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A social take on unconventional resources: Materiality, alienation and the making of shale gas in Poland and the United Kingdom

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Abstract

Unlike conventional resources, unconventional gas (such as shale gas) is trapped in low permeability rock, from which it does not flow naturally. Hence, its extraction is costly and requires sophisticated technologies. Building on my ethnographic work in north-west England and south-east Poland, I explore people's engagements with shale gas materialities to show how the category of the 'unconventional resource' – framed by geological and engineering sciences – has more than merely technical implications. Instead, shale gas produces new sociotechnical relations by trying to remove itself from social entanglements. These attempts fail to contain the unruly forces of the subsurface and local impacts, bringing the alienating dynamics of resource-making into sharp relief. The irregularities of materials and infrastructural limits, integral to the socially dis-embedded 'unconventionality' of the developments, inadvertently turn shale gas projects into a site of the political.

Introduction

Irene[1] picks up a pair of binoculars hanging on a wooden pole – a slightly shaking pillar of a makeshift kitchen and stares intensely across the road: 'They have gone around 910 meters down on the first well'. Through a line of heras fencing and a somewhat overgrown hedge, over to the field, up and above a ditch, two lines of shorter field fence, a topsoil bund, a line of solid

[1] All names changed.

perimeter panels, and a noise barrier probably around eight meters high, the top drive of the drilling rig, jokingly dubbed 'Rusty', is moving slowly downwards, seemingly unimpeded and according to its own rhythm. 'Do you want to look?' Irene asks, handing me another pair of binoculars. The makeshift kitchen, where we are crammed, is really a modest collection of a few chairs, among boxes of mugs and food, arranged around a wood burner and covered provisionally with a marquee that is miraculously withstanding the wind on this late morning in early October 2017.

However, this temporary structure constitutes also the main observation point of the 'gate camp' on Preston New Road (PNR) in Lancashire, north-west England. The reason why it is tucked so precariously on a narrow piece of pavement is the shale gas development on the other side of this busy road. Cuadrilla – who are the site operators – are planning to drill and hydraulically fracture up to four exploratory wells and their development is often perceived as a national test case of fracking. They started constructing the fracking pad in January and their drilling operations began in summer 2017. Their activities commenced after a long planning process (Bradshaw and Waite, 2017; Short and Szolucha, 2019) which lasted almost three years and involved a rejection of the company's applications by the local mineral planning authority, an appeal and a decision of the Secretary of State for Communities and Local Government to approve planning permission for shale gas development at PNR.

'The rig wasn't working for at least a day and a half. Tea? Oh, wait, another one'. Somebody sprints after a truck that is going into the drilling site with piles of steel casings (pipes). Some of these lorries are escorted by a few dozen police officers from Lancashire as well as adjacent and non-adjacent counties such as Warwickshire and Devon and Cornwall. A few people with

placards are either persuaded or pushed aside to allow the vehicles to go in. I look at Rob, a Police Liaison Officer who has been here since the first day, as he explains that the police have to facilitate the company to 'go about their lawful business'. The security guards quickly lock the gates behind the lorry and assume their unequivocal positions facing the road and the protesters. The runner comes back reciting the truck's plate numbers which are duly jotted down in a notebook together with the number of pipes that went in and the time of the delivery. The plate numbers began to be noted after some supplying companies started covering their names on the vehicles that were coming in to avoid 'pop-up' protests and disruption at their premises. 'We take a note of everything. We know the number of pipes that go into the site. Then we see how many of them are put down a well and, knowing the average length of one pipe, we also know how far below the surface they have managed to drill'.

Shale gas, that Cuadrilla is prospecting for at PNR, is one type of unconventional resources and its development depends on a simultaneous application of several costly and sophisticated technologies. Although geologists have known about the deposits of shale gas for decades (Selley, 1987), the materiality of this type of unconventional hydrocarbons has become accessible at scale only in the 2000s. The development of this resource has been controversial and socially contested in every country in which it took place, largely due to its potential environmental, health, and social impacts (Finkel and Hays, 2015; Hays et al., 2017; Jacquet, 2014; Shonkoff et al., 2014; Szolucha, 2016). Lancashire in north-west England as well as the village of Żurawlów in south-east Poland, where I conducted my research[2], have made a name for themselves as locations of some of the most sustained protests against fracking.

[2] This article is based on ethnographic research in the UK and Poland between 2015 and 2019. I used participant observation in Lancashire and the Grabowiec area over multiple research visits that lasted between two weeks and seven months. I attended local events, court hearings, planning inquiries, information days and protest sites. I have also conducted around 100 semi-structured interviews with local residents, businesses,

The multiple fences, the work of security and the police as well as the strategies of the suppliers are examples of measures that aim to conceal, separate and disentangle the operation of the fracking pad from the mesh of social relationships on the ground for the aim of the unimpeded movement of the drill and ultimately, the release of gas from the nanoscale pores in a rock several kilometres underground. Throughout the world, the extractive industry disentangles its operations from the web of social relations by enclaving its operations (Bowker, 1987), by moving its activities offshore, by employing subcontractors (Appel, 2012), and by limiting access to their data, which makes accountability and regulatory oversight notoriously difficult (Wylie, 2018). In the UK and Poland, the strategy of disentanglement has been also employed at the level of politics: shale gas has been granted a special status in decision-making and framed as an issue of national security and a solution to the population's energy needs. Discursively, the unconventional nature of the resource and the uncertainty implicated in it (Lis and Stasik, 2017) has been useful as a material determinant of the special status of shale gas in law, the planning process, and political debate. It served to dis-embed exploration from the social and the political. However, in this article, I explore how, in the face of these attempts, the same unconventional materialities of shale gas have had an opposite effect, reviving the political and ultimately, prompting a redefinition of unconventional gas developments in the UK as conventional projects. The technologies and processes that aimed to set shale gas apart from social and environmental relations, selectively over- or underplayed its 'unconventionality' i.e. its newness and indeterminacy. This resulted in the overflowing of the special status granted to shale gas.

farmers, politicians, officials, industry representatives, geologists and activists. Interviewees were selected using purposive and snowball sampling to cover all major groups of stakeholders interested in shale gas. The results were supplemented with documentary and policy research as well as information from several freedom of information requests submitted to various local and national institutions.

The strategies to remove shale gas development from the web of social relations have alienated local communities from the conditions of their physical and civic existence. They have felt that they lost control over their material environments and rights as democratic subjects. However, as the work of Irene and others who monitored the drilling shows, these conditions are being precariously re-appropriated, simultaneously entangling fracking in new sociotechnical relations. Additionally, the industry is being re-embedded in social relations because the special legal and political status of the resource requires material evidence of technically recoverable reserves which, for the most part, remain unproven and unmeasured. Many different actors are engaged in creating the unconventionality of shale gas. Their actions are not necessarily coordinated or planned, and they produce unexpected or unintended results. From a social perspective, the unconventionality of shale gas is better understood as an effect rather than a coordinated project, a 'thing' in itself or a free-standing characteristic, unaffected by material, social and political forces. Unconventionality is also an effect because, despite its social construction, it appears as if it was external to the very processes that constituted it. The ethnographic and analytical questions that I want to tackle in this article are, therefore: what work is required to produce an effect of unconventionality? What are the dynamics and materialities that entangle unconventional gas back with the social, political, and environmental relations? And with what outcomes?

In asking these questions, I probe the current thinking (from across several social science disciplines) about the role of materiality (see for example: Balmaceda et al., 2019) and social construction of resources/energy (see for example: Smith and High, 2017; Sovacool, 2014b) in social life. But the specific aim here is to confront the alienating dynamics of early resource development with the potentials of a social understanding of resources. Hence, the interdisciplinary approaches to 'resource-making' practices (Kama, forthcoming) and 'resource

materialities' (Richardson and Weszkalnys, 2014: 7-8) seem like an excellent point of departure. Recent literature (Bakker and Bridge, 2006; Ferry and Limbert, 2008; Kama, 2016, forthcoming; Richardson and Weszkalnys, 2014) has described natural resources as relational effects and their materialities as relational assemblages that take shape in the context of contending resource ontologies. Resources – such as shale gas – have been framed not as given, static materials but transient, distributed and nonlinear categories conducive to changes, especially in contexts characterized by political, scientific, and economic fluidity and uncertainty. Many authors hope that this rendering of resources could help democratize resource governance. However, it may also act in the opposite direction. Attempts to disentangle resource development from its social context and relationships can produce alienating effects. I argue that the industry's recent unilateral attempts to redefine unconventional gas projects in the UK as conventional – seemingly altering resource materialities without a fundamental modification in resource ontologies, infrastructures or the shape of social relationships governing them – demonstrate a potentially problematic alignment of corporate logics with a relational and open-ended view of resource-making. The redefinition of resources can, therefore, decouple developments not only from their social but also material realities – a dynamic the effects of which are yet unknown.

As I explore in the conclusion, this process suggests that the resource-making and remaking practices – rather than being only a result of ontological disagreement, politico-economic debate, and social controversy – may be primarily a function of asymmetric relations that alienate communities from the conditions of their existence and perpetuate the corporate forms of extraction (including through processes which try to subvert them). This is not to negate the important impact that local stakeholders have had shaping the science and politics of fracking, but social science research has pointed out (as have the stakeholders) that the formal techno-

political forms of partial inclusion through public engagement and consultation have severe limitations (Lis and Stasik, 2017; Stankiewicz et al., 2015), though work is in progress to render them more meaningful as a force for the democratisation of resource decision-making.

Simultaneously, social science research (Aczel et al., 2018; Beebeejaun, 2017; Evensen and Stedman, 2017; Partridge et al., 2017; Szolucha, 2018b, 2016) shows that it may not be simply disagreement about the nature of unconventional resources or the impacts of their extraction that underpins shale gas controversies. Instead, people tend to respond to the experienced and perceived alienation, manifested in their democracy and justice-based concerns. It is, therefore, pertinent to broaden our future enquiries to explore the potential for the democratisation of resource governance beyond the (re)constructions of ontological debates (in fact, corporate interests tend to thrive within social controversies). We need to critically examine the conflicting potentials of resource-making: the democratic re-appropriation as well as further corporatisation of resource governance.

Defining unconventional hydrocarbons

The nonsocial definitions of unconventional resources are based on materially distinct characteristics of unconventional hydrocarbon reservoirs and their associated extractive technologies. Though no formal classifications exist, there are at least three different but complementary ways of defining what exactly constitutes ‘unconventional gas’. From a geological perspective, it is geology that makes a resource unconventional. The shales and other similar sedimentary rocks are rich in organic content, fine-grained and characterized by low permeability, i.e. they hold natural gas, which is pervasive throughout a large area, but are very tight. They are both the source and the reservoir for gas, unlike in conventional sources in which

oil and gas, under pressure exerted by water migrate upwards until they encounter an impermeable layer which traps them in often discrete accumulations (Johnson and Doré, 2010; Ratner and Tiemann, 2015).

Another definition of unconventional resources hinges on the technological difficulties of getting the gas or oil to flow. Unlike conventional resources, shale gas does not flow on its own to the wellbore and needs to be 'stimulated' (Exxon Mobil Corporation, 2014; Gordon, 2012; International Energy Agency, 2013). What defines unconventionality of shale gas in this understanding is the fact that to 'free up' an unconventional resource, advanced technologies are required. They involve for example: horizontal drilling, hydraulic fracturing, and a range of seismic and measuring techniques. Industry has emphasized that this definition of unconventional resources is not fixed, and resources may become 'conventional' when new methods and technologies become available.

The third explanation of unconventional resources builds on the previous definition and points to global gas prices as a factor that determines whether unconventional technologies, which are usually many times more expensive than conventional ones, can produce gas economically (International Energy Agency, 2013; U.S. Department of Energy, 2015). According to this understanding, inflated oil and gas prices around 2008 were the driving factors for the shale gas revolution (Johnson and Doré, 2010). Unconventionality, therefore, is unlocked when market conditions are favourable. If exploration becomes prohibitively expensive, projected resources are scaled down and economy rather than simply geology determines the size of the resources.

Although unconventionality is clearly grounded in the geological and physical qualities of rocks (or their inaccessible surroundings), the category is flexible; the boundary of what is considered an unconventional resource tends to move quite quickly. For example, the ultra-deep oil extraction in the Gulf of Mexico was once considered unconventional but is now grouped into the conventional category (Gordon, 2012). Moreover, given that in 2010, unconventional gas provided 58% of the United States' natural gas supply, defining it as unconventional may seem rather misleading (International Energy Agency, 2013).

Shale gas was rarely mentioned in geological research in the UK and Poland before the 2000s. Early attempts at piquing the interest of the UK policy-makers in the deposits of this resource failed miserably in the 1980s and no British academic journal was interested in publishing a paper about it (Selley, 2012). Even as late as 2004 at a conference of the Geological Society of London (the oldest geological society in the world and largest in Europe), shale gas was far from a popular topic. One participant recalls how 'The organisers … asked [X] to give a talk on UK shale gas. The unconventional session was timetabled for the last one on the afternoon of the last day. [X] was scheduled as the last speaker. When [X] stood up to give [their] talk the vast auditorium contained the chairman, [X] and the projectionist'.

Hydraulic fracturing came to the attention of some Polish geologists in the late 1940s and the first tests took place in the 1950s. During the massive drilling programme beginning in the 1960s, shale gas layers were encountered and mapped but they did not constitute the target resource that the researchers were prospecting for. According to my interviewees, the first company to assess the possibilities for shale gas developments came to the country in 2005 and

it was a US-based exploration company that had already been doing work in the shale basins in Texas.

Due to the relative lack of country-specific knowledge, in the 2000s, geologists, politicians and activists in the UK and Poland borrowed heavily from the understanding of shale gas materialities developed in the United States (Beebeejaun, 2017; Lis and Stasik, 2017; Narożna, 2012). The US exhibited the most persistent and focused activity concerning unconventional resources. In the 1970s, following the oil embargo, the government focused on and expanded its energy-related R&D programmes (National Research Council, 2001; Wang and Krupnick, 2013), which later played a crucial role in developing new technologies, some of which spearheaded the shale gas boom.

However at the beginning of the 21st century, the resource-making dynamics of unconventional resources in the US ebbed and flowed. In the years directly preceding the US shale gas boom, the industry did not consider any ground-breaking new technologies that could fundamentally alter supply potential to be likely (National Petroleum Council, 2003). Even more puzzling, in 2007 (2008 is largely perceived as the breakthrough year for the US shale gas boom), it recognized the potential for unconventional oil and natural gas as vast but concluded that '[s]uccessful production at scale may still be several decades away' (National Petroleum Council, 2007: 20) and it would not be sufficient to reverse the decline in US production. In 2011, the narrative was reversed again, and the industry's view was that '[i]t is now understood that the natural gas resource base is enormous… These resources have the potential to meet even the highest projections of demand' (National Petroleum Council, 2011: 8).

In the industry and US government's narratives, the major milestones in the 'making' of shale gas have been mostly technological. The traditional stimulation techniques were largely found to be inefficient in shale gas development. Hydraulic fracturing, which is now widely adopted, is a stimulation method whereby a mixture of fluid, sand, and chemicals is injected into the formation under high pressure which cracks the rock and allows gas to flow. The industry emphasizes that it is a very old technology: the idea that wells can be stimulated was already being applied in the 19th century when operators used nitroglycerine to generate underground explosions. Hydraulic fracturing is often dated back to 1947 when Floyd Farris of Standolind Oil and Gas Corporation used gasoline mixed with napalm and a gel injection to fracture a limestone formation in Kansas (Golden and Wiseman, 2015). Slick water – low viscosity fracturing fluid – is a more recent invention, often accredited to George Mitchell and his activity in Texas' Barnett Shale in the 1990s. Horizontal drilling – another technology that proved key to shale gas development in the 21st century – has also been known and applied since the late 1920s. The combined techniques of high-pressure, high-volume hydraulic fracturing, horizontal drilling, slick water, and 3D seismic imaging methods became commonplace only in the late 1990s; they took decades to emerge and were often developed for purposes other than shale gas extraction (Burwen and Flegal, 2013).

Notwithstanding this technological advancement, shale gas materialities remain 'unconventional' because they are characterized by low flow and quick depletion rates, which ultimately lead to low recovery of the resource from the source rock (from less than 8% to 30% of gas in place, compared to 60-80% in conventional reservoirs) (International Energy Agency, 2013; Johnson and Doré, 2010). While a conventional well could be productive for 40 years and more, shale gas wells often peak after around 3 years (Sovacool, 2014a). At this stage and especially in Europe where shale gas developments are not pursued at scale, it remains

extremely difficult to predict well performance because long-term estimates are based on a few months of observation and experience (International Energy Agency, 2013a; Narożna, 2012; Sovacool, 2014a). This also means that contrary to many narratives, there are no factual grounds for a realistic assessment of the economic potential of shale gas. Unconventional resources are also not always abundant, and even in the US, '70% of [the country's] shale gas comes from fields that are either flat or in decline.' (Hughes, 2013: 308). The process is far from cheap when geological conditions are less than favourable (Golden and Wiseman, 2015) and all externalities are taken into consideration (Sovacool, 2014a).

Given the material and techno-economic uncertainties described above, it does not seem to be a foregone conclusion that in far less than a decade shale gas in the UK and Poland would begin claiming various places as resource environments and emerge as a realistic solution to these two countries' energy demands. Instead, to reach shale gas resources and to render them both visible and accessible, actors and materialities involved in unconventional resource-making had to make the lithosphere lighter. As I explore in the next section, the precarious and uncertain unconventional materiality of shale gas was reworked as 'real' and viable even before any drilling began and exploration could confirm the highly varying projections (Szolucha, 2018a).

Unconventional resource-making

Everyone was expecting an uplifting speech when the Polish Chief Geologist, a high-rank official at the Ministry of Environment entered the room during the shale gas conference organized in early 2010 by the Polish Geological Institute. As he was explaining the potential of shale gas in the country to excited journalists gathered for his press conference, Mr Jezierski held up a core sample of shale rock. To many of the more sharp-sighted listeners, it might be

difficult to imagine that this dark, solid piece of rock could contain gas in any substantial quantities. His presence, however, was not coincidental and signified the commitment of the Polish authorities to – as the slogan of the Chief Geologist put it - make the lithosphere lighter. The presentations at the conference focused on technological and geological issues; questions of need, sustainability as well as social and political impact were absent. Shale gas potential was entirely a question of how a solid rock (alone rather than within a raft of social relations) could produce gas. As well as depoliticising it, these separation techniques helped the tight shale rock to seem slightly more porous and cracked, making it also more likely to produce gas – all based on the promissory nature of the Chief Geologist's gesture and state power represented in it.

In keeping with the long traditions of extractive industries, shale gas has become depoliticized through several processes that removed it from the social, political, and environmental relations inherent in the development. Lacking hard material evidence and measurements, the techniques of separating shale gas from the political also helped its unconventional materiality to emerge; they reworked and objectified its special status in decision-making together with the rock's unconventional materiality through the anticipatory politics of resource-making.

The politics of unconventional gas-making

Extractive industries have always projected growth in global energy demand. ExxonMobil, for example, predicts that energy demand will rise 35% from 2010 to 2040 (Exxon Mobil Corporation, 2014). Although resources are deemed to be abundant, the industry points to accumulating risks from production that concern turning conventional resources into supplies. However, these increasing challenges are to be overcome by unconventional resources which

offer significant new production capacity (National Petroleum Council, 2008). Thus, a global need for unconventional development is created and objectified. It is also reinforced in national legislation through central government action in the face of local opposition. For instance, a few weeks after Lancashire County Council refused to grant Cuadrilla a planning permission to explore for shale gas at PNR, the Secretary of State for Energy and Climate Change issued a Written Ministerial Statement which set out the government's position on shale gas and obliged relevant authorities to take it into consideration in all planning decisions. Shale gas was reaffirmed as a way to guarantee energy security, foster economic growth and lower the UK's carbon emissions (Rudd, 2015). This statement reinforced the special status of shale gas in the British planning system which has long been plagued by the conflicting aims of ensuring sustainability and promoting development (Cowell and Owens, 2006). Additionally, local authorities were disciplined to process shale gas applications in a timely manner lest the Secretary of State steps in to determine the decision. Currently, the government is considering whether to make shale gas exploration a 'permitted development', i.e. to lift the requirement for a planning permission for the first stages of shale gas developments.

In Poland, the history of the loathed political as well as resource dependence on Russia meant that the need to develop shale gas resources has always been assumed rather than demonstrated. The early engagement of the US State Department in creating the conditions of possibility for shale gas exploration in Eastern Europe through various 'exchange opportunities' played a complementary role in the making of the resource's unconventional status. One of the most controversial issues concerning the special position of shale gas in Polish law was the hydrocarbon bill that was proposed in 2015. It had a status of a special act (*specustawa*), the aim of which was to set extraordinary rules and establish an expedient legal regime for hydrocarbon development. Its stated purpose was to limit administrative and formal barriers

hindering timely and profitable development of hydrocarbons. In the proposed bill, the legislators claimed that the development of hydrocarbons, including shale gas, was in public interest because it would enhance Poland's energy security and guarantee financial gain for the country; however, the proposed text did not present any evidence to support these potential effects. Ecological organizations (personal communication) criticized the bill for suspending ordinary legal rights and principles for temporary economic and political gain of a limited group of stakeholders engaged in a project that was based on highly uncertain geological and economic conditions.

The bill confirmed that recalcitrant landowners could be expropriated if gas was discovered under their land and weakened the role of local self-government in planning. The planning permission would only require non-binding opinions of local governments (instead of regular permits and agreements). The bill would also introduce a disciplining mechanism whereby a local administrative body had 30 days for signing an agreement with an exploration company outlining the conditions of water management in the development area. If it failed to do so in the given timeframe, a local representative of the government (*wojewoda*) would step in to determine the terms of the agreement.

The special status granted to shale gas in decision-making in the UK and Poland which was supposed to set it apart from the regular functioning and rules normally applicable to development, quite easily overflowed and fed political imagination with visions of resource independence and energy security. The Polish Prime Minister stated, for example, that: 'Today we are talking about the opening of a new energy era in which shale gas will play a significant part' ("Tusk," 2014). In 2011, he also affirmed that: 'Today, after many years, we can say that

my generation will become independent as far as gas is concerned and we will be able to set the terms [for energy trade]' ("Tusk," 2011). The framing overflows when governments equate energy independence with energy security despite the reluctance of the industry's majors to limit their scope of operation to domestic markets. The industry has warned that the concept of energy independence 'is unrealistic in the foreseeable future' and '[p]olicies espousing "energy independence" may create considerable uncertainty among international trading partners and hinder investment in international energy supply development.' (National Petroleum Council, 2007: 11).

As I will examine below, in addition to the politics of gas-making, the depoliticising effect of shale gas materialities is implicated in the workings of historical tropes of industrial heroism, bureaucratic and scientific culture, and anticipatory hopes of technological ingenuity which abound in the dynamics of resource-making.

Unconventional gas by other means

All Polish authorities have historically fostered the heroic ethos of coal mining. Geologists have portrayed their field as one which requires special rights because it is dependent upon fortune, patience, and money. Hence, it should come as no surprise that even before shale gas came into the picture, facilitating hydrocarbon development was incorporated into the aims of central regulators. The Ministry of Environment was tasked with granting and amending exploration licences (Zalewska & Szuflicki, 2007). Licences were granted on a first-come, first-served basis, without a public auction and for a period of a few years. Neither the terms of the licences nor their spatial extent was consulted with the Polish geological survey or the expert-based advisory commission at the Ministry of Environment. The terms of the licences remained in a loose logical relation to the extent of the licence, type of resource, time necessary for effective

exploration or the long-term national development strategies. Some licences were copy-pasted and depended on the discretion of the Chief Geologist. If a licence was successfully challenged and found invalid or deficient, it could not be recalled when exploration had already started (Narożna, 2012). This lack of transparency has led to a few arrests being made at the Ministry of Environment under the charges of corruption ("Korupcja Przy Udzielaniu Koncesji Na Gaz Łupkowy. Wielka Akcja ABW w Ministerstwie!", 2012).

In Poland, where shale gas has been hailed as an ultimate opportunity to become no less than independent from Russian gas supply and its geopolitical grip, the arrival of foreign extraction companies was greeted with great enthusiasm. State officials were proudly reciting the names of foreign corporations, highlighting the American, British, Australian, and Canadian origins of their capital. Geology experts promoted the Polish shale gas potential as the most attractive market for exploration with 'potentially gigantic' reserves (Poprawa and Zalewska, 2010; Zalewska, 2010). In the UK as well as Poland, the shale gas boom in the US was often referenced as an analogue of the benefits that exploring for unconventional resources could bring to Europe. The geological and economic specificities were glanced over as well as the fact that the largest financial rewards in the United States were received not from shale gas production per se but from selling smaller companies with their leases of large tracts of land, associated property rights, and technological know-how to larger bidders (Wang and Krupnick, 2013).

Nevertheless, a leasing frenzy involving some of the major international energy corporations such as Chevron ensued and soon the US Energy Information Administration estimated that Poland may have 5.3 trillion cubic meters of shale gas resources – the largest in Europe

(Advanced Resources International, Inc., 2011). Although these estimates were scaled down considerably in all subsequent reports, the sheer potential of those vast resources influenced decision-making. Initial plans to develop shale gas according to the Norwegian model of oil extraction – under significant central control and with a pension fund – were soon substituted with calls for more regulatory relief. Conspiracy stories about alleged Russian influence on local protests proliferated and reached the level of the NATO Secretary General.

Geology experts from esteemed universities and research centres advised against touting the shale gas potential and discouraging exploration companies with robust regulation. During a conference in *Senat* – the upper house of the Polish parliament – one geologist warned: 'let's not publicize this issue! It's not the European Union that is going to impede our shale gas project, but we will do it ourselves. It is against Polish national interest to talk about taxation of resources, to threaten with them… Law can be created in secret and so on, but I warn you not to talk about it out loud because it will end badly' (Narożna, 2012). He prepared a slide which depicted Gazprom (as a huge Russian bear) playing chess with the European Union. The cartoon summarized the way in which many Polish geologists thought about the main threats to the shale gas project: both Russia and the EU were not interested in developing this resource in Poland. This slide evoked also the historical image of the global empires conspiring and reaching deals over the heads of the Polish authorities. The spectre of EU regulations and a possible European ban on fracking[3] has been haunting many shale gas experts. They mobilized personal connections to learn about the prevailing 'mood' in the EU institutions and issued a Europe-wide statement on behalf of EuroGeoSurveys (European network of national geological

[3] A European ban on fracking was not possible under the EU law. Nevertheless, its threat was treated as real in many national debates.

surveys) together with an information booklet, distributed among EU officials, that affirmed that shale gas could be developed in a safe and environmentally friendly manner.

At multiple conferences about shale gas in Poland and the UK, experts mingled with politicians and regulators. The presentations offered a highly specialized view of geological and technological detail which created an effect of a well-developed and depoliticized subject area, spaced with declarations about the economic or geopolitical significance of shale gas. During meetings with local residents and other non-specialist stakeholders, geology experts were quick to point out that others may hold an inadequate view of fracking which, narrowly conceived, is a stage in shale gas development when water with sand and chemicals is pumped underground to release gas. However, in the popular vernacular, fracking is a shorthand and covers all stages of shale gas development, including the construction of a fracking pad, drilling, fracking, and production.

One of the industry's often repeated claims is that the fracking fluid is safe and contains well-known ingredients such as citric acid and washing up liquid. Experts still resent questions about it and often assert that unlike in the United States where disclosure exemptions apply, in Europe companies do declare the composition of their fracking fluids. In Poland, some fracking companies used ngsfacts.org to voluntarily self-report chemicals they used in hydraulic fracturing. However, the website does not contain any guidance as to the rules governing disclosure. It is therefore difficult to assess how accurate these records are. If the US experience is anything to go by, corporations that do disclose the composition of their fracking fluids, may also list some of the ingredients as proprietary and commercially valuable trade secrets. They pursue a mixed strategy of partial secrecy and disclosure: the withholding rate is increasing and

amounts to almost 20%, and compliance is low (Konschnik and Dayalu, 2016). Other impacts such as spills from fracking operations are reported by the industry, but the regulations and oversight are way too half-hearted to be able to count disclosure as an effective mitigation mechanism (Patterson et al., 2017).

The 'unconventionality effect' of shale gas has, therefore, been co-determined by social, political as well as technological and geological processes and framings that drew on traditional tropes, bureaucratic and scientific cultures, and anticipatory hopes. The separation from the political was a means that objectified shale gas and thus helped legislators to understand the complicated geology of the shale gas resource which required special legal and political backing as its condition of possibility. However, the special support for and facilitation of shale gas developments implicated local communities in an asymmetric relationship that alienated them from the physical and civic conditions of their existence.

Exploration by alienation and its effects

In the reality of strictly geological environments, the 57 earth tremors induced by fracking at PNR between October and December 2018 could hardly be felt on the surface. Any physical damage was unlikely and hence the current regulations – as the reasoning goes – could be safely relaxed to facilitate a more timely and efficient exploration process. The unconventionality of shale gas was responsible for the earthquakes and hence, the resource materialities proved that they could not be kept under strict control because of the unpredictable play of pressures, stresses, and fault lines deep underground. The unruly materialities could delay development because fracking had to be temporarily stopped if the monitoring equipment detected tremors bigger than 0.5ML. The industry and some scientists soon joined forces to lobby the

government to raise the seismic thresholds, while reassuring communities that the current regulations were unnecessarily conservative. However, the measure of ground movements cannot fully explain the affective charge that the earthquakes generated in Lancashire.

From a social perspective, the tremors could be felt on the surface, even if the seismometer indicated otherwise. At a local post office, at a shop, in a cab, on the front page of all local newspapers, at the roadside of Preston New Road and in people's homes near Cuadrilla's shale gas well, earthquakes were literally on everyone's radar. Local residents refreshed the website of the British Geological Survey (BGS) that records all recent earthquakes in the country almost every hour. Some were so vigilant as to identify minor corrections that BGS made from one update to another, when information about a previously unrecorded tremor was published. These dynamics indicate an exploration process that proceeds through alienating communities from the conditions of their physical existence, which amplifies a sense of injustice and a loss of control. For many residents, the underground processes with wellbores extending over hundreds of meters, out of sight and into an unstable and uncertain geology that only few had access to, became an implicit analogy to the non-transparent ways in which hydraulic fracturing was to be regulated. It was estranged from the local communities at both the physical and civic levels.

Exclusion and disconnection are strategies of social (dis)engagement that have accompanied resource extraction for many decades. Extractive industries have closed their operations off from the surrounding populations by building enclaves, militarising their activities and infrastructures, causing local dispossession and moving offshore. They have resorted to this strategy when environments were deemed as hostile and when capital benefited from distancing

itself from the social and economic responsibility for what was happening onshore (Appel, 2012; Bowker, 1987; Marriott and Minio-Paluello, 2013; Mitchell, 2011). Michael Watts talks about these spaces and temporalities as resource frontiers characterized by 'complex processes of dispossession, compromise, violence, and engagement' (2012: 446) where ordinary rules are suspended, and rights are in question, creating the conditions of possibility for the local operation of extractive industries. In the UK and Poland, shale gas developments have often moved the physical and political location of the frontier into areas that have traditionally been excluded from invasive industrial or central interference. This has contributed to the effect of unconventionality of those developments, even though they still employed the same alienating dynamics.

However, in the next subsections, I show how the attempts to remove shale gas from the mesh of social, political, and environmental relations failed to contain the unruly forces of local impacts, protests, sociotechnical pressures and the unmanageable obstinacy of the subsurface. Thus, the irregularities of materials, the mundane limits of infrastructural forms and temporal tactics to outmanoeuvre one's opponents, which were integral to the very 'unconventionality' of the developments, inadvertently turned shale gas projects into a site of the political and contributed to the formation of new social relations.

Local impacts

In the early stages of the development in both locations, most local impacts did not arise directly from the physical aspects of development but from interactions with state agencies and the industry. In Żurawlów, Chevron limited its local presence to a security hut, a power generator, and a lamp to 'hold' the field they were leasing before it withdrew from the village in 2014. In

Lancashire, most local residents did not even realize where Cuadrilla wanted to drill for shale gas before a group of Lancashire Nanas set up a protest camp in the area in 2014.

In Lancashire, the prospect of fracking in the area caused splits within the community, some of which led to police intervention and contributed to the atmosphere of increased surveillance and distrust. Residents have started experiencing various health impacts from stress and anxiety that was building up as a result of their engagement in the planning process and direct action against the construction of the fracking pad. Many have experienced arrest and were being handled by the police for the first time in their lives. The relationship with the police has been strained. Anti-fracking residents have quickly become disillusioned with their political representatives (see also Rasch and Köhne, 2018). These experiences contributed to a form of 'collective trauma' (Short and Szolucha, 2019) which has had a lasting effect on people's political views, health, and community cohesion.

In Żurawlów, residents claimed that their water wells and buildings were damaged after the first seismic surveys. The huge machines went unknowingly onto the fields of local farmers, leaving turned soil and deep furrows behind them. Opposition to the development grew and culminated in a 400-day blockade of the field that Chevron was leasing. Local residents, the vast majority of whom sustain themselves through agriculture, did not feel represented in the central government's plans to usher into the shale gas extravaganza.

Through the force of social impacts, shale gas was implanted as an immanent element of the communities' natural, bodily, and social environments. Estranged from the means to control the developments, this was an unwanted interference of a foreign material and force on the

everyday lives of local communities. Shale gas captured and perfused residents' bodies and manifested in sleeping disturbances or elevated blood pressure; it was the tacit determinant of neighbour-to-neighbour relationships and an alien presence that changed the nature of farmers' land. Shale gas permeated lives without claiming responsibility for it. The unconventional relation that this resource established with local communities – a strange material but intimate in its impacts – created the grounds for the re-appropriation of local control through opposition and protest.

Protest

When Cuadrilla started to build the fracking pad, one of the main resistance strategies adopted by those who opposed the development, was a 'lock-on' where protesters lie in front of the main gates locked on to other protesters by the arms in order to prevent deliveries and slow down the build. They have been motivated by the potentially significant environmental and health impacts of fracking and aimed to physically disrupt the construction of the fracking infrastructure that could bring about the feared consequences. The mere possibility of fracking infrastructures materialising at PNR and Żurawlów prompted responses to and new interpretations of politics and the ideology behind fracking (see also Harvey and Knox, 2012). In the face of the government's overruling of the local decision to refuse fracking permission and subsequent strategies to take similar decisions out of the local representatives' hands, the political contestation over the sustainability and desirability of shale gas was transposed onto the narrow pieces of land: a common dirt road in Żurawlów and a tarmac bell mouth on PNR. The physical occupation of this space through lock-ons and other tactics was the way in which the political was experienced.

People engaged in various forms of resistance which forced the companies to adapt their daily time regimes and seek strategies to circumvent protest. In Lancashire, for example, deliveries to the future fracking site were arranged in convoys to minimize the number of times that supplies could be prevented from reaching the site. The deliveries were coordinated with the police who appeared in force throughout the entire period of construction and drilling. The drilling rig itself was brought around 4 a.m. on 27 July 2017, in breach of planning conditions but with cooperation of the police. The scale of protests has led some suppliers to withdraw from contracts with Cuadrilla and to make a promise to never service the fracking industry again. In the face of these problems, Cuadrilla ordered delivery of a crane not to the fracking pad itself but a nearby football club. After arriving at the club, the supplier was told about the real destination and escorted to the PNR site.

The physical blockades mounted by the residents were social forms through which the political became translated into the content of resource environments. At the height of protest activities at PNR in summer 2017, two pallet towers and multiple tents were erected in the direct vicinity of the bell mouth. Protesters used them to hold permanent presence at the site and as observation points to document potential breaches and impacts of construction that could not be easily noticed from the level of the road. The towers were taken down in early July 2017. Additionally, Lancashire County Council issued a ban that prohibited people from going onto a narrow grass verge between the road and the hedges bordering the site. The Council employed security guards at the cost of over £59,000 per month to guard the half-a-meter wide piece of land from encroachers. These extraordinary measures re-entangled hydraulic fracturing with the social, political, and environmental relations. The actions that the police and the Council took in response to the protests, repositioned them in relation to local communities and engaged them as agentive subjects in shale gas developments.

Sociotechnical pressures and obstinacy of the subsurface

The forms of affect intrinsic to resistance and protest have become an object of political, scientific, and PR action on the part of different actors (see also Weszkalnys, 2016). The UK government, for example, announced plans to pay up to £10,000 to households near fracking pads. Cuadrilla has also set up a Community Liaison Group composed of community representatives, industry, and regulators. It meets regularly to share information and answer questions from the residents. In Żurawlów, Chevron engaged with residents by distributing gifts to children and organising information days at a local venue.

In both the UK and Poland, national research councils launched funding calls for projects about shale gas. Industry has partnered in or sponsored some of those projects. Researchers faced new pressures to detect, measure, describe and predict the workings of shale gas materialities. Some of these attempts were marked by academic competition and fierce disagreements.

The constant sociotechnical pressure to demonstrate the potential of shale gas and the expectations and imaginaries that it gave rise to have been met with mixed results: in Żurawlów, Chevron withdrew without ever constructing a fracking pad in the village; in Lancashire, it took Cuadrilla over two years to secure planning consent for PNR. Although many narratives about shale gas in both countries still revolve around geopolitics and economy, a closer look at the developments shows that it was really a very immediate set of conditions and objects that has shaped the chances of fracking. For example, the slow pace of exploration in Poland is better explained by the incredibly small infrastructure and logistical base of shale gas service companies than Moscow's interference. The small number of drilled wells meant that all

subsequent predictions were ultimately based on productivity results from a handful of wellbores and hence, were unreliable. The local specificity of geological conditions necessitated a trial-and-error approach, which, however, is hardly reflected in the official data that publicized the number of shale gas wells drilled (72) and hydraulically fractured (25). These numbers obscure the fact that only a few of these wells were drilled properly i.e. nothing got stuck in the wellbore and the drill reached the gas-bearing formations. PNR is Cuadrilla's latest attempt to explore for shale gas in Lancashire. Like its counterparts in Poland, it also ran into technical problems and abandoned a few earlier locations.

Although these physical and social limits can be temporarily overcome – for example by raising seismic monitoring thresholds – the obstinacy of the subsurface did ultimately lay bare the political rather than merely the material of shale gas-making. When the then Polish Prime Minister – Donald Tusk – stood in front of a working flare in Lubocino, few people knew that the column of fire was a political materiality – an image engineered to fit a particular political rather than solely material reality. According to my informants, gas flared during Tusk's visit was not flowing from shale gas formations underground. The image of a working flare, however, was useful to perpetuate the anticipatory politics of resource-making and served to estrange the public from the material reality of the subsurface. The public does not know exactly whether shale gas in Lancashire can be extracted at scale. However, Cuadrilla have used similar images of a working flare as well as a core sample of shale rock which submerged in water, had bubbles of gas coming out of it. As the example from Poland shows, these images may reveal as well as conceal the geological reality of the subsurface.

The ways in which the material constraints of shale formations were handled, embraced or denied testifies to the power of shale gas materialities to shape political relations and social imagination. Sociotechnical pressures and the unruly materialities of shale gas – inherent in the very unconventionality of the resource – worked in the opposite direction to the disentangling forces of the extractive industries. They created an uneasy reminder that the unconventional materiality of shale gas was a chimerical entity – its material consistency was intertwined with its political, social (including scientific), and environmental reality. It did not have a material or political presence without the mesh of the social relationships with which it was entangled. It is, therefore, plausible to argue that it was not so much the material that failed the shale gas project in Poland and delayed it in the UK as the attempts to disentangle the resource from the social relations that have constituted it.

Conclusion

Unconventional resources may often be perceived as an uncomplicated and open-ended way to describe the materially distinct qualities of a hydrocarbon reserve which requires a particular technological and economic approach. However, far from being simply a factual description of a particular material, the framing of a resource as unconventional has more than merely technical implications. Various resource-making processes extend beyond the realms of geology into politics and the social, where they manifest themselves in the special legal and political status granted to unconventional hydrocarbons such as shale gas. They also create new sociotechnical relations based on anticipatory dynamics. Bureaucratic cultures and historical tropes shape popular imaginaries in ways that are at once specific to every country as well as bearing close similarities which attest to the alienating tendencies of resource-making.

The emerging scholarship on ‘resource-making’ can further expand its analytical power and relevance by attending to the hidden underbelly of resource-making practices, i.e. the asymmetric social relations that underlie them. This would help to avoid idealising the power of social controversies for the collective constitution of resources by overlooking the relation of alienation (and potentially, a re-appropriation) that underpins these processes. If considered from this perspective, unconventionality emerges as an effect of the interplay between the processes of alienation from and re-appropriation of the material, social, and political relations that constitute shale gas. This approach helps us avoid the ideological blind to the corporate logics and forms of resource exploration (as well as the associated transformations of the social) which rely on a sense of entitlement and an essentialist as well as a socially dis-embedded view of natural resources. The emphasis on uncertainty, relationality, and fluidity that we may use to describe resources mirrors the distributed and changeable nature of the corporate form with complicated subsidiary structures and lines of accountability. On the other hand, the analytical attention to the asymmetric nature of relations that constitute resources does not legitimize corporate interests and directions but denaturalizes the asymmetry in considering the intended and unintended effects of alienation. Due to this asymmetry, dis-embedding resource development from social and political relations can shift the decision-making balance in favour of extraction. This dynamic helps explain how the logics of resource exploitation are perpetuated. In a climate-changing world, the politicization of this dynamic is at the centre of climate actions which address the issues of equitable energy transitions (Burke, 2018; Fairchild and Weinrub, 2017).

Shale gas developments in the UK and Poland have become controversial due to many factors but research suggests that democracy- and justice-based concerns played a decisive role. This conclusion would support the understanding of unconventionality as an effect of thoroughly

alienating relations. In other words, one of the symptoms of the shale gas controversy is that the unconventionality of the resource has become metonymically representative of inequality. Even though unconventional resources represented a relatively new category of extractable materialities, their social dynamic is hardly original. The (dis)entanglements of the political with the material, which constitute unconventional resources, are not a break, but rather a continuity with the history of the industry which depends on multiple forms of alienation and expropriation to further a fossil-based future.

It is in this light that the recent attempts to redefine unconventional exploration projects in the UK as conventional merit our critical attention. Unlike Cuadrilla in Lancashire, many other shale gas developments in England have been classed by the industry as conventional. This change in the corporate renderings of resources does not seem to be based on the achievement of a breakthrough in extractive or surveying technologies or in the transformation of the materiality of the source rock. Gas extracted from shale is still understood by the public in the same way and similar concerns are raised whether or not the operator proposes to hydraulically fracture the reservoir. It cannot, therefore, be asserted that a redefinition of unconventional projects as conventional ones stems from a material, social or technological change regarding the status of shale gas. Rather, it may be more accurate to think about it as an attempt to further dis-embed and depoliticize shale gas development. By compartmentalising development and (temporarily) forgoing fracking as an exploratory technique, the industry can overcome some regulatory hurdles and remove the formal planning grounds on which exploration could be challenged by its opponents. Thus, the making and remaking of resources could continue as a form of alienation and a mode of experiencing inequality.

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