What lies beneath?
Exploring the material influence of the underground on urban development in Newcastle and Lake Macquarie

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Abstract: This paper draws on materialities approaches to explore the influence of the underground on development opportunities. In Geography, these approaches focus on the interaction of the physical world with social, political and economic geographies (Lorimer, 2013). The material is not a base to which everything responds but a necessary component of the iterative interaction process. Cities, then, are more than amalgamations of physical components, they are products of plurality in which materiality is an agentic component (Latham & McCormack, 2004), influencing social, political and economic assemblages. A range of iterative relationships link the materiality of the underground with the aboveground including through extractive technologies (historic, current and future), economic value, government regulation, public perceptions and surface land values. Drawing on two case studies from the NSW Northern Coalfields, we explore these links between this underground materiality with aboveground urban outcomes. First, we explore the influence of historical underground mining on the urban redevelopment of inner-city Newcastle. The city has been the focus of significant urban regeneration activity. However, the form and economic viability of this regeneration has been mediated by the presence of underground mining shafts and costs associated with “grouting” (filling in) these shafts. Second, we explore the influence of Mine Subsidence Districts on development occurring in southern Lake Macquarie where coal deposits work to define the form of development occurring aboveground. Here, coal deposits restrict some forms of development, thereby opening up opportunities for alternative development/housing forms, such as caravan parks and relocatable home villages (retirement community). Together these cases illustrate the agentic potential of the materiality of the underground in actively co-constituting urban development forms.

Key Words: materialities, underground, urban regeneration, urban housing development, seniors housing

Introduction
Underground coal has long been a significant material element shaping the physical, economic and social development of the Hunter region in New South Wales (NSW). Coal mining activities have influenced the location and growth of townships, and employment and economic growth as coal is exported globally via the world’s largest coal exporting port (Port of Newcastle). Historically, coal mining commenced around the mouth of the Hunter River, resulting in the establishment of the Newcastle. While coal mining activity has progressively moved away from the established urban areas (primarily to the upper Hunter), its influence on the planning and development of the city remains. Now in its absence, coal moderates the aboveground urban built form through underground voids from mined coal (old mine shafts) which can lead to significant subsidence resulting in property damage and restrictions on the forms of development occurring throughout the city. A multitude of ongoing, iterative and interactive relationships link with underground voids with the aboveground. Legislation, town planning, mining technology, historic record keeping and property values all interact with the physical absence (and the historical extraction) of coal to constitute the aboveground built forms.

Materialities approaches and assemblage thinking provide a framework for examining the relationship between underground voids and aboveground built form. These approaches allow the city to be viewed as an assemblage of diverse material, cultural, social and economic elements and for the agency of the material to be considered in analyses of urban development trajectories. Specifically, they allow us to
appreciate how, as part of an urban assemblage, the materiality of the underground exerts agency over the form and function of the city. In Newcastle’s case, while the presence of coal was essential in establishing the city historically, the emergent and fluid nature of urban assemblages means that it continues to influence aboveground urban built form by restricting physical development through the influence of the underground voids. In short, coal is a central element of urban Newcastle as its initial presence encouraged extraction and the establishment of an urban centre, while its ongoing absence continues to influence location and size of urban development.

This paper explores the relationship between underground coal and aboveground development through two case studies located in the NSW Northern Coalfield. The first considers inner Newcastle where the voids from coal mining require expensive grouting in order for higher density (and heavier) development to be structurally viable, adding additional costs to development. The second considers Manufactured Home Estates (MHEs) in southern Lake Macquarie and the northern Central Coast, specifically the suburbs of Chain Valley Bay and Lake Munmorah. In these locations, historical mine subsidence regulations limited development due to the impact of future mining. Now that the mining has been completed, these decisions continue to impact upon current and future land uses. Together these case studies illustrate the agentic capacity of underground voids (caused by coal mining) in shaping the ongoing trajectory of urban development.

Theoretical/Conceptual Framework
This research draws on materialities approaches and assemblage thinking to explore the influence of the materiality of underground coal on aboveground social, political and economic geographies. Materialities approaches permit a focus on the interaction of the physical world with land use outcomes allowing an examination of the relationships and linkages between the material and the immaterial (Lees, 2002; Latham & McCormack, 2004; Anderson & McFarlane, 2011; Lorimer, 2013; Latham, 2016). Materiality is not a subject and/or an object; rather it is part of the interaction of other components in a dynamic system (Latham, 2016). Materialities co-constitute the urban built form through a multitude of relationships including legislative, financial, demographic and social. Examining the influence of these co-constitutive relationships demonstrates the enduring power of the material (Edensor, 2012). The current urban built form is the emergent outcome of relations between a wide range of diverse immaterial and material elements which evolve over time, working through diverse temporalities. These relationships are dynamic and ongoing (Latham & McCormack, 2004), and they shape and condition the production of, inter alia, buildings, property uses and land zoning codes, which are not static end results but are part of an ongoing process of assembling the urban. A focus on materialities and assemblages highlights emergence and immanence as opposed to settled spatial outcomes. Moreover, this focus acknowledges the coexistence of multiple agencies—the social and the material—and it emphasises the ongoing and iterative nature of relationships between diverse elements such that activities and decisions made years ago continue to resonate through to the present and into the future. Materiality is part of the interaction with historical and future components in a dynamic urban system (Latham, 2016).

Materialities generate their own forms of agency and can be viewed beyond their immediate human-made context (Latham, 2016). Underground coal has co-constituted the Newcastle, Hunter Valley and Lake Macquarie regions. Its physical presence encouraged postcolonial extractive activity and settlement encouraging land use patterns that continue to this day. Historic relationships with an underground extractable resource that had economic value resulted in physical buildings and spatial land uses. Planning and development decisions were made on the basis of coal’s economic value resulting in mining activities including above and below ground infrastructure, transportation networks, commercial and civic buildings and residential housing. Urban built form in the region comprises a legacy to these historic relationships and decisions continue to influence the social, economic and political geography.

Across the established urban area, underground coal has now largely been extracted resulting in underground voids, yet the materiality of coal continues to have agentic power through its absence (Edensor, 2012). The now extracted coal continues to influence aboveground uses through relationships which are legal, physical and financial. The absent materiality resonates through history and its physical constraints with the aboveground social, political and economic geography, notably through the potential for subsidence from historic mine workings to damage buildings. Thus, the materiality of coal continues to be evident despite its physical absence. Crucially, new assemblages have been created to address the influence of the extracted material on aboveground urban processes. In particular, legislative
frameworks and planning processes which define affected locations and approve new development
emerge as central to addressing the agentic capacities of underground voids and the potential for mine
subsidence. Past, present and future are dynamically related as underground coal is physically present,
future mining activity is accommodated in the mine subsidence legislation, and proposed mining
activities will result in voids that have the potential to cause subsidence. The extent of this mining,
the voids and potential subsidence are not yet known, therefore the legislation quarantines aboveground
activity.

Assemblage thinking is multiplicitous: it positions the city as part of a multiplicity of further assemblages
which may be local, national or global (McFarlane, 2011; Edensor, 2012). There is a focus on the
process of events, activities and practice produced by multiple agencies, drawn together through
contingencies across diverse temporalities (McFarlane, 2011). Assemblage thinking, then,
accommodates the complexities and messiness of urban processes and facilitates examining its diverse
components (Anderson & McFarlane, 2011; Anderson, et al., 2012) and the potentially convoluted
relationships and linkages that emerge between them in the complexity of the real world. This approach
gives the diverse actors in the process due recognition, and in its recognition of multiplicity and
complexity, suggests an appreciated of the nonlinear logic whereby the urban outcomes may emerge
unpredictably (Dovey, 2012). Assemblage thinking’s recognition of multiplicity is inclusive rather than
exclusive allowing an examination of dynamic practices and events and how they have constituted urban
outcomes.

The agentic potential of the materiality of the underground is dynamic. Relationships between
underground coal, present or absent, with urban built form are not straightforward nor easily explained
but they are entwined across elements as diverse as politics, international commodities markets, current
and projected economic value, technologies of extraction and building technologies. The assemblages
of the underground and the aboveground have interacted over time resulting in historic development
patterns which are evident in current land uses. Both materialities approaches and assemblage thinking
allow examination of relationships over time. This acknowledges that the history of a material—
underground coal—matters as it has contributed to current and future urban development forms. In the
case studies that follow we mobilise materialities approaches and assemblage thinking to identify and
trace coal mining voids as a powerful agent shaping contemporary and future urban development
options.

Case Studies
Whereas historically, territory has been considered as a two-dimensional concept to be divided and
demarcated, three-dimensional territory – the underground and the aboveground – has become a new
contested space (Elden, 2013). Bebbington (2012) examines the political ecology of this new space
where the rights of miners are brought into conflict with the livelihoods of people dwelling on the surface.
Australia facilitates examination of this contested three-dimensional space as conflict is managed
through legislative frameworks. Subsidence from underground mining has an established history in
NSW with legislation commencing in the 1920s including the principle of State Government
compensation for subsidence induced damage. Subsidence Advisory NSW1 (SA NSW) proclaims Mine
Subsidence Districts (MSD’s) over areas where there is the potential for mine subsidence to cause
damage, including via historic, current and future mines. Despite the principle of compensation, the cost
of the underground mining is born by surface residents through increased construction cost, disrupted
land use patterns and decreased property values. We examine these processes through the exploration
of two Newcastle region case studies.

Case Study 1: Urban Development in Inner Newcastle

… mine subsidence remain[s] the city’s ‘unique problem child’
(Property Council of Australia Regional Director, Andrew Fletcher, in Gordon, 2013, p.9)

Coal has co-constituted Newcastle since colonial settlement; the city was founded in the 19th century
taking advantage of the easily accessible coal and water transport via the harbour. Extraction of coal
reserves was vital to the early economic survival of Newcastle. In the contemporary context, however,
mine subsidence constitutes a unique development and planning challenge to Newcastle CBD. SA

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1 Previously the Mine Subsidence Board

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NSW mapping of the Newcastle CBD outlines the extent of mine subsidence (Figure 1). Underground voids from historic mine shafts continue to influence aboveground development. They are material actors which have exerted influence of the social, physical and economic development of the inner city as the underground voids of mine shafts have emerged as historical material presences and absences inhibiting, shaping and reconfiguring development in the city.

**Figure 1: Newcastle mine subsidence**

![Newcastle mine subsidence map](image)

Source: Authors, data from Subsidence Advisory NSW

Newcastle has long been the subject of planning and urban regeneration schemes which have sought to rejuvenate the inner city (Ruming, et al., 2016). Over the past 20 years local and state government agencies have developed a multitude of urban regeneration and renewal schemes. In 2012, the *Newcastle Urban Renewal Strategy* (NURS) presented a new urban form for Newcastle: in the West End, a new transport interchange and high-density CBD and, in the East End, removal of the heavy rail line and replacement with a light rail system and redevelopment of the historical centre of the city with large-scale development of Hunter Street Mall (Figure 2). Together Figures 1 and 2 (of the same geography) outline the common location of major urban regeneration activities in areas where development is affected by mine subsidence. Regeneration activities have had to acknowledge and respond to unique material, social and economic attributes which were part of the inner-city assemblage. Inner Newcastle continues to be shaped by the agentic capacity of coal through requirements for grouting, development cost and state funding.
Underground mines from historical mining activity in inner Newcastle have long been identified by the private sector as a financial barrier to development (Urban Development Institute of Australia, 2013; Property Council of Australia, 2015). Addressing these underground voids comprise an additional development cost, adding risk to development projects. In order for development to occur on mine affected land, grouting must occur. Grouting is the process where slurry – consisting of fly ash and concrete – is pumped into underground voids through drill holes (Figure 3). It is an imprecise process, as it can often fill areas larger than expected, increasing cost, especially in locations where the extent of the mine shafts is not fully known, despite mapping and specialist geotechnical surveys. Voids are often larger than anticipated, increasing costs and grouting often fills voids under neighbouring properties (Kirkwood, 2014).

Figure 3: Grouting in Honeysuckle

Source: Ruming (2016)
Grouting incurs additional costs to development which have been identified by industry as prohibitive to development in the city (Harris, 2014). These costs interact with planning legislation and the development process increasing time and further adding to costs. Materialities of coal interact with development approval processes and feasibility highlighting the difficulties of urban renewal in the Newcastle CBD. Industry arguments about the cost implications of grouting are widely accepted by government development agencies, including the Hunter Development Corporation and UrbanGrowth NSW, and acknowledged in planning documents:

"The problem is that developers don't know what it's going to cost until they start digging, [one project] nearly sunk because the cost of filling in the mines underneath it cost $2 million, double what was budgeted."

(Fletcher, in Gordon, 2013, p.9)

"The final cost of mine grouting works is often impossible to define upfront making this the quintessential “wicked problem”."

(Hunter Development Corporation, 2013, p.36)

Full costs of grouting are unknown until they have been completed, adding to development uncertainty which is considered by banks when assessing debt finance applications. Property development operates with debt finance and borrowed funds incur interest costs. Where development costs and the uncertainty around development is increased both the quantum and cost (interest rate) are increased resulting in a double increase to developers.

"[The] real cost to developers was much higher because the industry generally worked with borrowed money, which had to be repaid with compound interest."

(Fletcher, in Kirkwood, 2014, p.6)

Under Section 94A of the **NSW Environmental Planning and Assessment Act, 1979**, development contributions (including the 3% infrastructure contribution charge) are calculated on the total cost of development. Costs associated with grouting (which are included in total development costs) therefore result in additional government levies being charged; an inclusion which has been widely challenged by the private development sector as they do not contribute to the size or impact of a development. Industry has responded by arguing that by increasing heights and floor space ratios, financial feasibility of developments is improved, overcoming the costs of grouting. For development to be financially feasible additional height and density was required (Green, 2013). Additional heights and densities interact with existing planning regulations preserving views to the Cathedral, a material element of the East End of the CBD (Ruming, 2018). Significant public opposition seeking to preserve the city’s low-density heritage character have met these proposals for increased height and densities.

Newcastle’s problems with urban regeneration highlights a multiplex of relational processes between the underground and the aboveground (McGuirk, et al., 2016). It was argued by the Lord Mayor of Newcastle, a developer, that Newcastle needed to change thinking around height and density in order to address the cost impost of grouting underground voids.

"Newcastle needs to lift ‘ridiculous’ height restrictions, stop worrying about view corridors to Christ Church Cathedral and embrace high-density living in order to become a truly vibrant city."

(Lord Mayor Geoff McCloy, in Green, 2013, p.8).

In response to costs of grouting, industry advocated for government to provide funds to cover the remediation process (Kirkwood, 2014). Three weeks before the NSW Government election, a $15 million fund to assist private sector grouting costs in Newcastle was announced.

"The legacy of mining voids beneath Newcastle have been an ongoing issue for the city and we’re pleased to help address these voids so Newcastle can continue to grow and flourish."

(Minister for Planning, Rob Stokes, 2015, p.1)

Funding, sourced from the Hunter Infrastructure and Investment Fund and administered by the Hunter Development Corporation and SA NSW, allowed developers to apply for one-off grants to cover the costs of grouting. The scheme was positioned as a catalyst of urban renewal overcoming the main barrier to such renewal in Newcastle and posited to benefit the entire community. The fund was lauded by industry and government agencies responsible for coordinating the regeneration of the inner city. Criticism that it was a “handout” for developers and a reallocation from other community infrastructure was voiced by some in the community and some political parties (primarily the Greens) (Osborne, 2015).
Underground voids drew an additional planning and approval authority into the assemblage. On land within an MSD, SA NSW sets planning guidelines including height, materials and footprint plus assesses and approves development applications. Across the Hunter region, but in inner Newcastle especially, SA NSW is a central planning agency and detailed due diligence enquiries with SA NSW are a pre-requisite prior to undertaking development (Hunter Development Corporation, 2013). For the private development sector, this additional layer of approval was a source of frustration and a barrier to development in the city. Prior to 2014, development approvals from SA NSW had a duration of two years before they lapsed requiring developers to (repeatedly) reapply. A further regulatory layer increased the development lead-in time with additional planning and design processes including geotechnical studies. Lengthier and (therefore) more risky development increased the costs of finance and made it more difficult to obtain. In 2014, the Mine Subsidence Compensation Amendment Bill was passed increasing the duration of approvals to 5 years. Private developers who had long lobbied for these changes were appreciative.

Whether you’re building a family home in a Mine Subsidence District or a commercial office building in the CBD, there will now be one less layer of bureaucracy to deal with… It slashes red tape by no longer requiring two or more MSB approvals during the life of a Local Government development approval. (Fletcher, 2014, p.1)

Coal’s agentic power in influencing aboveground development has been through a multitude of processes. Voids from mining result in subsidence affecting higher density (multistorey) development with additional costs for grouting, additional taxes on these additional costs, increased time and uncertainty in the development process increasing finance costs and additional legislative approval. Tensions between the underground and aboveground mediated through legislative frameworks, which in themselves create further time delays and complexity. Regeneration of Newcastle CBD continues to be influenced by the material element responsible for the original colonial settlement, reflecting the material agency of the underground as a constituent element of the assembling of aboveground urban development.

The next case study highlights the influence of underground voids in shaping manufactured housing estate. In both case studies the underground voids have influenced aboveground development, however a multiplex of different interactions have co-constituted different aboveground land uses.

**Case Study 2: Manufactured Home Estates in Chain Valley Bay and Lake Munmorah**

The NSW Northern Coalfield includes the Hunter region, Newcastle and extends south to the north of the Central Coast LGA. An agglomeration of age-segregated Manufactured Home Estates (MHEs) is noted in the suburbs of Chain Valley Bay and Lake Munmorah on the isthmus between Lake Macquarie and Lake Munmorah (Figure 5). MHEs are a form of retirement community where the residents own a relocatable home and pay site rental to the operator on a fortnightly or monthly basis. This urban built form has been mediated by underground coal, prior to extraction, by the quarantining of development and, post extraction, through interaction with legislation, property values and development densities.

Applying assemblage thinking to an examination of these interactions since the 1960s highlights the messiness and complexities of urban processes. Chain Valley Bay and Lake Munmorah are located above Mannering Colliery GN Seam (Figure 4), part of the NSW Northern Coalfield; this colliery supplied the Munmorah Power Station both of which commenced operations in the 1960s (King & Hodgson, 1995). The location is distant from the main population centres to the north and south; at the time of mining commencement there was piecemeal residential subdivision along with market gardening activities.
MSD proclamation of future mining activities restricted further residential subdivision in the suburbs of Chain Valley Bay and Lake Munmorah (Figure 5) based on the possibility of subsidence. The full extent of subsidence could not be known until the mining had ceased. Thus, allowing permanent structures to be built before the cessation of mining could have resulted in claims for payments for subsidence damage. By restricting aboveground building until the mining had concluded, the cost of this compensation was avoided. This restriction is due to the weight of conventional residential housing. However, it did not restrict caravan parks and MHEs with lighter relocatable homes.

**Figure 5: Cadastral map of Chain Valley Bay showing dryland mine subsidence districts**

Source: Authors, data from Subsidence Advisory NSW
Caravans and relocatable homes are lighter than conventional residential housing and are permitted in areas where there was a potential for subsidence from future mining. A “temporary” activity was permitted as compatible with a situation in which the extent of future subsidence was not known. Caravan parks commenced in the area in the late 1970s (Figure 6) and early 1980s. The land was effectively quarantined from further residential subdivision due to the unknown impact from underground mining and potential subsidence.

In 1986 legislation was changed and permanent residency was permitted in caravan parks and a number of caravan parks fully or partially converted from tourism uses to become MHEs, openly acknowledging what had previously been an ‘illegal’ use (Figure 7).

In a separate process, by the early 1980s, retirees were already moving to the location and seeking accommodation choices. Responding to an ageing population and a growing demand for retirement housing, MHEs were partially or fully operated on an age-segregated basis as a retirement community (Figure 8). A feature of MHE accommodation is its relative affordability compared to permanent detached residential housing in surrounding areas. As such MHEs have appealed to older people who do not have sufficient assets to purchase into permanent housing.

Development of MHEs continued throughout the 1990s and into the 2000’s and they were now being advertised as retirement communities (Figure 9). In Chain Valley Bay, Lake Munmorah and nearby suburbs there are now seven MHEs, with the most recent established in 2006. Using high-resolution aerial photos (Nearmap) it is estimated that these MHEs currently comprise over 1,500 dwellings.
In 2002 mining operations at Mannering Colliery concluded and the site was placed on care and maintenance. Yet, the MHEs remain, demonstrating the ongoing agentic power of coal in co-constituting the aboveground land uses. This case illustrates how an historical restriction, based on an unknown impact from future mining activity, continues to influence the urban built form, even after the coal has been extracted and the effect of mine subsidence is known. Coal’s mediating influence on the urban built form is through interactions with the assemblages of land uses, property values and soil types resulting in an agglomeration of MHEs in this location. Assemblage thinking focuses on the contingent processes and practices by which this land use has continued. MHEs can achieve higher densities (>18 dwellings/hectare) than other local forms of residential housing, including detached residential or a traditional retirement village. Infrastructure costs, road construction, water and sewerage reticulation costs are lower for development of an MHE compared to these other forms of housing. These factors improve the financial feasibility of MHE development compared to conventional residential subdivision or retirement villages.

Property values in the area are relatively low compared to other suburbs in the Central Coast and Lake Macquarie. These lower property values can in part be attributed to the distance to services and amenities and the proximity to the Munmorah and Vales Point Power Stations located immediately to the west. Power stations and associated lands fracture residential subdivisions and impact on surrounding residential values. Lower property values reduce the financial feasibility of developing either general residential or a retirement village. Such feasibility requires sale prices or incoming capital contributions to be greater than the cost of development. This is difficult to achieve when the locality has relatively lower property values. To develop a retirement village at a similar density to an MHE would require a multi-story development. With MSD constraints, medium density development would require expensive grouting which would add to the cost of construction (see the case of inner Newcastle discussed previously). The locality is affected by acid sulphate soils (a further material agent influencing development opportunities) requiring strengthened footings. Such additional costs of construction would be difficult to be recouped with lower incoming capital contributions for retirement village living.

Assemblage thinking can provide critical insight as to how this agglomeration of MHEs formed. This was not a deliberate or strategic planning outcome. Rather, a series of iterative interactions, especially the agentic capacities of underground coal, resulted in the concentration of a peculiar property type in this location. MHE operators responded to a restriction based on the possibility of subsidence from a future mining activity by introducing a property type which fitted in with the material conditions of the site and the regulatory framework which framed development. As part of the wider assemblage, this form of housing also drew together low relatively property values, an ageing population and demand for affordable housing. The location was popular with older people seeking to make a “sea change” relocation. Those seeking cost-effective retirement accommodation supported these developments by purchasing relocatable homes and moving in. Inherent factors in the operational model of MHEs
including higher densities continue to result in this being a more financially viable land use compared to traditional retirement villages.

Materialities approaches and assemblages thinking provide a productive framework for examining how interaction between an underground resource prior to its extraction has resulted in an agglomeration of a particular type of retirement community. Ongoing iterative interactions have occurred between coal in its pre- and post-extracted stage and aboveground legislative frameworks, demographics, soil types and property values. These interactions highlight the emergent nature of materialities and assemblages, the current urban built form is in itself a ‘temporary’ or ‘transient’ land use.

**Conclusion**

Drawing on assemblage thinking help demonstrate the agentic potential of coal, in present and absent states, in shaping urban development assemblages. Coal, through its presence, encouraged extraction and resultant economic activity with associated urban built form. Now, through its absence, it influences and restricts aboveground development. Unpacking the relationships through which demonstrates the multiplicity of relationships between the underground resource and aboveground land uses. In both case studies the aboveground built form is influenced by the additional cost of development in locations which have underground mining. For development above a certain level in both locations, grouting (and additional footings and strengthening) is required. Additional costs of construction result in different outcomes in each location.

The materiality of underground coal interacts with aboveground assemblages of land uses and planning resulting in each location having a different highest and best use and a different response by property developers. In inner Newcastle, while high-rise commercial and residential buildings have long been viewed as essential in the regeneration of the city, the costs and approval processes associated with addressing the influence of underground voids mean that development has been affected. In inner Newcastle developers have gone about accommodating (in some form) the additional cost of construction and seeking further ways to ensure profitability of development. Recent planning and funding decisions by the State Government have attempted to address these concerns and overcome the influence of underground voids on future development. In Chain Valley Bay and Lake Munmorah low density residential in the form of MHEs have emerged as the built form which accommodates the influence of underground mining. Operators of MHEs (developers) elect to forego additional costs associated with construction of permanent dwellings by erecting, lightweight, cheap, relocatable buildings.

In both case studies, coal, through its absence (voids), exerts significant and ongoing agency over the form and functions of the aboveground city. In each location, coal interacts with existing land uses, town planning and property values resulting in different responses and built form. Assemblage thinking offers an approach to examining the multiplicity of relationships and linkages between the underground material and aboveground social, economic and political geographies. The two contrasting case studies demonstrate how similar physical properties of underground voids from coal mining in different locations and through different relationships and linkages results in different responses by developers and ultimately different urban built form.

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