**Introduction to the Special Issue: Subterranean Geopolitics**

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**Abstract**

Recent scholarship in political geography and allied disciplines such as Anthropology and Architecture has used registers such as the elemental and volumetric to explore the calculative, material, technical, and atmospheric interventions in, on, through and beneath the earth’s surface. In this special issue, our contributors engage in a ‘subterranean turn’, as they drill down, dive into, travel through and speculate with underground and underwater domains. Although varied in their geographical environments and locales, and diverse in their time-frames, the papers speak to four themes that constitute a ‘subterranean geopolitics.’ First, the subterranean is conceptualised as volume with distinct material qualities including height, pressure, depth and shape. There are multiple undergrounds on offer. Second, the subterranean is integral to nation-state building and geopolitical strategies of control, enclosure and exclusion. Third, there is evidence of and for subterranean infrastructures aplenty. States and other actors want to design, experiment and plan with the underground and underwater environments. Finally, the subterranean is never divorced from calculative, legal and technical regimes of regulation, and the cultivation of expertise – scientific, military, engineering – is a crucial element in these contributions to subterranean geopolitics. Taken together, the nine papers in this special issue offer a rich array of case studies including a nineteenth century volcanic eruption in the Mediterranean (Hawkins), subterranean nationalism in the South Atlantic (Benwell), lead mining in 19th century English Peak District (Endfield and Van Lieshout), a transnational gas pipeline running through Italy (Barry and Gambino), subterranean security in Israel/Palestine (Slesinger), natural gas infrastructure (Forman), deep sea mining off Papua New Guinea (Childs), US military planning in and under Greenland’s inland ice (Bruun), and managing the shipping routes of the English Channel (Peters).

**Introduction**

Tunnels, bunkers, caves, mines, mountain lairs, sewers, railway lines, and practices of sub-surface extraction, burial, dumping, and militarisation are attracting increasing attention. There is, as Bradley Garrett (2011) highlights, a ‘growing public fascination with revealing the subterranean world’. Whilst Higman (2017) argues that the world is being flattened and understood in increasingly planar terms, the likes of Weizman (2002), Elden (2013), and Bridge (2013:55) engage with the ‘underground’ as a ‘very particular spatial context that generates insight and questions that unsettle and undermine a ‘horizontalism’ that has traditionally dominated both critical geopolitics and urban research in the Anglophone world (Graham and Hewitt 2013:71-72). Yet, as Dobraszczyk et al. (2015:26-27) highlight, whilst there is a ‘clutch of new geographic literature’ that ‘thinks through our relationship to vertical space’, ‘much of this work has continued to see subterranean space as space out, over and under what we know – continuing to render it conceptual, forbidden and even exotic.’ This is beginning to change with attention paid to the intersections between the subterranean and post-colonial studies (Scott 2008), feminist geophilosophy (Bosworth 2016), and the ‘subterranean anthropocene’ and work encouraging us ‘not just to think about the underground, but to think with it (Melo Zurita et al. 2018:302). Yet even with this resurgence of interest, the geopolitics of the subterranean remain ‘mostly unexplored and untheorised’ – particularly in contrast to other voluminous contexts like ‘atmosphere’ (Bille 2019).

More broadly, the sense of radical difference and intrigue has rendered the subterranean and undergrounds of varying kinds as rich sites of cultural imagination (Bridge 2013). Whether in Alice’s descent into the underground wonderland or Jules Verne’s *Journey to the Centre of the Earth* and the seafloor, the vast spaces beneath the surfaces of our lives are important sites of imaginative, embodied, exploration. One only has to look to James Bond to see the centrality of the sub-surface in popular culture. The British super-spy extraordinaire was and is never far from an underground or underwater environment. Invented by the journalist and wartime naval intelligence officer, Ian Fleming, Bond’s missions frequently brought him into contact with subterranean and underwater realms (Funnell and Dodds 2017). The first Bond film, *Dr No* (1962), was released in October 1962 and coincided with the Cuban Missile Crisis and with public statements by President Kennedy in 1961 for American families to dig their own nuclear shelters in the gardens of their suburban homes (Rose 2004: 4). *Thunderball* on the other hand, sees spectacular underwater battle scenes unfold beneath the waves.

As della Dora (2011) highlights in relation to the cave in Byzantine traditions, the subterranean functions in more profound ways too where ‘wonders took place beyond human vision and understanding’ (2011:761). These were spaces to empty oneself of passion and earthly cares with a ‘lack of matter, light, and comfort in order to be filled with divine grace’. The subterranean, in this instance, gave ‘expression to what landscapes do not show’ (2011:777). On the other hand, caves and the subterranean have also been associated with mental and spiritual experiences of an entirely different nature. As Carroll (2015:152) highlights, ‘madness…was a danger associated with subterranean exploitation’, the descent of the body synonymous with the decay of the mind.

Of course, the underground has not just served as a space of spiritual self-discovery but as a vector to literally ‘unearth’. The ‘common plotline’ in archaeology, anthropology, geology and palaeontology ‘is a descent into the underworld in a quest of truth’ (Williams 1992: 23). It is a manifestation of ‘deep time’ both practically and metaphorically and humans continue to burrow down, to excavate, dig up, and understand the practices, spatialities, habits, and technologies of our predecessors. It is to this practice of ‘excavation’ that we now turn. As Dobraszczyk et al. (2015:26) highlight it is a practice with purchase beyond ‘archaeological praxis’. The excavation of urban undergrounds, they write, functions ‘as a sort of reverse archaeology where the newest stratigraphy must always go further down’, a practice that is ‘feeding intellectual interest in underground spaces.’ It is a way of thinking through the subterranean as well as engaging with it and this mode of thinking may offer a practical prism to continue, and offer an explicit framework for, the wide-ranging work taking place in geopolitics on the underground. To this end, there are a number of questions and cross-cutting themes that this introduction and the papers within this special issue seek to attend to. How might we apply a praxis of excavation to critical geopolitics? What are we unable to bring to the surface? How do we make known and shed light on the ever complex burrowing, unearthing, immersing, extracting, engineering, detecting, leaking, surveilling, filling, and demarcating practices that take place on a daily basis beneath our feet and away from our eyes? What can we gain intellectually and conceptually by taking critical geopolitics more explicitly into the underground? How are these spaces exploited, controlled, occupied, and resisted for whom and what end? How can we better account for subterranean materials, flows, circulations and technologies in critical geopolitics? How can we avoid what Garrett (2011) would term a ‘shallow excavation’?

This special issue seeks to join the wide range of scholars seeking to attend to these questions and to contribute to the diverse and rewarding space of enquiry that constitutes subterranean geopolitics (Scott 2008, Williams 2008, Bille 2019, McNeill 2019). In what follows, we develop our engagement with subterranean geopolitics in two ways. First, we consider why there has been a re-enchantment with the underground in political geography and geopolitics. We tease out issues that speak to the elemental, the more than human and territories as volumes. Second, we introduce the special issue papers and themes, and empirics that underwrite them.

**Going underground: Subterranean Geopolitics**

Whilst the subterranean remains an ‘understudied geopolitical space’ (Valdivia 2015:1425), there have been a number of interventions over the last 10 or so years highlighting the purchase of engaging with subterranean geopolitics. Some of this work owes a great deal to a ‘volumetric turn’ in scholarship on territory, borders and the elemental (for example, Weizman 2002, Elden 2013, Squire 2016a, Bille 2019). Drawing inspiration from writings in resource geographies (Bridge 2013) and vertical geopolitics (for example Graham 2016), critical subterranean pioneers such as Bruce Braun (2000) drew attention to the role of the sub-surface in helping to generate ‘vertical territories’ in 19th century Canada. Taking inspiration from this interest in height and depth, Stuart Elden’s timely intervention on territory as volume picks up on how the subterranean is complicit with state power (Elden 2013). Using Israel and Palestine as his empirical context, Elden offers us a provocative agenda; the political technology of territory is a complex affair involving calculation, measurement, surveying, controlling, ordering, policing and the organization of data. But there are few places in the world where it is not possible to trace similar patterns of activity; if Israel worries about the tunnelling activities of adversaries, the Algerian government has been busy digging trenches to try and prevent surface-level fuel smuggling, human trafficking and illicit trade. As border scholars remind us, the underground is often complicit in struggles to define, refine, reinforce and patrol borderlands (Graham and Hewitt 2012, Sorrenson 2014, Jones and Johnson 2016 Even in more pacific arenas of world politics, city-states such as Singapore and Hong Kong are world-leaders when it comes to thinking about how the subterranean can be re-engineered, re-planned and retro-fitted with every more infrastructural provision. Confronted with population increase, shortage of affordable housing, and preoccupied in some cases with national security dilemmas, the underground is a productive space to plan for new storage, circulatory capacity, and even sub-surface inhabitation. As Dobraszczyk et al. (2015:28) highlight, ‘the long histories of many cities are as much about processes of sinking as they are about reaching for the skies’. Unsurprisingly, civil engineers are in demand in places like Singapore and charged with unveiling ever more elaborate plans for the underground. The underground has, and will continue to be, a productive space for three-dimensional urban and border geopolitics.

**Lived and experienced**

Yet, as the papers in this Special Issue highlight, the subterranean is not merely a site of calculation, measurement and survey. On the contrary, the subterranean is constructed, lived and experienced (Perez 2015). It can be gendered – reflecting the ‘masculinist heroics of exploration (Perez 2015:226), racialised, and serve to entrench pre-existing societal structures or provide liberation from them. The subterranean can engender emotive, embodied, and affective responses with depth, volume, pressures, darkness, cold, heat and subterranean atmospheres taking their toll nonhuman bodies, infrastructures and minds.

As Scott (2008:1864) asserts in relation to colonial projects, the subterranean comprises an ‘array of ideas, fears, and aspirations’ that come to ground certain geopolitical projects (such as mining). They are diverse, often contested spaces bound up with anxieties with the spectre of catastrophe ever present. As Dobraszcyk et al. (2015:29) highlight ‘whether built to ‘escape war and destruction or planned as a conscious exercise in building national identities’, the subterranean can ‘speak to primordial fears and debris, intimacy, enclosure, labour, and the envisioning of futures.’ These are, as the authors assert, spaces of function and meaning and also spaces of becoming (Dobraszczyk et al 2015:29). The subterranean then, whilst presenting opportunities to engage with the militarised practices and expressions of state sovereignty that ‘loom large in some of these discussions of vertical territory’, also presents opportunities to engage with the geopolitical at ‘a finer scale’ (McGlynn 2019). Feminist perspectives are key here (Bosworth 2016), the subterranean presenting the capacity to ‘heighten a sense of the openness of our bodies to geological forces’ and different ways of ‘generating thought through encounters with earthly’ and subterranean matter (Bosworth 2016:22). Building on his work on Deep Sea Mining in this issue, Childs (2019) exemplifies the significance of this issue of scale in Pacific Island Communities. The geological spaces that are the subject of increasing attention from miners are invisible to those on the surface, yet remain ‘intimately connected to humanity, despite the geographical distances involved’ (Childs 2019). As Childs explores, for the people of the Duke of York Islands in Papua New Guinea, DSM ‘disturbs the spirits that inhabit their culture and beliefs’ and even ‘a sense of who they are’. As one clan chief asserted, ‘when they start mining the seabed, they’ll start mining part of me’. When thinking through and with the subterranean, we might think of immersion in different settings and atmospheres (Adey 2013), but distance does not preclude connection.

**Resistive and resistance**

As a litany of accidents, disasters and mishaps remind us, underground environments prove more than capable of frustrating as well as enabling human designs, interventions and aspirations. The politics of governing and managing the subterranean are far from straightforward and resources often provide the vector through which these difficulties are made apparent. Valdivia’s (2015) work on oil fields is a prime example. The paper seeks to situate the subterranean as a ‘moment of geopolitical analysis to investigate how regional integration becomes entangled with and diffracted by the ‘materiality’ of resources’ (2015:1422). In doing so, Valdivia’s work highlights how the subterranean can ‘afford frictions to oilfields that territorialise geopolitics’, that enable, destabilise, and diffract certain geopolitical interventions as they move and exist underground (1426-1427). Rather than conceptualise the underground oil field as a fixed site, we are instead urged to consider the ‘place specific frictions that inflect’ its movement. Indeed, the subterranean poses many challenges to the ‘systemising efforts of sovereign power’ (Coleman 2016:88). The subterranean ‘structures, organisations, and fluid stratifications’ that we seek to engage with are often invisible to those on the surface. Remote sensing technologies or other ways of ‘seeing’ are needed to represent and communicate the subsurface to those above (see Slesinger’s contribution in this issue). The underground is, according to Graham (2004:18) the last vestige of concealment with an aerial view ever dependent on ‘the subterranean invisible’ and depths that are only accessible via ‘sound and sound waves’ (Bishop 2011:272). These are spaces resistant to visual and physical colonisation, often characterised as spaces of ‘stubborn fixity, omnipresent darkness, features that retard rather than enable mobility’ (Carroll 2015:11).

The subterranean is a terrain of and for resistance in other ways too. While it is common to speak of ‘underground politics’ as a register of covert political activity in repressive political spaces, the subterranean has become productive of expressions of alter-geopolitics (Koopman 2014). Activities such as mining, infrastructural development, and territorial enclosure often carry with it the possibility of challenge and resistance. From fracking protests to pipeline protests on indigenous indigenous and aboriginal territories around the world, the contested politics of the underground often brings to the fore the very things that might remain invisible to public scrutiny. Public protest might serve to un-earth the toxic legacies of fracking, the historic injustices of settler colonialism, the legality of land ownership, the consequences of militarization and the hidden costs of resource-led capitalism. Struggles for indigenous and aboriginal rights, moreover, have never been divorced from the underground and how it is used and abused (for example, Nystrom 2014). Further research into subterranean geopolitics will surely interrogate further the socio-material terrain for state violence, militarism and the unequal geographies of vulnerability. Disasters, for example, can and do immerse communities and ecologies. Unwanted submersion in the form of flooding reveals who and what gets access to higher ground, emergency care and long-term settlement in a post-disaster context – being underwater might be temporary for some but the consequences and legacies can be painful and long-lasting (Angel 2014, Sidiqi 2018).

**Methodological considerations**

In order to avoid ‘shallow excavations’ of the subterranean, some consideration of the methodologies of ‘unearthing’ is warranted – particularly if we are, as Adey (2013:52) suggests, ‘to take seriously the volume in order to consider its inhabitation’. By its very nature, the subterranean is often out of reach and sight of many of us. While we might take for granted access to underground infrastructure such as the public subways, very few of us will be able to access underground smuggling tunnels, travel in submarines, explore military infrastructures such as bunkers, laboratories and bases, and/or experience underground and underwater activities such as mining and fishing. Some scholars have actively embraced immersive methodologies such as learning to dive (Squire 2017), accompanied cavers, soldiers, miners and civil engineers via ethnographies, and/or secured special or approved access to those who work with subterranean environments. This is not always possible, safe, or feasible however.

As demonstrated in this special issue, there are a rich range of ways to engage with the geopolitics of the subterranean, providing possibilities for the unearthing, excavating, and reconstructing spaces and experiences that may otherwise remain underground. The varied contributions serve as a reminder of these practices and the knowledge to be gained in their application to often unseen spaces. Archives, for example, both formal and informal, have provided rich possibilities for the unearthing, excavating, and reconstructing subterranean geopolitics at multiple scales and across multiple contexts and bodies (see the papers by Peters, Bruun, Endfield and Van Lieshout). We might also consider how geopolitical scholarship can make a more concerted engagement with the people at the forefront of the subterranean (see Perez 2017) – including miners, diggers, cavers, archaeologists, indigenous communities, divers, tunnelers, and those delving into the ‘deep’ via remote technology to name but a few. Such an effort may shed light and provide access to different strata, layers, scales, and experiences of the subterranean. As Harriet Hawkins highlights in this issue, aesthetics, sensing, and optics provide a rich and revealing entry point to the underground. Artistic and creative practices can unlock new discussions on the subterranean, and as Hawkins highlights, elucidate ‘how we come to know, or to sense subterranean volumes’. Aesthetics are important in other ways too. As Slesinger highlights, effort to ‘see’ the underground shape and frame many engagements with it. There is, argues Bishop (2011:270) a ‘deeply connected relationship between the imaginary and the material in attempts to realise a mastery of space and populations (Bishop 2011:270). Whilst on the one hand the subterranean challenges notions of ‘flatness’ that pervade modern life (see Higman 2017) we might think about how these three dimensional, voluminous, and volumetric spaces have been drawn into this narrative. Represented on screens via certain sensing technologies, carved into flat surfaces to reveal strata in archaeological digs, and smoothed to create walkways and habitable space in underground bunkers.

We also see in this issue the importance of the material and elemental. Substances such as ice (Bruun), gas (Forman), soil and rock (Benwell), water and manganese (Childs) and pipelines (Barry and Gambino) are at the forefront of discussions and powerfully illustrate how human and non-human actors engage make and remake subterranean environments. Beyond this Special Issue, the dynamic intersection of ice, land and water is proving productive of underground and underwater geopolitics involving indigenous peoples, coastal states and extra-territorial states such as China eager to exploit the territorial volumes of the Arctic. Future research might well embrace other technologies and data sources including virtual reality, digital sources, and data sets that collect, monitor and evaluate underground environments. Diverse methodologies and sources will contribute to better understanding how the subterranean can take multiple forms; abstracted and estimated as resource, as geopolitical arena, as container of state authority, as elemental medium, and as opportunity for indigenous self-determination.

**The Special Issue: Themes and Spaces**

A number of cross-cutting themes emerge in the paragraphs above. We see the subterranean as an exclusionary space; a space of obscurity wherein technologies must be deployed to see; a space of disaster, where the ‘outside’ infiltrates ‘inside’ with catastrophic consequences; it’s a space of myth, conspiracy, crime, deep time, and technological innovation to sustain, support, and sanitise the surface; and it’s a space where the earth’s elemental properties really matter. Clearly, in one special issue it is impossible to account for every ‘dimension’ of the subterranean but many of these themes are addressed in the rich and diverse set of papers that are to follow. Each understands subterranean geopolitics slightly differently and as this is articulated the significance of these spaces within the sub-discipline are exemplified.

We have nine papers in this special issue, and although they are varied in terms of empirical scope and theoretical framing, they share a mutual fascination for the underground. There are four themes that run through the papers to varying degrees. First, the subterranean is conceptualised as volume with distinct material qualities including height, pressure, depth and shape. Slesinger’s paper invites us to consider how Israeli engineers, scientists and military address the security challenges posed by Hamas tunnelling, and by association how adversaries seek to capitalise on their subterranean knowledge. When the subterranean is caught up in a broader volumetric struggle for territory, resources and influence, the proverbial stakes are shown to be both high and low. There are multiple undergrounds on offer, as Peters’ exploration of submarine worlds. While the Israelis are determined to disrupt underground tunnels, the administrators and technical staff responsible for shipping in the English Channel are eager to avoid disruption. While the prevailing geopolitical contexts for both authors are very different (Israel/Palestine and English Channel), the circulatory patterns of ships and smugglers and non-state actors can and does invite concern on the part of coastal states and their national security networks. Endfield and Van Lieshout invite us to plunge down a network of underground channels found in the 19th century Peak District in England in order to reveal how law, geology, politics intersected with one another to reveal a contested terrain below and above the surface (see also Scott 2008). Unpublished legal records provide a fascinating entrée into this contested subterranean realm, and remind us that past conflicts over the underground continue to haunt contemporary landscapes. Second, the subterranean is integral to nation-state building and geopolitical strategies of control, enclosure and exclusion. Benwell’s interrogation of underground nationalisms in Argentina involving the disputed South Atlantic islands of the Falklands/Malvinas are literally rooted in and routed through rock, water, and soil. Ranging wide and deep, Benwell reminds that the subterranean is integral to the production and reproduction of banal, hot and everyday nationalisms. Third, there is evidence of and for subterranean infrastructures aplenty. States and other actors want to design, experiment and plan with the underground and underwater environments. Barry and Gambino use the Southern Gas Corridor to explore the human and more than human geo-politics and bio-politics of the pipeline. As they reveal, by ‘following the pipeline’ we enter into a multi-species world of encounter, co-existence and competition. This paper leads to Forman’s interrogation of the UK gas infrastructure, which teases out the dynamic inter-relationship between three dimensional geographies, circulatory flows and sub-surface governance. Finally, the subterranean is never divorced from calculative, legal and technical regimes of regulation, and the cultivation of expertise – scientific, military, engineering – is a crucial element in these contributions to subterranean geopolitics. From Bruun’s interrogation of the US military’s interest in the subterranean properties of inland ice in Cold War Greenland to Childs’ focus on commercial stakeholders in the field of deep sea mining, remote and inaccessible spaces are being colonized, enclosed and militarised with alarming alacrity. But as Harriet Hawkins’ paper reminds there are geopolitical aesthetical qualities of the underground as well that need to be better understood, especially in the way in which they might ‘un-earth’ and ‘un-settle’ our territorial and earthly imaginaries.

**Conclusion**

This special issue on subterranean geopolitics offers a rich entrée into a field that is promising to be an area of growing academic attention. It connects and enriches areas of enquiries such as territory as volume, geopolitical assemblage, infrastructural studies, legal regimes and knowledge production, materiality and materials, elemental geographies, and more-than-human geopolitics. It should encourage further reflection on geopolitical traditions, and the often troubling intellectual histories that have sought to make sense of politics and nationalism via the materiality of the earth. If we were to revisit ‘geopolitical traditions’ would we, for example, look more explicitly below the ground, ice and water? Whether visible or invisible, the subterranean continues to inform expressions of territorial nationalism, mapping impulses, securitization projects and resource-led initiatives eager to assess, collect and capitalise upon knowledge of the sub-surface (Williams 2008).

We can also point to a popular geopolitics of the subterranean and how that has informed, nurtured and inflamed geopolitical cultures, from the fantasy novels and stories of C S Lewis to bizarre science fiction films such as *Battle Beneath the Earth (1967)*and hard-hitting documentaries such as *Dirty Business: How Mining made Australia* (2017), which reveal the struggles of aboriginal peoples to secure recognition of their legal rights of ownership and custodianship. Video games such as the *Fall Out* series (1996-2018) have shown an enduring capacity to use the vault as a productive space to imagine and re-imagine life after the disaster. More broadly, There is surely no nation-state that could not have its origin story and subsequent economic, political and cultural development told via its engagement with the subterranean. There are stories aplenty of fictional and non-fictional underground worlds.

We might also think here of the political importance of the infrastructure and transportation mechanisms that facilitate this sort of engagement with the subterranean (Graham 2014). The ‘elevator’ writes Graham, has a ‘neglected politics’ that enables a descent ‘deep into the earth to sustain ‘ultra-deep mining (2014:242). Sustaining a surface metropolis, the technologies of building massive vertical mining structures deeper and deeper into the ground have fundamentally co-evolved with those for building the growing forests of taller and taller skyscrapers into the sky (258). The elevator is crucial to this practice of ‘sinking’ and no more than in the Mponeng mine, 60km from Johannesburg. It is the ‘poster child for the so-called ‘ultra-deep’ gold mining where super-long elevators descend over 2.2. miles into the earth. As Graham (2014:259) highlights, ‘the entire mine has to be refrigerated using 6000 tons of ice a day to stop the miners from baking alive.’ Just as the elevator enables us to travel higher into the worlds skyscrapers, so too does it open up the earth’s materials and elements to systematic exploitation.

A subterranean geopolitics draws our collective attention to the visibility and invisibility of state power, regimes of governance, knowledge generation, experiences and encounters of accumulation and dispossession, and material extraction. By going underground, we learn a great deal about the geopolitical; the geophysical affordances of the subterranean, the scope of engineering and purpose of design, and the ideologies that sustain all of the above. Geopolitics was never a flat discourse, and this special issue speaks to this depth, height, and volume and the implications of the vast subterranean materials and movements’ that subtend to human and non-human life (Bosworth 2016:33, Weizman 2012, Steinberg and Peters 2015).

**Acknowledgements**

We offer our sincere thanks to Colin Flint, editor of *Geopolitics* for his enduring support. The genesis of this special issue lies with a session on subterranean geopolitics at the 2016 RGS-IBG annual conference in London. Finally, thank you to all the contributors and the referees for their collective commitment, insights, and support.

**References**

Adey, P. (2013) Securing the volume/volumen: Comments on Stuart Elden’s Plenary paper ‘Secure the volume’, *Political Geography,* 34, 52-54

Adey, P. (2010) ‘Vertical security in the megacity: Legality, mobility and aerial politics’ *Theory, Culture and Society* 30: 51-67.

Ackroyd, P. 2012. *London Under*. London: Vintage.

Angel, R. (2014) *Community Lost: The State, Civil Society, And Displaced Survivors Of Hurricane Katrina*Cambridge: Cambridge University Press.

Barry, A. and E. Gambino (2019) ‘Pipeline Geopolitics: Subaquatic Materials and the Tactical Point’ *Geopolitics* online published 14th March 2019

Bille, F editor (2019) *Volumetric States* Duke: Duke University Press.

Bille, F. Volumetric Sovereignty part 2: The subterranean realm, *Society and Space* <http://societyandspace.org/2019/03/12/volumetric-sovereignty-part-2-the-subterranean-realm/>

Bishop, R. (2011) Project ‘Transparent Earth’ and the Autoscopy of Aerial Targeting The Visual Geopolitics of the Underground, *Theory, Culture & Society*, 27- 8, 70- 86

Bosworth, K. (2017) Thinking permeable matter through feminist geophilosophy: Environmental knowledge controversy and the materiality of hydrogeologic processes, *Environment and Planning D: Society and Space*, *35*(1), 21–37.

Braun, B (2000) ‘Producing vertical territory: Geology and governmentality in Late Victorian Canada’ *Cultural Geographies* 7: 7-46.

Bridge, G. (2013) ‘Territory, now in 3-D’ *Political Geography* 34: 55-57.

Bruun, J. ‘Invading the Whiteness: Science, (Sub)Terrain, and US Militarisation of the Greenland Ice Sheet’ *Geopolitics* online published 17th November 2018.

Carroll, S. (2015) *An Empire of Air and Water: Uncolonisable space in the British Imagination*, Penn Press: Philadelphia

Coleman, D. (2016) An Empire of Air and Water: Uncolonizable Space in the British Imagination, 1750–1850, European Romantic Review, 27(1), 87-90

Childs, J. 19 February 2019, Deep sea mining threatens indigenous culture in Papua New Guinea, *The Conversation*, <https://theconversation.com/deep-sea-mining-threatens-indigenous-culture-in-papua-new-guinea-112012>

Childs, J. ‘Extraction in Four Dimensions: Time, Space and the Emerging Geo(-)politics of Deep-Sea Mining’ *Geopolitics* online published 14th June 2018.

Cons, J. (2016) *Sensitive Space: Fragmented Territory at the India-Bangladesh Border*. Seattle and London: University of Washington Press

della Dora, V., 2011. Anti-landscapes: Caves and apophasis in the Christian East. *Environment and Planning D: Society and Space*, *29*(5), pp.761-779.

Dobraszczyk, P., Lopez-Galviz, C.A. and Garrett, B., 2015. Digging up and digging down: urban undergrounds. *Journal of Contemporary Archaeology*, *2*(2), S26-S30

Elden, S. (2013) ‘Secure the volume: Vertical geopolitics and the depth of power’ *Political Geography* 34: 35-51.

Endfield, G. and L. Van ‘Water and vertical territory: the volatile and hidden historical geographies of Derbyshire’s lead mining soughs, 1650s–1830s’ *Geopolitics* online published 9th October 2018.

Forman, P. ‘Security and the Subsurface: Natural Gas and the Visualisation of Possibility Spaces’ *Geopolitics* online published 17th October 2018.

Funnell, L. and K. Dodds (2017) *Geographies, Genders and Geopolitics of James Bond* London: Palgrave.

Gandy, M. (1999) ‘The Paris sewers and the rationalization of urban space’ *Transactions of the Institute of British Geographers* 24: 23-44.

Garrett, B and I. Klinke (2018) ‘Opening the bunker: Function, materiality, temporality’ *Environment and Planning C: Politics and Space* online published 11th December 2018.

Graham, S. (2016) *Vertical: The City from Satellites to Bunkers* London: Verso.

Graham, S. and Hewitt, L. (2012) Getting off the ground: On the politics of urban verticality, Progress in Human Geography, 37(1), 72-92.

Hawkins, H. (2018) ‘A Volcanic Incident’: Towards a Geopolitical Aesthetics of the Subterranean’ *Geopolitics* online published 25th September 2018.

Higman, B. (2017) *Flatness*, Reaktion: London

Jones, R. and Johnson, C. (2016) Border militarisation and the re‐articulation of sovereignty. *Transactions of the Institute of British Geographers*, *41*(2), 187-200.

Koopman. S. (2011) ‘Alter-geopolitics: Other securities are happening’ *Geoforum* 42: 274-284.

McGlynn, E. (2019) Quake, *Society and Space*, Volumetric Sovresignty collection (edited by Franck Bille) <http://societyandspace.org/2019/03/12/quake/>

McNeill, D. 2019. ‘Volumetric urbanism: the production and extraction of Singapore’s territory’ *Environment and Planning A: Economy and Space* online published 20th February 2019.

Melo Zurita, M. George Munro, P. and Houston, D. Un-earthing the subterranean Anthropocene, *Area*, 50(3), 298-305

Nystrom, C. (2104) *Seeing Underground: Maps, Models and Mining Engineering in America* Reno: University of Nevada Press.

Perez, M. (2015) Exploring the vertical: science and sociality in the field among cavers in Venezuela, *Social and Cultural Geographies*, 16(2), 226-247

Peters, K. Deep Routeing and the Making of ‘Maritime Motorways’: Beyond Surficial Geographies of Connection for Governing Global Shipping’ *Geopolitics* online published 1st February 2019.

Pike, D. 2005. *Subterranean Cities: The World beneath Paris and London, 1800–1945.* Cornell: Cornell University Press.

Rose, K. (2004) *One Nation Underground: The Fallout Shelter in American Culture* New York: New York University Press.

Scott, H. (2008) ‘Colonialism, landscape and the subterranean’ *Geography Compass* 2: 1853-1869.

Sidiqi, A. (2018) ‘Disasters in conflict areas: finding the politics’ *Disasters* 42: 161-172.

Slesinger, I. ‘A Cartography of the Unknowable: Technology, Territory and Subterranean Agencies in Israel’s Management of the Gaza Tunnels’ *Geopolitics* online published 8th February 2018.

Sorrensen, C. (2014) Making the subterranean visible: security, tunnels, and the United States–Mexico border, *Geographical Review*, *104*(3), 328-345.

Squire, R. (2016a) ‘Rock, water, air and fire : Foregrounding the elements in the Gibraltar-Spain dispute’ *Environment and Planning D: Society and Space* 34: 545-563.

Squire, R. (2016b) ‘Immersive terrain : the US Navy, Sealab and Cold War undersea geopolitics’ *Area* 48: 332-338.

Squire, R. (2017) “Do you dive?”: Methodological considerations for engaging with “volume”’ *Geography Compass* 11: 1-11.

Steinberg, P. and K. Peters (2015) ‘Wet ontologies and fluid spaces: Giving depth to volume through oceanic thinking’ *Environment and Planning D: Society and Space* 33: 247-264.

Valdivia, G., 2015. Oil frictions and the subterranean geopolitics of energy regionalisms. *Environment and Planning A*, *47*(7), 1422-1439.

Weizman E, 2002, The politics of verticality, *Open democracy*, http:⁄⁄www.opendemocracy.net⁄conﬂict-politicsverticality ⁄ article\_810.jsp

Weizman, E. (2012) *Hollow Land: Israel’s Architecture of Occupation* London: Verso.

Williams, R. 2008. *Notes on the Underground: An Essay on Technology, Society and the Imagination*. Cambridge: MIT Press.