supply geothermal water to the residents of Reykjavík, a tectonic intervention that enabled the development of a thriving metropolis on the outer rim of the subarctic. While preliminarily used for domestic purposes, in particular washing and cooking, it was in the 1930s that it began to be developed as an alternate heating system to coal. During the 1960s geothermal water became the central component of Reykjavík's heating system, spreading across the country in the 1970s as the global oil crisis catalysed the state to fully develop this potentially rich indigenous energy source. Today, geothermal sub-stations draw and pump water from many shallow sub-surface springs around the country, up to a temperature of eighty degrees Celsius.[9]

This story of thermal water for heating has become a much valorized one at geothermal conferences and conventions the world over as Iceland is held up as a leading example of the sustainable use of indigenous energy resources.[10] Today, 93 per cent of all Icelandic heating needs are satisfied by geothermal water as it provides thermal energy across the country for residential and business heating, fish farming and processing, greenhouse production, swimming pools, winter pavement de-icing, and a host of other ancillary uses. One way of putting this is to say that the tectonic landscape is being mobilized by the state and its agencies[11] in a particular way, in order to produce replenishable, and cheap, hot water. Alternatively, one could say that the liveliness of the Hengill volcanic landscape has been arranged in a specific way so that one configuration of tectonic relations (thermal water for heating) has emerged and stabilized over the course of the last several decades. Arrangements of tectonic liveliness have been mobilized in the service of particular arrangements of living, as humans, volcanic rock, heat, and water form lively, thriving coalitions at subarctic latitudes.

Bjarni introduces me to Grímur, head of reservoir engineering at Reykjavík Energy during the transformation of the Hengill volcanic

zone in the years between 2006 and 2012. In this timeframe these landscapes became home to the Hellisheiði Geothermal Power Plant, a project that was the realization of a long-standing ambition of the municipal company to supply electricity to a large global aluminium consortium. As I will discuss a little later, this project was bound up with the influx of capital that washed over Iceland in the mid to late 2000s.

In a long conversation, Grímur also talks to me about the importance of geothermal water in Iceland. His words resonate with my own embodied experiences. Being around and within this earthy water requires a sensory adjustment, as the pungent sulphuric smell and the burning heat of this silica rich, silky-to-the-touch water washed my body, cleaned my dishes, and warmed my apartment when I lived in Reykjavík for six months in 2013–2014. Almost daily trips to a swimming pool in central Reykjavík, where residents of the area bathe and chat in the 40 plus-degree outdoor hot tubs, tuned me in to the sheer pleasure of being soaked in a blissful heat. Eventually I was able to strike up conversations with locals where I heard similar stories about Reykjavík to the ones both Bjarni and Grímur were telling me; tectonic displacements, smoky bay, rat infestations. But then they'd talk about thermal heat coming to Reykjavík. Not the heat from burning peat or coal, intermittent, unstable and dirty, but a consistently reliable heat from subsurface water. But now it's quite ordinary, and that's a good thing they tell me. This ordinary heat allows for such after-work gatherings, as heads bob momentarily under the water to counter the ice forming on our hair, and sounds of contentment eek out of people around me. Gathering in hot tubs is one way to counter the long, dark, cold months that blanket an average Reykjavík winter. In a place such as this, thermal water is ordinary in extraordinary ways (see also Jónsson 2010).

Grímur points towards the possible reasons why this energy form has stabilized and been such a success story in Iceland. And it has a lot to do with the ways in which the relations between geology, capital, the state, and communities are arranged. Energy extraction, in this model, is a mode of doing welfare to create liveable relations:

> Heating is based on a welfare model. No matter what the temperature, whether two or minus twenty degrees Celsius, we have a setup whereby the towns always have a plentiful supply of heating at a cheap cost. In this way heating stabilises unstable towns. So, this is its politics, the town pays off the debt to the state and the people, as the owner of the resource, get the profits. Well, they are distributed to the citizens by way of cheap energy bills (two cents per kilowatt-hour). This is what made geothermal

> water spread so rapidly throughout Iceland. But today it's all about power [electricity production], and the same approach just doesn't work.[12]

Grímur brings many interesting points to the fore in this small but concise statement about geothermal water. Firstly, he highlights the historic role of the state and its agencies – the national energy agency, financial and lending institutions – in providing welfare for its citizens via landscape interventions. Additionally, he emphasizes that making townships viable in such places cannot be taken for granted and requires complex forms of human and non-human interaction. As rock migrated from the central volcano at Hengill to Reykjavík over vast timescales, certain capacities of these bio-tectonic processes – just the right variations in pressure, temperature, and depth – have enfolded with the desires of human groups to settle in these particular subarctic latitudes. Fragile assemblages of rock and humans are bound together through schemes of state capital and community ownership to distribute the vitality of these relationships. Extracting thermal water at rates to satisfy the community has enabled the shallow sub-surface reservoirs in many of Iceland's towns to be replenished over the course of their lifetime. As such, residents can take advantage of cheap energy over multiple generations.

This is the sense I have of what Grímur is telling me when he talks of freezing temperatures, energy prices, state and municipal welfare politics, and what I read from my own experiences of being sensorially attuned to geothermal water: the ways in which hot water makes a difference. Not a minor difference, but the difference between townships being able to survive, or stabilize as Grímur puts it, or not. This is how liveability emerges, not as mythic stories of men and women battling the subarctic world through hardy constitutions, but through modes of arranging relations between rock, water, heat, capital, and politics (both national and local). But Grímur is also reflective about Reykjavík Energy's new role in producing power (electricity) for aluminium smelters, acknowledging that this model of relations cannot be simply scaled up to meet power's demands. Moving from extracting thermal water for heating to extracting steam for electricity is not merely a technical shift, the substituting of one resource for another, but is a rearrangement of the relations between geology, communities, and the state that, as Grímur reminded me, is part of a different story:

> To get steam to make power (electricity) is clearly very different to getting thermal water. With geothermal water you have to drill just a little

> into the ground, but with steam, that's a whole different story. I always say that in extracting steam for aluminium we are trying to get the landscape to serve power, rather than how it should be, getting power to serve the landscape.

It is to that different story that we now turn our attention.

Experimenting with the State: Finance Capitalism and Resource Economies

The former section describes how the extraction of geothermal hot water has made liveable communities in the far north through particular sets of human and non-human relations. What is important to note here is that relations between geology, capital, the state, and communities have been arranged in ways that work *with* the landscape. As such, hot water extraction has produced not only sustainable resources, but also sustainable state–citizens relations. The coming sections will turn to what Grímur, above, calls a 'whole different story': the extraction of steam from volcanic landscapes to make electricity for aluminium multinationals.

As I noted in the introduction, aluminium multinationals have a long history of energy extraction in Iceland. Their arrival in the 1960s heralded a clear change in resource thinking and practice as landscapes shifted from being rendered as natural and cultural resources, to being materially and energetically resourceful. A not dissimilar shift in resource thinking and practice occurred in the 2000s as Iceland's second phase of infrastructural development set in. As global asset values surged during this decade, vast quantities of capital found a temporary resting place upon Iceland's shores. Heralded as the financial Mecca of Northern Europe,[13] this moment in the country's history is one where access to capital was freed up and became available to all Icelanders, as the lives of residents, companies, and municipalities were transformed in unprecedented ways. An eighteen-year conservative regime – fronted by the Independence Party – introduced a sweeping array of aggressive neoliberal reforms during the 1980s and 1990s that structurally transformed the economy. Their rhetoric of the *liberating powers of capital* was central to policy changes such as deregulation and private ownership, and became the calling card of successive governments (Durrenberger and Pálsson 2015).

The newly privatized banking sector rapidly internationalized the economy as vast amounts of capital flowed through the country,

primarily through debt financing strategies that leveraged bank debt to a ratio of almost ten times Gross Domestic Product (Boyes 2009; Jónsson 2009). Tales of the *Útrásarvíkingar*, variably translated as Venture or Business Vikings, emerged alongside capitally infused endeavours, a trope that lauded the risk-taking practices of investment bankers as bold and courageous. Valorized as wild, yet serious figures of a newly emerging era of globalized capital, these (for the most part) young men were rendered as national icons, reminiscent of saga heroes from the pre-colonial era of Nordic glory.[14] As a small cohort of these newly empowered men continued to buy up companies around the globe, Iceland was engulfed in the activities of the financial markets. Capital had next to magical effects on the everyday as banks arranged for Icelanders to circumvent inordinately high national interest rates by brokering low interest foreign currency loans.[15] As banks aggressively marketed such loans,[16] consumer spending exploded as large SUVs and shopping trips to Europe became de rigueur. Property prices, as well as pension funds, soared, as Iceland became a momentary resting place for vast quantities of globally circulating capital. This approach to risk and debt gripped not only consumers and corporations, but also run-of-the mill municipalities across the country, as they too borrowed on the international markets in the realization of longstanding infrastructural dreams, as community swimming pools, school buildings, and libraries sprung up one after another in remote locations around the country.[17]

As capital became more freely available, the imaginative horizon of what constituted the value of Icelandic landscapes began to open up once again as the volcanic landscapes of the Hengill volcanic zone became the target site for the production of electricity. Conversations with geologists and others at Reykjavík Energy leave little doubt about how *Útrásarvíkingar* logics were in play in the push to develop electricity at Hengill. Particular discursive forms such as 'drill baby drill' became part of how senior geologists at management and board level articulated the aggressive optimism associated with geothermal production. Although this is not to say that there was no push back from 'ordinary' geologists at the company; there was. But their voices typically went unheard.[18] As noted above, the aluminium industry has been buying Icelandic electricity since the 1960s, so the intensification of resource extraction in volcanic landscapes – switching from thermal water to electricity – can be seen as both a continuation of previous efforts, as well as a new departure. A deal was struck to provide 303 megawatts of power to Century Aluminium, a large US-based

aluminium consortium. While the state has long held a monopoly on the production of energy in Iceland, the waves of liberalization that accompanied the era of finance capital repurposed the state's role away from resource owner towards resource mediator. Within such a configuration the state – through the national energy agency and the national power company – no longer extracted the energy itself but organized the framework conditions governing a deal between the city of Reykjavík (instantiated via Reykjavík Energy) and Century Aluminium. Such a framework consisted in the provision of tax incentives, infrastructure projects, political guarantees, and environmental exemptions. This was on the back of cumulative concessions already given to the aluminium industry since the 1960s in the form of legislative reforms (changes to labour law), pension reforms, educational and language guarantees, as well as local and regional taxation exemptions (Skúlason and Hayter 1998).

One way to think about how this shift in the configuration of resourcefulness is achieved is through the lens of infrastructure. Work from within anthropology – from Max Gluckman's work on a Zulu bridge opening (Kapferer 2005), right through to more recent engagements with roads (Harvey and Knox 2015) – has demonstrated that infrastructures are a way of making the state visible; projecting its power and legitimizing its role in the lives of its citizens. They are sites of action and discourse where the dreams and desires of the state are played out as modern, or progressive (Easterling 2014; Howe et al. 2015). Work at the productive intersection of anthropology and science and technology studies has pushed this line of thinking in more explicitly performative directions, conceptualizing infrastructures as politically and ontologically generative (Harvey et al. 2017). As such, infrastructures are not only what states make, but are part of what make states. Infrastructuring, therefore, is the sets of processes and practices through which resourcefulness gets made, and through which the state and aluminium emerge as particular types of entities. Infrastructuring Iceland's volcanic landscapes within the architecture of aluminium unleashed the island's inherent potential, an aggressive means of converting tectonic instability into the promise of resource stability.

Making Earthquakes: Electricity

My fieldwork at Reykjavík Energy in 2013 and 2014 was partly spent at a desk in the geology department of the municipal company.

Figure 1: Geothermal Power Plant in the Hengill Volcanic Zone, Southwest Iceland (Photograph courtesy of Einar Gunnlaugsson of Reykjavík Energy).

Here I attended meetings, had conversations, and conducted interviews with both geology staff and members of the corporate team (finance, marketing). When not at the office, I accompanied geologists to the volcanic terrain surrounding the geothermal power plant, where we conducted field tests and monitored the progression – or lack thereof – of the geothermal wells. While at the company, large-scale restructuring (staff layoffs, asset selloffs) had been set in train. The mood amongst the employees was sombre and reflective as they recounted how the path of the municipal service company followed the broader contours of the finance crisis itself. In the space of ten years, the company's debt rose to two billion US dollars, nearly four times the annual budget of the city of Reykjavík, with 1.7 billion US dollars denominated in foreign currency loans. This leveraged the debt profile of the company to almost one thousand per cent of its 1990s level.[19]

Amongst the geologists I was doing fieldwork with, much of the talk was about the Hellisheiði Geothermal Power Plant in the Hengill

volcanic zone. These friends repeatedly lamented what they described as excessively aggressive drilling practices during the construction of the power plant up to 2012. In particular, they connected these aggressive practices to the recent outbreak of anthropogenic earthquakes associated with steam extraction.

One way of thinking about extracting steam to produce electricity is as a form of volcanic terraforming. Despite being Iceland's most continuously active earthquake zone (Foulger 1988), over fifty wells have been drilled three kilometres deep into Hengill's subterranean, stretching over vast quadrants of the landscape. While geothermal fluids exist in an intensely pressurized form deep within underground rock fractures, getting them up to the surface involves calibrating relations between the underground and overground – in particular heat and pressure relations – to maximum acceleration effect. Moving through underground chambers, fluids accelerate as they heat up, exploding upwards through the extraction technologies, and phase transitioning, almost magically, into steam. So, producing electricity for aluminium is a process of geological acceleration; configuring the landscape to phase-shift water into steam. While producing these accelerations deep within the subterranean of a continuous volcanic zone might appear, on the face of it, risky, the probability of inducing seismic activity was deemed close to zero by those geologists who modelled the project's overall risk parameters in the initial phase of development. As the current group of geologists liked to point out to me while on fieldwork; 'the history of geothermal is almost 100 years old, this is stable, sustainable: this is not fracking'. What these geologists had not accounted for were the forms of economic acceleration at the heart of how aluminium conducts its business. Century Aluminium's smelters operate 24/7, as smelter pots gobble up continuous round-the-clock current to keep from freezing. Given its control over large parts of the electricity market, the aluminium industry has become very adept at extracting cheap energy prices – particularly from small, inexperienced states such as Iceland – in order to keep aluminium prices competitive. Here's how a senior geologist at the company put it to me one day:

> But just like in oil and gas, coal you name it, geothermal is mining, a type of heat mining. But remember with power, the commodity [energy] price is always the decision maker. Those big aluminium smelters, they only locate wherever the energy is cheapest, so we had to compete with the cheapest coal and natural gas, and the only way to do that was through cheap prices.

> But everything about power here in this country is political; power is a political story. The business model of steam [for electricity] is run on one hundred per cent debt, but it's the debt of Reykjavík. The financing was guaranteed by the city, and that gives a much lower capex [cost of capital]. In that way we could borrow much cheaper from the European investment bank and other Nordic banks. In a normal power company, you would have to sell for eight cents [per kilowatt-hour], but we could cut it right down to the bone and that's what got aluminium here. We end up only getting about three to four cents [per kilowatt-hour]. Selling power at the lowest possible price through politics.

Being 'cut to the bone from a price perspective', had serious consequences for the ways in which the volcanic landscape was configured to extract steam. In addition, particular models of capital[20] also incentivized extracting steam as fast as possible. Such models are premised on the idea that steam extracted today is more valuable than steam extracted tomorrow. This combination fuelled more aggressive development, and hence the need to scale up (the number of wells) and speed up (the drilling of those wells and the extraction rate per well) operations. What I learned from my geology friends at Reykjavík Energy was that the tried and tested geologic practice of giving geothermal wells the requisite amount of time to adjust to the unpredictable effects of drilling,[21] as they have done for many years in extracting thermal water, was overridden by the need to satisfy the huge energy demands of aluminium: in a way that made sense to capital.

As Grímur reminded us earlier, the model for making and extracting thermal water just doesn't work for electricity. For electricity production acceleration is what drives the process. This is not just the geological acceleration needed to convert water to steam, but the material landscape effects of the pricing structures and capital models that globally powerful corporations can impose on small states. In order to make thermal water resources, rock and humans are bound together through schemes of state capital and community ownership in which cheap energy prices are a means of redistributing benefits back to the community. However, in electricity production cheap prices act as an accelerator that provoke the landscape into excessive responses as anthropogenic earthquakes become a lived-with side effect of satisfying aluminium. Converting subterranean forces into energy resources in this instance does not take geological processes seriously enough but subtends them to the needs of aluminium pricing and capital. With thermal water, geology, capital, communities, and the state are infrastructured to produce liveable welfare relations, and extraction proceeds at a

pace that sub-surface geothermal reservoirs can cope with; the relations between extraction, replenishment, price, and capital work towards the purpose of stabilizing townships in subarctic latitudes. What we see with electricity production is that capital accelerations (cheap pricing and capital models) are disconnected from other considerations. As Grímur put it earlier, 'the landscape is made to serve power rather than power serving the landscape'. As a result, anthropogenic earthquakes have now emerged as a collateral effect (Law 2004) in the lives of the residents of Hveragerði, a small town in the vicinity of the power plant.

Reconfiguring Resources and Reconfiguring the State

Residents of Hveragerði are dismayed and anxious about the production of these anthropogenic earthquakes. It's not that earthquakes are something new to them; quite the contrary in fact. Iceland is a place with a long history of socio-environmental catastrophe. Its annals are full of stories of unbearable icy winters, famine, and plague, as well as violent volcanic eruptions and earthquakes (Hastrup 2012). Lying within the contours of the Hengill volcanic zone, this small town has experienced a number of 'natural' earthquakes in recent years. Having lived with, and through, these events, the town's residents are particularly concerned about what the future might bring as the actively powerful forces of nature are provoked and disrupted by the ever-increasingly powerful forces of humans. The extent and degree to which earthquakes can be felt depends upon where in the town one lives, with residents in the western parts, closer to the geothermal power plant, being more vulnerable than others. The town was deeply shaken in 2012 when over 4,000 earthquakes were registered in the space of two months.[22] Ongoing occurrences, while considerably below the levels between 2011 and 2013, are still a feature of life. As would be expected there have been a wide range of reactions to these earthquakes within the town. While a few have moved away, another small section has been deeply affected, seeking medical and psychological help. The more common reaction, however, is one of resigned acceptance and frustration.

While the town's inhabitants get on with daily life in the midst of these new earthquake entities, the intersecting politics of resource extraction and post-crisis recovery are such that they have little chance of halting energy production. It is not just that providing an evidentiary basis for anthropogenic earthquake responsibility is extremely difficult, it is also about the complex political relations between the

landscape, municipalities, the state, and capital. In the wake of the finance crisis, a shift away from the instability of debt and currency speculation and towards the apparent stability of resource production has been high on the state's agenda. The idea of disrupting electricity production due to non-fatal earthquakes does not figure into this strategy. The prohibitive contracts that Reykjavík Energy have with Century Aluminium mean that any reduction in electricity output would come with unbearable financial consequences.

At the same time, Reykjavík Energy is so central to the lives of the inhabitants of Reykjavík city that allowing it to fail is simply not an option. In fact, the residents of the city have already bailed the company out on two separate occasions. In its reconfigured role as resource mediator the state does not have any direct responsibility for the situation between the residents of Hveragerði and Reykjavík Energy (and by extension the residents of Reykjavík) and as a result has not yet intervened. An expert panel was convened and produced a report on anthropogenic earthquakes, the conclusions of which suggested that given the ways in which extraction processes are triggering these earthquakes – speeding up the release of already-in-situ rock stress – the municipal company was, in all likelihood, reducing the possibility of 'bigger' future 'natural' earthquakes from occurring (Bessason et al. 2012; Maguire 2019). While many see this report as an exercise in legitimizing continued extraction, the town remains disconnected from the institutions of the state. The absence of the state, in this instance, is what is noticeable as actors try to figure out how to manage what is, in many ways, an unmanageable situation.

At various moments in Iceland's history landscapes have been rendered as unstable, dangerous, and unproductive, while at others, they have become sites of potentiality; places of transformation where unstable tectonics engender the dream of stable economics. However, infrastructuring the explosiveness of volcanic sites in the service of aluminium has brought with it other variants of instability, as cheap energy prices and capital models accelerate and provoke further seismic instabilities. While the construction of the Hellisheiði Geothermal Power Plant was part of a process of reconstituting the state in an aggressive era of finance capital, it has also become a part of the story of resuscitating the state in the wake of this era's collapse. But this resuscitation does not come without its own price, as the small 300-plus population of Hveragerði emerge as a problematic part of the story.

Anna Tsing's work reminds us that the creation of new resources arises not from naturally discovered frontiers, wild spaces awaiting

exploitation, but from the material and imaginative work that makes them become so (2005: 32). In an insightful analysis, Tsing suggests that the work of frontier making is oftentimes that of erasure; landscapes have to be unmade from the worlds that they belong to, so as to be re-made into wild barren spaces disconnected from any pre-existing relationships. In particular, she deploys the term 'salvage accumulation' to characterize the ways in which 'stuff with other histories of social relations (human and non-human) are converted into capitalist wealth' (Tsing 2015a; Tsing 2015b).

Through the actions of a state in the midst of recovery from financial collapse we also see a form of erasure. Given the state's mediator role in resource extraction, it does not deem itself accountable for the events occurring in Hveragerði, and, from the perspective of those that live there, it continues to ignore its duty of care to all its citizens. Much work in anthropology has reminded us that the state is far from singular or monolithic, but rather an entity that emerges in particular configurations through particular moments, with varying degrees of visibility (Scott 1998; Stepputat and Nuijten 2018; Thelen et al. 2014). What we are seeing here is how the Icelandic state re-makes itself through a re-configuration of landscape forces, becoming less visible to one part of its citizenry (Hveragerði) in order to remain more visible to another (Reykjavík). As varying configurations of state, geology, community, and capital produce, at times, viable relations for liveable townships, other configurations (state, city, geology, and aluminium) produce more shaky relations. In activating the resourcefulness of these landscape forces in relation to other constellations of people and capital, electricity emerges as a somewhat complex and ambivalent form of power. The collateral effects of such resource intensification pose multiple governance problems for the Icelandic state. While remaining technically unaccountable for the events occurring in the southwest, they still bear a duty of care to those that live there. The ambivalence of electricity as a form of power resonates with the ambivalent power of the state to care for certain parts of its citizenry as the ongoing effort to stabilize relations of power remains shaky.

Conclusion: Ambivalent Power

This paper has offered an ethnographic analysis of a complex set of landscape transformations that occurred through one of the most turbulent periods of recent Icelandic history. It has unfolded the story of

a shift from one articulation of volcanic landscapes that has produced viable townships around the country over many years, to another that has activated the resourcefulness of these landscapes for other means – the production of electricity for the aluminium industry. But this shift is also part of how the colonial and environmental legacies of this small state play out through the resourcefulness of its landscapes. As a small island nation with few economic options, the fish stocks have formed the backbone of the economy over the last 100 years. As such most regional economies became dependent on the vagaries of each year's catch, peaking and ebbing in rhythm with, for the most part, cod stocks. While the area around Reykjavík enjoyed a post-war boom from the development of a US military base at Keflavík just south of the capital, times remained hard. But both of these primary forces, maritime, as well as neo-colonial, were highly uncertain: both the Americans and fish, it was argued, could leave on a whim.[23] The desire, therefore, to develop a solid industrial base, one that could provide what Iceland had always lacked – a sense of stability over a broader temporal scale – has remained the clarion call of the Icelandic state. It is the aluminium industry that has been tasked with mediating this desire, facilitating a shift away from fish and foreign powers, and towards the apparent stability of industrial production.

But what this fieldwork from south Iceland shows is that relations of instability and stability are not absolute, but recursive. As the Icelandic state continues to intercede in the landscape, attempting to make unstable subterranean forces into resources that bring economic stability to the lives of Icelanders, new forms of instability have emerged, both within the landscape and within the state. Anthropologists who conceptualize the state in infrastructural terms (see those listed above) have long argued that infrastructural work is oftentimes a form of state work; that is, the state can be materially manifested and made visible through infrastructure projects. However, this ethnographic work from Iceland goes one step further by specifying the ways in which relations of stability-instability in one, can recursively affect the other.

The wave of neo-liberal experimentation that restructured Iceland in the early 2000s was not only about large inflows of money. It was, at the same time, also about how prevailing attitudes to risk and reward were manifested in sets of practices that opened up the imaginary of what constituted the value of Icelandic landscapes. Reconfiguring these landscapes into a viable proposition for aluminium resulted in a terraforming operation productive of vast quantities of steam. But

the powers of this landscape cannot be contained within the bounds of electrical power, as its unruliness continues to prove ungovernable. Such ungovernability speaks not only to the ongoing forces that continue to shake the ground in and around Hveragerði, but also to how these landscape instabilities produce instabilities within the state, as a portion of its citizenry become invisible to its care.

Acknowledgements

This research was conducted as part of the Alien Energy research project at the IT University of Copenhagen and was supported by the Danish Council for Independent Research. I want to warmly thank Marianne Elisabeth Lien and Frida Hastrup for inviting me to the Northern Resource Frontiers workshop hosted at the Center of Advanced Studies at the University of Oslo.

James Maguire is an anthropologist and Assistant Professor at the IT University of Copenhagen. E-mail: jmag@itu.dk

Notes

1. Iceland is characterized by two intersecting geological phenomena, the mid-Atlantic Ridge and a mantle plume (also known as a hot spot). The former, a 16,000 km tectonic plate boundary running through the Atlantic Ocean, was raised upwards towards its northern end approximately twenty-five million years ago by the latter, resulting in the landmass we today call Iceland. Geologists imagine this mantle plume to be a large funnel shaped upwelling of magma generated deep inside the earth's mantle.
2. Iceland was part of the Danish Kingdom (formerly Norwegian) from the late 1280s until 1945 when it declared its full independence from Denmark after the Second World War.
3. The classic period of Icelandic literature from the ninth to the twelfth centuries is oftentimes referred to as Saga literature. This genre of writing has captivated scholars around the world for its richly symbolic tales of belonging and identity that recount the arrival of the first settlers to Icelandic shores.
4. Such occasions were the celebration of the millennium of the Alþing in 1930, the foundation of the Republic in 1944, and the commemoration of the fiftieth anniversary of the Republic in 1994.
5. This text refers to the speeches of two former prime ministers and a president

who use the phrases 'heart of Iceland', 'place of the heart', and 'the nation's heart beats at þingvellir'.

6. Aluminium has been dubbed 'packaged or solidified electricity' because smelting requires so much power; up to 17,000 kilowatt-hours per ton (Sheller 2014: 52).
7. I would like to thank one of the reviewers for bringing this point to my attention.
8. This building, located 25 kilometres from the company's geothermal power plant, was designed to depict a large black fragment of basalt rock (the most common rock in the volcanic area).
9. Approximately half of Reykjavík is supplied with hot water through this method. The rest of the city is supplied by larger district heating installations that use heat exchangers due to the high temperature of the extracted water.
10. This is based on reading geothermal conference papers from multiple conferences over the last 20 years.
11. Over the course of this history there have been varying constellations of organizational forms involved in the prospecting, drilling, and supply of hot water to citizens. But the majority of them have been state owned. The city of Reykjavík is quite unique in terms of state-municipal relationships as the city accounts for seventy per cent of the country's entire population.
12. The energy industry refers to electricity as power. This requires producing vast quantities of steam to drive electrical turbines.
13. While this characterization came from one very well-known conservative commentator, it was circulated by many media outlets (both national and international).
14. The rector of Reykjavík University suggested that the historic 'battle with the forces of nature, weather, storms, volcanic eruptions, and isolation had fashioned individuals determined to survive whatever occurred'; this was reflected, she argued 'in the life of Icelanders through difficult times as well as today in the Útrásarvíkingar temperament of Icelandic companies' (Durrenberger and Pálsson 2015: xxii).
15. A long economic history lies behind these high national interest rates. But as mentioned a little earlier, one part of this story is the vicissitudes of the fishing economy that led to frequent currency devaluations to compensate for low catch years. The effects of which was a circular relationship between higher inflation and higher interest rates to counter inflationary effects. A rapidly growing economy did nothing to alleviate these high rates, at times up to eighteen per cent. Borrowing in a foreign currency offered a way out of this loop.
16. Friends tell stories of being repeatedly called by banks pushing various financial products. One friend from the Westfjords told me of a death in the family that left him with a small inheritance. He recounts how he received a call from the bank not two days after he had received the inheritance, asking him to convert the money to an account in Swiss francs.
17. For a more extensive discussion of the financial crisis in Iceland see (Maguire 2017; Durrenberger and Pálsson 2015).
18. This is also the case with what many geologists saw as extravagant purchases of geothermal facilities in North Africa, purchases that almost bankrupted the company. See http://grapevine.is/mag/mag-featured/2011/07/15/reykjavik-energy-in-deep-water/.
19. Again, see http://grapevine.is/mag/mag-featured/2011/07/15/reykjavik-energy-in-deep-water/ (accessed 18 February 2016).

20. In particular time-based financial discounting models.
21. This is known as stepwise development, a process that begins with the drilling of a well, followed by the gathering of geochemical and geophysical data over the course of up to a year, possibly two. This is followed by drilling another well in close proximity to the first to see how they react to one another. Then a third well is drilled, and so on, until geologists have a greater understanding of how each well affects those in its vicinity. Operating at a tempo that allows subterranean relations to stabilize after drilling is considered crucial for sustainable production.
22. While the average magnitude was between four and five (moment magnitude scale), several dozen were over five. Although there have been no fatalities, and while property damage has been limited, residents continue to feel these earthquakes. Given that this area is such an active earthquake zone (geologists predict another large earthquake within the next several years) these smaller tremors serve to keep many in a state of perpetual anxiety as they wonder if each tremor is the 'next big one'.
23. In fact, both did, over time, disappear. The collapse of the cod stocks in the 1980s was shortly followed by the introduction of a quota system, which thoroughly commodified the fish stocks to the benefit of a small handful of people. Despite this form of stringent management, the stocks continued to fall – from 500,000 tons in the early 80s to 160,000 in 2011 (Maguire 2015; Einarsson 2011). The withdrawal of the Americans in 2006 also dealt a severe blow to the economy.

References

Bessason, B. et al. (2012), Verklag vegna örvaðrar skjálftavirkni i jarðhitakerfum' [Procedures for induced seismicity in Geothermal Systems], (Working Papers: Reykjavík Energy no. 117439).

Boyes, R. (2009), *Meltdown Iceland: How the Global Financial Crisis Bankrupted an Entire Country* (London: Bloomsbury).

Durrenberger, E. P. and G. Pálsson (2015), *Gambling Debt: Iceland 's Rise and Fall in the Global Economy* (Colorado: University Press of Colorado).

Easterling, K. (2014), *Extrastatecraft: The Power of Infrastructure Space* (London: Verso Books).

Einarsson, N. (2011), *Culture, Conflict and Crises in the Icelandic Fisheries* (Uppsala: Uppsala Studies in Cultural Anthropology 48).

Foulger, G. R. (1988), 'Hengill Triple Junction, SW Iceland 1. Tectonic Structure and the Spatial and Temporal Distribution of Local Earthquakes', *Journal of Geophysical Research: Solid Earth* (1978–2012) 93, B11: 13493–13506.

Hálfdanarson, G. (2000), 'Thingvellir: An Icelandic "Lieu de Memoire"', *History and Memory* 12, no. 1: 4–29.

Harvey, P., C. Bruun Jensen, and A. Morita (2017), *Infrastructures and Social Complexity: A Companion* (London: Routledge).

Harvey, P. and H. Knox (2015), *Roads: An Anthropology of Infrastructure and Expertise* (Ithaca: Cornell University Press).

Hastrup, K. (2012), 'History and the Question of Causation: North Atlantic Lessons on Environmental and Social Change', *Geografisk Tidsskrift-Danish Journal of Geography* 112, no. 2: 117–125.

Howe, C., et al. (2015), 'Paradoxical Infrastructures Ruins, Retrofit, and Risk', *Science, Technology & Human Values* 41, no. 3: 547–565.
Isleifsson, S. and D. Chartier (2011), *Iceland and Images of the North* (Québec: Presses de l'Université du Québec).
Jónsson, Á. (2009), *Why Iceland?: How One of the World's Smallest Countries Became the Meltdown's Biggest Casualty* (New York: McGraw Hill).
Jónsson, Ö. D. (2010), *Geothermal Living* (Reykjavík: University of Iceland Press).
Jónsson, Ö. D. and Ó. Rastrick (2017), 'Enjoying the Outdoor Pool in a Cold Climate', *Geothermal Energy* 5 no. 2: 1–14.
Kapferer, B. (2005), 'Situations, Crisis, and the Anthropology of the Concrete', *Social Analysis* 49, no. 3: 85–122.
Law, J. (2004), *After Method: Mess in Social Science Research* (London: Routledge).
Magnússon, S. G. (2012), *Wasteland with Words: A Social History of Iceland* (London: Reaktion Books).
Maguire, J. (2015), 'Virtual Fish Stink Too', in E. P. Durrenberger and G. Pálsson (eds), *Gambling Debt: Iceland's Rise and Fall in the Global Economy* (Colorado: University Press of Colorado), 121–136.
Maguire, J. (2017), *Icelandic Geopower: Accelerating and Infrastructuring Energy Landscapes*, PhD diss. (IT University Copenhagen).
Maguire, J. (2019), 'The Temporal Politics of Anthropogenic Earthquakes: Acceleration, Anticipation, and Energy Extraction in Iceland', *Time & Society online* https://journals.sagepub.com/doi/10.1177/0961463X19872319 (accessed 10 April 2020).
Oslund, K. (2011), *Iceland Imagined: Nature, Culture and Storytelling in the North Atlantic* (Seattle: University of Washington Press).
Pálsson, G. (2005), 'Of Althings!', In B. Latour and P. Weibel (eds) *Making Things Public: Atmospheres of Democracy* (Cambridge, MA: MIT Press), 250–257.
Scott, J. C. (1998), *Seeing like a State: How Certain Schemes to Improve the Human Condition have Failed* (New Haven, CN: Yale University Press).
Sheller, M. (2014), *Aluminum Dreams: The Making of Light Modernity* (Cambridge: MIT Press).
Skúlason, J. B. and R. Hayter (1998), 'Industrial Location as a Bargain: Iceland and the Aluminium Multinationals 1962–1994', *Geografiska Annaler: Series B, Human Geography* 80, no. 1: 29–48.
Stepputat, F. and M. Nuijten (2018), 'Anthropology and the Enigma of the State', in H. Wydra and B. Thomassen (eds) *Handbook of Political Anthropology* (Cheltenham: Elgar), 127–144.
Thelen, T., L. Vetters and K. von Benda-Beckmann (2014), 'Introduction to Stategraphy. Toward a Relational Anthropology of the State', *Social Analysis* 58 no. 3: 1–19.
Tsing, A. L. (2005), *Friction. An Ethnography of Global Connection* (Princeton, NJ: Princeton University Press).
Tsing, A. (2015a), 'Salvage Accumulation, or the Structural Effects of Capitalist Generativity', *Cultural Anthropology Online*, March 30, 2015, http://culanth.org/fieldsights/656-salvage-accumulation-or-the-structural-effects-of-capitalist-generativity (accessed 12 Feburary 2016).
Tsing, A. (2015b), *The Mushroom at the End of the World: On the Possibility of Life in Capitalist Ruins* (Princeton, NJ: Princeton University Press).