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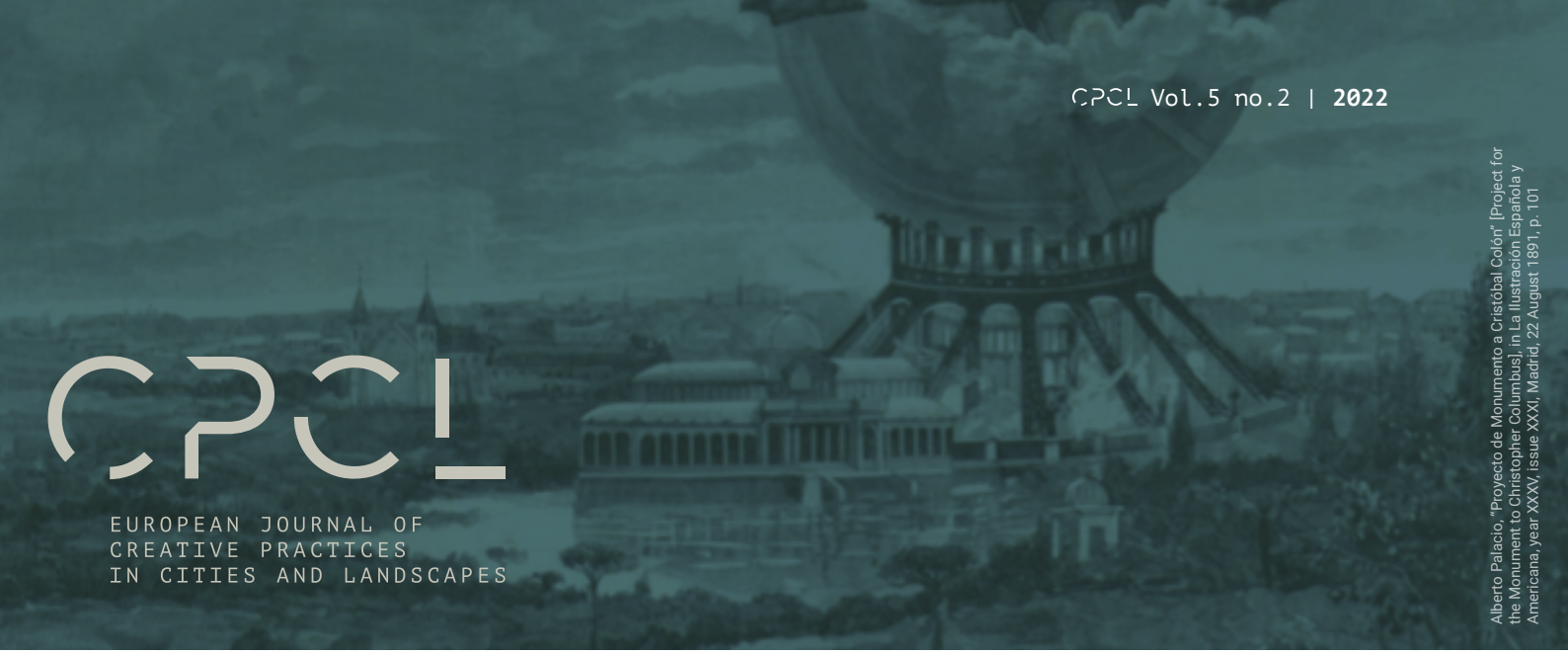

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Alberto Palacio, "Proyecto de Monumento a Cristóbal Colón" [Project for the Monument to Christopher Columbus], in La Ilustración Española y Americana, year XXXV, issue XXXI, Madrid, 22 August 1891, p. 101

MAIN SECTION

Anthropocene as Energy Imaginaries: Fossil Culture between Industrial Revolution and Global Warming

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ABSTRACT
This essay proposes a reading of the Anthropocene from the reconstruction of the energy imaginaries at the beginning of industrial civilisation. The transformations that took place in the energy matrix of productive processes, with the new social and geographical organisation of work derived from the use of fossil fuels, had their correlate in the appearance of a series of discourses and images with a strong ideological component. The emergence of thermodynamic science, based on the observation of the processes of energy transformation, was underpinned by narratives oriented to boost the denigration of subjects who resisted integration into the productive devices of the industrial world. These imaginaries contributed to naturalise a certain worldview, where the universe was assimilated to an immense repository of energy at the service of the West civilisational project, where the development of industry should guarantee the production of exponential wealth. In this context, the imaginaries of energy contributed to constituting a new socio-environmental relationship that, for the last two centuries, has conditioned the cultural development of fossil modernity, while generating eco-systemic effects that are at the origin of the climate crisis.

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KEYWORDS
Anthropocene, Energy Imaginaries, Fossil Culture, Industrial Revolution, Global Warming

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Fossil culture

Ecological awareness of the serious consequences of reaching the planet's biophysical limits is present in public opinion, although not widely. Furthermore, we have yet to see a more precise genealogy of how cultural imaginaries have contributed to a very powerful inertia in understanding the relationship between energy and modernity. To transpose the content of an essay by Martin Heidegger, we could say that fossil modernity is the age of the energetic image of the world (the world is seen as a huge container of energy), but also the age in which a certain implementation of energy has made it easier to perceive the world as an image.[1] Without industrial modernity, for example, the technological development that allows us to have an aerial mapping of the planet, one of the most aesthetically relevant products of the Cold War and the development of which forms the basis of contemporary forms of control and surveillance, would have been unthinkable.

Although the assignment of an industrious value to nature goes back to classical sources, the coincidence of the development of industrial modernity in the nineteenth century, the mass and systematic use of fossil fuels as a primary energy source, and the conclusions of thermodynamic physics was to give new content to this imaginary. The "productivist" link between energy and labour, productivity and social recognition was to find a historical formulation that is still present today. The worker's body, his masculinised image, was to be the catalyst of cosmic energy, the guarantor of the production of social wealth as a prerequisite for collective well-being.

If energy is, first and foremost, a physical reality and, secondly, a cultural and aesthetic construct, in the case of culture the opposite occurs: its construction seems more evident than its materiality. A concept as changeable as that of culture refers in the first place to its discursive character and its relationship with a series of daily habits, subject to relative variability in the many contexts and periods of human history. From this point of view, there is just one physical reality, contrasting with the plurality of cultural formations. Having said that, the fact that the concept of culture is exempt from the tyranny of physical laws such as universal gravitation does not mean that it does not have a material persistence. As Terry Eagleton points out, today it is easier to level a mountain than to put an end to sexism.[2]

Furthermore, the time scales assigned to the natural and the cultural seem to have been interchanged. The gradualism and long duration that we usually associate with geological and natural history have been altered

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1 Martin Heidegger, "The Age of the World Picture," in *Science and the Quest for Reality*, ed. Alfred I. Tauber (London: Palgrave Macmillan, 1997), 70–88.

2 Terry Eagleton, *Culture* (Yale: Yale University Press, 2016).

by the conversion of the civilization that emerged from industrial modernity into a biogeochemical surface force, capable of altering the planet's climatic and ecosystemic reality. Human history turned into a natural agency, which would seem to be precipitously changing the evolution of terrestrial systems. The Anthropocene, a notion proposed in 2000 by Paul Crutzen, Nobel Prize for Chemistry, is the concept that describes this mutation, adopted somewhat uncritically by recent cultural theory.[3] But aside from the scientific discussion on the possibility of delimiting a new geological period in the Earth's history, the concept of the Anthropocene has had a strong impact on the imaginaries of late modernity, turning the relationship with the whole of planetary dynamics into a major geopolitical issue.[4] In this article, I am interested in underlining that this new geopolitical imagination can find precedent in the genesis of fossil modernity and the emergence of a new concept of energy whose cosmovision effects continue to this day.

Ecosystemic transformations in recent decades seem to demonstrate an acceleration of time in contrast with the stranding of utopian imagination that has followed the crisis of emancipatory narratives. Some authors have associated this political and cultural climate with the "slow cancellation of the future", a form of subjectivity that signals the triumph of neoliberal reason, frequently associated with Margaret Thatcher's much-cited statement: "There is no alternative."[5] The fall of the Berlin Wall and the death of communism overlap with the advanced phase of what scientists call the Great Acceleration of the environmental crisis, the period following World War II that definitively divided the paths of civilization and ecological sustainability. The end of History (or at least of a way of understanding it) coincides with the return of nature as a radical force, paradoxically located outside human control due to anthropic activity. At this juncture, nature steps into the avant-garde that modernity had reserved for culture and politics.

Meanwhile, the capacity for mutation that we usually associate with cultural phenomena (and, more specifically, with the protean vertigo of the modernist age) has slowed. The shrinking of cultural innovation (noticeable in areas such as popular music)[6] is further evidence of the resistance to change of a civilization determined to perish due to its inability to respond to the demands of an ongoing ecosocial crisis. Nor have the emancipatory movements of recent decades been able to create shared social imaginaries with an institutional anchor that presents a real alternative to neoliberalism. The appreciation made by Cornelius Castoriadis

3 Paul J. Crutzen and Eugene F. Stoermer, "The Anthropocene," *Global Change Newsletter* 41 (2000): 17-18; Paul J. Crutzen, "Geology of Mankind," *Nature* 415 (2002): 23.

4 Eva Lövbrand, Malin Mobjörk and Rickard Söder, "The Anthropocene and the Geo-political Imagination: Re-writing Earth as Political Space", *Earth System Governance* (4), 2020.

5 Mark Fisher, *Capitalist Realism: Is There No Alternative?* (Alresford: Zero Books, 2009).

6 Mark Fisher, *Ghosts of My Life: Writings on Depression, Hauntology and Lost Futures* (Alresford: Zero Books, 2014).

in the eighties is still valid: "we are not currently witnessing a phase of historical creation, strongly instituted. At best, it is a phase of repetition; at worst—and much more likely—it is a period of historical destruction […]."[7] In most contexts, the global wave of indignation that followed the 2008 crisis was expressed more as a force to depose (directed at the political class and finance) than as an affirmative proposal of institutional imagination with a marked anti-systemic component.

Whereas postmodernity consisted in making it easier to envisage the end of the world than the end of capitalism,[8] the present age barely manages to repress a death drive in which the end of capitalism and the end of the world tend to converge. Faced with the hibernation of the creative imagination, apocalyptic narratives about the ecological crisis are attractive because they channel an escape: a symptom of the need we experience to free ourselves, even at the cost of making things worse, of the mental malaise that grips us. The inclination to generate dystopian images of the future can, in this sense, be interpreted as the emergence of a certain *jouissance* that, while evading repetition of the same, reproduces the collapse that neoliberalism represents for the strategic imagination of systemic alternatives. The melancholic left and catastrophic imagination are the two sides of the same historical sensibility.[9] They represent the fatalism, nihilism and escapism of those who feel overwhelmed by political challenges that they consider too great and that require an unbiased analysis of the political legacy of the twentieth century.

Tenacity facing the change in acquired cultural inertias (consider, for example, the association between free time and mass consumption: the proletarianization of sensibility studied by Bernard Stiegler[10]) reveals that the assignment of a contingent character to cultural formations has an ideological component. It is based on an idealistic contrast between Culture (the mutable life of the spirit) and Nature (seen as a kind of permanent material substrate) that is subject to criticism by theoretical approaches such as decolonial anthropology. This same duality has protected the dominance of modern Man (monopoly holder against the rest of the animal world of the benefits of Culture) over Nature. From this point of view, the Anthropocene represents the consecration of an image of Superman, who, having killed God, embodies in History the will of the universal Spirit to subdue Nature. However, Anthropocene Man and the proletarianization of consumption represent two illusory sides of the same coin. The demiurgic, Promethean omnipotence of the former and the subjugation

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7 Cornelius Castoriadis, *Sujeto y verdad en el mundo histórico-social. Seminarios 1986-1987. La creación humana I* (Buenos Aires: Fondo de Cultura Económica, 2004), 16 -tranlated by the author.

8 Fredric Jameson, "Future City," *New Left Review* 21 (2003): 76.

9 For a different approach to left-wing Marxist melancholy, Enzo Traverso, *Left-Wing Melancholia. Marxism, History and Memory* (New York: Columbia University Press, 2019).

10 Bernard Stiegler, "The Proletarianization of Sensibility," trans. Arne de Boever, Lana Turner. A *Journal of Poetry and Opinion,* 4 (2011): 124-140.

of the latter to an induced culture are conditioned by the history of capital. Anthropocene Man is like a ventriloquist's dummy whose voice is provided by the tyrannical subject of value accumulation. The proletarian consumer is being faced with a commodity endowed with the life of which they feel deprived. In the Anthropocene epoch, arrogance and alienation emerge along with the phantasmagoria of capital's designs.

Fossil capital

The use of fossil fuels does not respond to a historical explanation independent of the confrontation between social classes. As Andreas Malm has shown, the synthesis between the use of coal and the development of machines during early industrial capitalism (particularly the application of the steam engine to the textile industry, with the appearance of the various inventions concerning the spinning machine and the power loom) was socially conditioned.[11] Malm contests modern interpretations based on technological determinism, according to which it is advanced in technology that drives the processes of change in means of production and constitutes social relations. This conviction was summed up in a famous statement by Karl Marx in *The Poverty of Philosophy* (1847), the invective he dedicated to the French revolutionary Pierre-Joseph Proudhon:

> In acquiring new productive forces men change their mode of production; and in changing their mode of production, in changing the way of earning their living, they change all their social relations. The hand mill gives you a society with the feudal lord; the steam-mill society with the industrial capitalist.[12]

In keeping with political Marxism (following the works of Robert Brenner and Ellen Meiksins Wood), Malm turns the tables, pointing out that at the start of industrial modernity, it was, conversely, social struggles that drove technical innovations (the various versions of the steam engine) and the increasing exploitation of fossil fuels as counterrevolutionary responses by the capitalist class. In this interpretation of industrial modernity, the class struggle precedes technological development, rather than the latter itself generating social formations. This is how, from an eco-Marxist viewpoint, Malm describes the political genesis of the Industrial Revolution and fossil capital. His research seeks to demonstrate not only that the business as usual of the history of fossil capitalism has distributed its benefits in an increasingly unequal way, but also that, originally, subordinate life forms have assumed this device of power in a conflictive fashion.

Malm, whose work is situated in the field of environmental history, highlights the ambivalence that the concept of power has in English. This refers

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11 Andreas Malm, Fossil Capital. *The Rise of Steam Power and the Roots of Global Warming* (London: Verso, 2016).

12 Karl Marx, *Collected Works* (Moscow: Progress Publishers, 1975-), V, 43.

both to the force that serves to activate energy transformation processes and to political domination. The generalization of fossil culture was an extremely violent process. Only the dispossession of the livelihoods of traditional communities (closely linked to farming and stock-keeping), based on the enclosure of common land and the urban concentration of growing masses of factory workers, made possible the meeting of the new social division of labour, the application of fossil energy to industry (particularly the textile sector) and the appearance of various versions of the steam engine. These factors provided the basic conditions for the exponential growth rates required by the capitalist economy.

The historical development of the steam engine (an invention attributed to British engineer James Watt) starting in the late eighteenth and continuing into the nineteenth century represented the synthesis of the carbonization of production processes (and the atmosphere) and the genesis of the concept of energy coined by thermodynamic physics. Coal provided the steam engine with a source of energy, optimizing the conversion of heat into motion. Observation of this engineering device in operation was to inspire the creation of the new science of energy. The steam engine was based on scientific foundations that were known long before its industrial reinvention.[13] Handcrafted steam engines had been created in China as early as the fourteenth century. As for coal, the Asian country had also used huge amounts to produce iron in the eleventh.[14] In England, although coal had been increasingly monopolized as an energy source since the sixteenth century (by 1700 it already accounted for half of the consumption), its use had not been developed as a prime mover in industrial production. It was in this industrial context that, given the growing scarcity of timber, the transition from charcoal to mineral coal also occurred.

Parallel to these changes in the energy matrix, a process of social transformation was accelerated, dispossessing the popular communities of their livelihoods. As Karl Polanyi points out, industrialization was a process of technical innovation preceded by a successful plan of social engineering, which unequally ended both pre-capitalist forms of economic domination and the ambivalence of traditional social relations (which combined regressive cultural elements with more supportive community ties).[15] The generalization of the figure of the free worker who sells his labor

13 This is recalled by Kropotkin in his cooperativist rereading of Darwin's evolutionary biology. Kropotkin points out that Watt could have reduced the time spent devising the steam engine if he had had the knowledge accumulated during the Middle Ages by craftsmen in cities such as Florence, Nuremberg and Bruges. And he suggests that it was the dismantling of community ties in the medieval city that prevented this technical innovation from having a political meaning diametrically opposed to the one that characterized the capitalist accumulation processes of the nineteenth century. Piotr Kropotkin, *Mutual Aid. A Factor of Evolution* (Manchester: Extending Horizons Books/Porter Sargent Publishers, 1970).

14 Ramón Fernández Durán and Luis González Reyes, *En la espiral de la energía. Historia de la humanidad desde el papel de la energía* (Madrid: Libros en acción, 2018), I, 273-274.

15 Karl Polanyi, *The Great Transformation: The Political and Economic Origins of Our Time* (Boston: Beacon Press, 2001).

power in exchange for a wage was one product of this event. The need to reduce wages to increase the profits of capital has since prompted the creation of new technologies to replace the workforce. Before this great transformation, the use of servile or slave labor (in the case of the colonies) provided productive processes with endosomatic energy (within the human body), which delayed the need to resort to technical mediation that extracted exosomatic energy (from outside the human body) from the natural environment.

However, that exosomatic energy source could have taken the form of the flow of wind or water rather than coal. Why did this not happen? For Malm, the introduction of the steam engine/fossil fuel binomial had a political rather than a technological justification. Actually, the steam engine powered by fossil fuels was neither more efficient nor cheaper than the energy produced by water mills driven by the current of rivers. As early as in the sixteenth century, the privatization of common land in the British Isles had established a model of appropriation of fossil deposits that was later to favor their systematic exploitation by industrial capitalism. But the decisive elements in the generalization of the use of coal and the steam engine lie elsewhere. The water mill model, applied to the textile industry, brought with it a series of problems. The first was the dispersion of the productive structures across the territory since facilities had to be located where currents were favourable. The centrifugal nature of the hydraulic model contrasted with the centripetal model associated with the use of coal. Unlike flowing water, it could be transported to urban industrial centers. The stockpiling of fossil resources in city space accompanied the geographical densification of the so-called reserve army of labor, used to cut back workers' wages and working conditions. The conjunction of coal and engines gave the capitalist class this advantage in the class struggle. Secondly, the hydraulic model meant that the employer had to meet the basic needs (infrastructure, services, food, etc.) of the workers who lived in these productive colonies, often far from any other centre of the population. Furthermore, this concentration of the labour force favored riots and automatically empowered wage earners, since the owner of the means of production did not have a reserve army like the one generated in big cities.

This pressure on the productivity of the hydraulic model was exacerbated as the Chartists' calls for a ten-hour working day (Ten Hours Act [1847], ending the exploitation of child and female labour) and greater political rights (particularly universal male suffrage) spread throughout British industrial regions. Its legal recognition by Parliament prompted the capitalist class to opt for a combination of fossil fuels and technological innovation. Timetables were incompatible with the variability of river currents, which required production times to be extended depending on the intermittence of the flow. Since the working day restricted the possibility of increased exploitation by means of absolute surplus value (total number of hours worked), coal and the steam engine met the need to intensify

the extraction of surplus value per time unit of social production (relative surplus value). Technological development was used to try to counteract the growing power of the workers in industrial centres and mines who began to combine methods of rioting and the general strike (the first took place during the Plug Plot Riots in 1842, involving coal miners and mill workers),[16] and sabotaging boilers and industrial machinery by flooding coal pits.

Malm points out how this historic victory of the first labour movement prompted a redefinition of the capitalist political economy, leading to a growing abstraction of labour, subjected to exploitation by metric units of time, and a fetishistic transfer of productive capacity from labour force to machinery (reinforcing the power of the bosses over the working class). The decline of formal slavery in the colonies (approved by a decree of 1833) therefore coincided with its silent extension by means of free labour, based on the availability to the employer of the wage-earning workforce, fossil fuels (easier to harness than water) and technological innovation.

The consolidation of fossil industrialism paved the way for a new phase of struggles that enabled the working classes to conquer a series of rights. This dialectic was to continue until World War II. To use Timothy Mitchell's terms, the carbon democracy, based on the material power of miners, extended to the partial empowerment of workers in the workplace.[17] Industrial democracy improved their working conditions and even gave them decision-making capacity as regards the organization of production, provided this did not challenge private ownership of the means of production. The gestation of the social state as a way of containing proletariat revolution is also set against this historical background. Western states sought to counteract this historical inertia after 1945 with the decision to substitute coal with oil as a primary energy source. The extraction of crude oil requires less labour (breaking up collective forms of antagonism) and locates the practice of sabotage beyond the workplace (the objective then becomes the pipeline), at the same time facilitating a geographical relocation of hydrocarbon exploitation, since the semi-liquid condition of oil makes it easier to transport than coal.

The other side of this process of constitution of fossil democracies is the history of fossil colonialism. In addition to increasing the social division of labour and facilitating the integration of markets at international level, the synthesis of the steam engine and coal helped to strengthen the relationship of dependency between the peripheries and the centre of the capitalist world system. Western energy imperialism has often denied the popular classes in other parts of the world the rights that have been conquered in countries of origin. Capitalism has, then, monopolized the

16 The succession of strikes, encouraged by Chartism, began in Staffordshire and later spread to Lancashire, Yorkshire and the Welsh coal mines.

17 Timothy Mitchell, *Carbon Democracy. Political Power in the Age of Oil* (London: Verso, 2011).

reservoirs of cheap (if not unpaid) labour and energy that globally underpin the dynamics of exploitation of wage labour and the coverage, to varying degrees, of social rights.

The coal-iron-steam engine triad also sparked a revolution in the field of transport. The extension of the railways (trains, incidentally, were used to transport coal before passengers) had its imperial complement in the application of the steam engine to the British navy. The *Nemesis*, a warship built partly of iron with a mixed sail and steam navigation system, was the cutting edge of the installation of the fossilist model in the China Sea. The Labuan mines on the island of Borneo then experienced a coal fever previously unknown to its native inhabitants.[18] This is just one more example that the Anthropocene narrative, which sees the industrial burning of fossil fuels as the culmination of a pyromaniac passion beginning with the invention of fire, is a Western artifice. There is no biblical curse that affects the fate of the entire species.

Although the use of coal and colonial dynamics in no way provide a complete, unambiguous explanation of the history of Western fossil democracies, some data inevitably attracts our attention. For example, in the 1840s, the mobilizations and protests that ended with the passing of the Ten Hours Act (1847) and led to the replacement of water mills by the steam engine coincided in time with the biggest infrastructural leap of the railway network and steam navigation, and with the proliferation of colonial settlements in the Far East after the end of the First Opium War (1839-1842). The transformation of coal into capital facilitated the geographical expansion of processes of unpaid appropriation of resources and labour force in the colonies,[19] the increase in the relative exploitation of the salaried population in British factories and the breakdown of the metabolic balance in relations between country and city.

The pollution that began to affect industrial work spaces can be seen from our historical vantage point as a harbinger of what was progressively to spread to the entire planetary atmosphere. For Malm, we are the heirs to that civilizational watershed. Climate change has its historical roots there. Unlike what happened in other past times when the climate influenced the course of history (I am thinking, for example, of the famines caused by climate change during the fall of the Roman Empire), the particularity of global warming is that it is history that has disturbingly influenced the climate. The sky is more than a field of meteorological study: the atmosphere we breathe is also a record of the relationship between fossil fuels and class struggle over the last two centuries.

This interpretation of industrial modernity could be seen as a climatic

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18 Andreas Malm: "Who Lit This Fire? Approaching the History of the Fossil Economy", *Critical Historical Studies* 3, 2 (2016): 215-248.

19 Jason W. Moore, *Capitalism in the Web of Life* (London: Verso, 2015): 134-137.

critique of fossil capitalism, pointing out the need to reverse the dynamics introduced by that historical event: we have to return from stock to flow, directing our steps towards a stage prior to the replacement of water mills by steam engines. From this perspective, Malm's approach seeks to complement the geographical turn of Marxism proposed by authors such as David Harvey with the redefinition of the dimension that is most applicable to him: the historical.

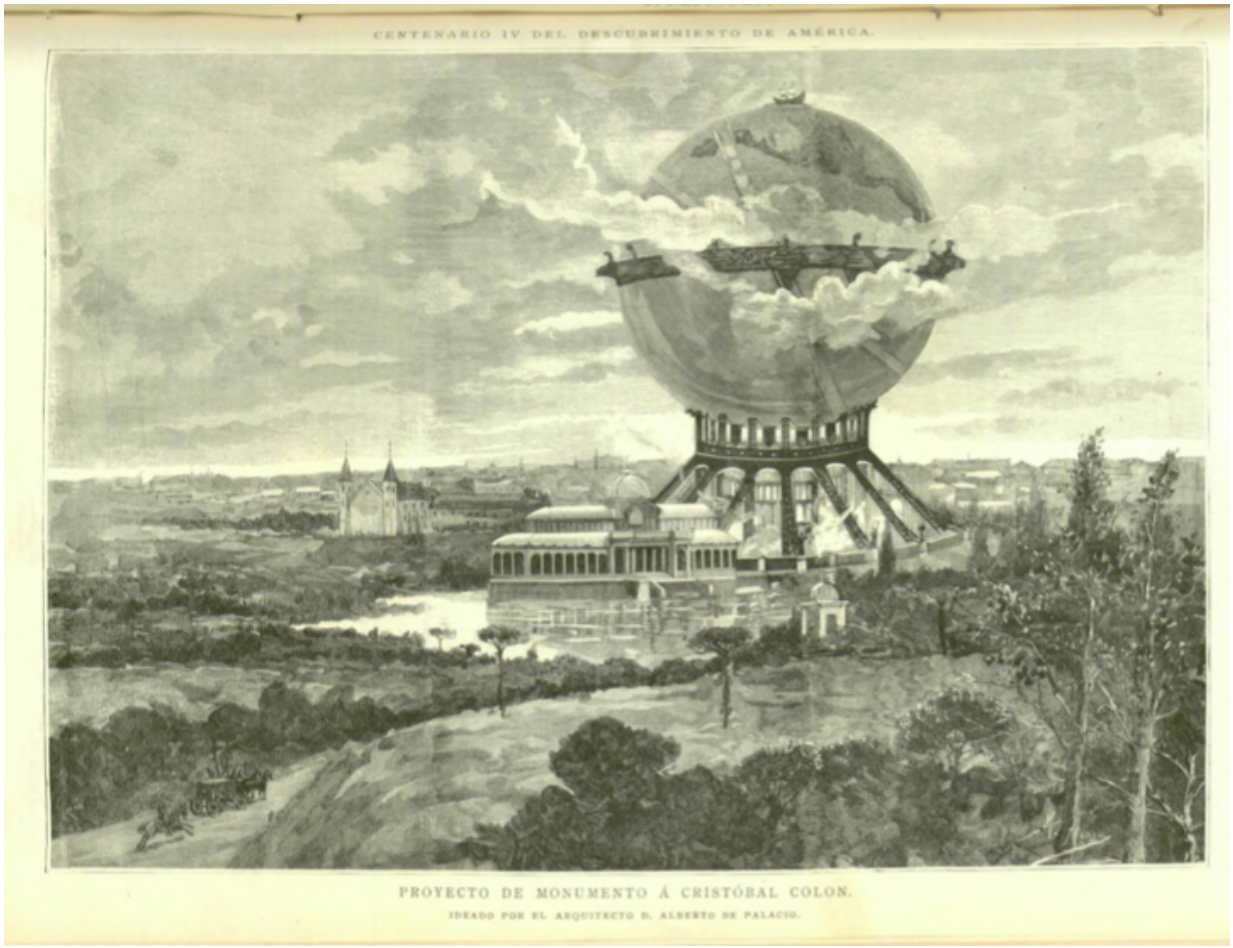

FIG. 1 Alberto Palacio, "Proyecto de Monumento a Cristóbal Colón" [Project for the Monument to Christopher Columbus], in *La Ilustración Española y Americana,* year XXXV, issue XXXI, Madrid, 22 August 1891, p. 101

Fossil imaginaries

The paradox of industrial modernity lies in the fact that the immobility and the geological scale of fossil formations are placed at the service of mobility (of fuels, goods and human beings) that serves to intensify the performance of productive factors and accelerate the pace of history in an unusual way. The solidity of stock literally vanishes into thin air, giving new content to the quote included in the *Communist Manifesto (*1848).[20]

Industrial modernity is precisely that: putting the Earth, on a geological scale, to work. But this would not have been possible without not just

20 Marshall Berman, *All That Is Solid Melts into Air: The Experience of Modernity* (London: Verso, 1983).

the application of the extreme violence that Marx related to the "primitive accumulation of capital", but also the gestation of new cultural imaginaries anchored in the historical and scientific development of the nineteenth century. This is the aspect that I am interested in highlighting: the way in which energy industrialism has been configured as a kind of cultural unconscious of capitalist modernity.

The transformation of Gaia into a colossal steam engine had a visual translation, testifying to the impact of fossil capitalism on cultural imaginaries. The 25 October 1890 issue of *Scientific American* opened with an illustration by Spanish architect Alberto Palacio, who planned the creation of a monument to Christopher Columbus that was never built and was later recovered on the occasion of the Chicago World's Fair (1893), organized to commemorate the fourth centenary of the "Discovery" of America. In it, the Earth was arranged on a pedestal (built not coincidentally of iron, the metal that symbolized industrial progress) and crowned by one of the caravels from Columbus's voyage to the West Indies. The monument, some 300 meters high, was supposed to be taller than the Eiffel Tower. A panoramic walkway was built around the equator, while the black clouds visible in the sky linked the colonial genesis of capitalist modernity with its fossil and industrial prolongation. The inside of the planet contained a characteristic spiral structure associated with the acceleration of historical time, which inspired later, equally productivist designs such as the ramp towards the cosmos that Vladimir Tatlin devised for the Monument to the Third International.

Palacio's image is picked up by Cara New Daggett in her book *The Birth of Energy. Fossil Fuels, Thermodynamics and the Politics of Work* (2019), in which she traces how, as of the mid-nineteenth century, the construction of the energy culture of industrial modernity brought together these three dimensions: the use of fossil fuels, the conclusions of thermodynamic physics and the productivist imaginaries of work.[21] After training at the Barcelona School of Architecture, Palacio was able to travel to Paris, where he became a disciple of Gustave Eiffel and had access to innovations in iron architecture. On his return to Spain in 1883, he applied this knowledge (in collaboration with Ricardo Velázquez Bosco and ceramist Daniel Zuloaga) first in the construction of Velázquez Palace (1883-1884) and, later, in the "Palacio de Cristal" ("crystal palace") (1887), both of them situated in El Retiro Park in Madrid. The latter incorporated more decidedly one of the most advanced typologies of the synthesis of architecture and engineering to characterize the nineteenth century: the combination of iron and glass as a technical resource that enabled the construction of large interior spans with natural lighting.

The origin of this synthesis was a typology that was very thermodynamic

21 Cara New Daggett, *The Birth of Energy. Fossil Fuels, Thermodynamics and the Politics of Work* (Durham/London: Duke University Press, 2019).

in nature: greenhouses, developed in the 1830s and 1840s. Though equally concerned with maximizing the use of heat energy (in this case, the sun), this new architectural typology represented the other face of coal-based steam engines. The clean nature of solar energy and the open spaces of glass architecture contrasted with the dirt and darkness of the industrial factories or the boilers of the railways. Eduardo Prieto describes how the greenhouses, as "solar machines", aspired to generate a kind of climatic utopia in a closed space, using glass structures to concentrate light rays, thereby maintaining a homeothermic constancy inside the rooms.[22]

What I am interested in highlighting is that this climatic utopia, materialized in the benign nature of the air that could be breathed in the greenhouses, was developed alongside the consolidation of the fossil model of exploitation of labour and nature. This presents a kind of dialectical image that contrasts the atmospheric goodness of the greenhouses with the unbreathable smoke of the factories. Its climatic utopia emerges as the other, immaculate face of the greenhouse-effect dystopia that we are experiencing today, of the carbon bond that industrial capitalism was forging between fossilist modernity and global warming.

In addition, greenhouses had a colonial component: they contained botanical species from naturalist expeditions overseas. The climatic utopia reproduced the temperate air of the tropics in the cold heart of the fossil Empire, in an image that was, however, somewhat illusory. Although it was not the only heating system used to be combined with solar action, the greenhouses did resort to the steam engine to consolidate their benign climate. In this respect, the climatic utopia of the greenhouses was also a transparent screen that concealed its fossil dependence.

This typological innovation did advance beyond its initial functionality. The combination of glass and iron (or steel) was to extend to other architectures than the thermal utopia of the greenhouse, in a very important process to understand the cultural gestation of industrial modernity. One of the main architects of the evolution from hothouses to the new glasshouses was Joseph Paxton, who, in 1843, built a prototype in Chatsworth that was replicated and developed. Paxton of course is known for designing Crystal Palace (1851), which was also heated by a steam engine. This crystal palace moved beyond the climatic scale of the greenhouse to become a temple of merchandise and a eulogy of colonialism, displaying products from various points of the globe.

The effect on Marx himself of a visit to the universal exhibition held there is well known, to the point of relating the experience in one of the best-known epigraphs of *Capital* (1867): "The fetishism of commodities and the secret thereof." Marx reflected on the way in which capitalist commodities were arranged before the public's gaze as a contradictory reality:

22 Eduardo Prieto, *Historia medioambiental de la arquitectura* (Madrid: Cátedra, 2019), 104.

their sensible appearance was abstracted from the social relations of production, according them a life of their own that erased all traces of labour. Something similar could be said of the architectural arcadias under glass: their apparent weightlessness and transparency concealed their association with heating machines and the colonial campaigns of fossil capitalism.

The architectural and ideological spirit of the universal exhibitions was later picked up by the event that justified the construction of the Madrid version (less megalomaniac than its London counterpart) of the Crystal Palace. The building of Velázquez Bosco, Zuloaga and Palacio was constructed on the occasion of the Philippine Exposition (1887), an event by means of which a declining, decadent Spanish empire sought to equate itself with the modernity of European nations. In addition to the exhibition of native plants under the glass structure, during the event a Philippine Zoo was created in El Retiro Park, where both the animals that made up the fauna of those islands and their indigenous peoples were placed on view. Colonial fever made no speciesist distinctions between humans and non-humans. Photographs taken during the event, together with the illustration from *Scientific American*, make up a montage stretching in time from the start of the colonial process of appropriating nature, triggered by the conquest of America, to the inability of a southern European nation to board the train of fossil modernity. This superposition of images was created long before these lines were written. An illustration dated 1891 shows the fossil Gaia imagined by Palacio for the tribute to Columbus, against a backdrop of the Madrid skyline (Fig. 1). The lightness and transparency of modern architecture stand out against the image of the Earth turned into a huge fiery engine, its smoke rushing to join the clouds to conceal its fossil origin. The montage featured in 1891 in the journal *La Ilustración Española y Americana*, along with a text by Emilio Castelar, former president of the First Republic, which grandly summed up the perception of the world in which fossil culture was to take its place:

> The centenary of Columbus ascends to the feast of humanity on the wings of fervid universal enthusiasm […] This unexpected creation, invented at a providentially opportune hour, changed the relations of men with other men, as well as the relations of men with the Universe and all Nature, our species seeming like a new species, and another planet our planet […] in the discoverer and in the adventurer, the sketches of the modern industrial working individual were found […] There the soul was redeemed; here Nature is redeemed. We come into possession of our consciousness through one, and through the other we come into possession of our planet.[23]

23 Emilio Castelar, "Proyecto de monumento a Colón, ideado por el ingeniero D. Alberto Palacio," *La Ilustración Española y Americana*, 35, 31 (1891): 99-100.

Thanks to Palacio's visual montage and Castelar's textual passage, we are able to refer the extractivist rationality of modernity back to its colonial origin. Dialoguing with Malm's interpretation of the emergence of the fossil economy, this illumination provides us with precise historical keys to understanding the biogeochemical mutation that shapes the climate, ecological and energy crisis. As opposed to explanations of the Anthropocene that emphasize technical issues (the invention of the steam engine) or anthropological questions (the use of fossil fuels by a species–humans– with an irrepressible tendency to hubris), the colonial dimension of the Capitalocene underscores the need to go back to the historical shift that both the conquest of America and scientific revolutions in areas such as astronomy, cartography and surveying represented for the process of global expansion of the West. Using the term Anthropocene, in this sense, is a way of camouflaging the Eurocentric component of this civilizational logic.[24]

As Donald Worster has recounted, the "discovery of America" glorified by the Palacio´s monument was a central event in forging the imaginaries of abundance that have accompanied the development of modernity to the present day, concealing the perpetuation of inequality and scarcity in the midst of that abundance. Worster has described the conquest of America as a truly historic turning point for human ecology and its conflicting relationship with planetary dynamics.[25] It opened a new era of history that helped to create the modern link between material abundance and freedom, later redefined by liberalism. Associated in 16th century cartography with a "Second Earth", the "discovery" of America freed European societies from the feeling that they had run up against their ecological limits, an anguish that would only disappear from Western imaginaries in the 20th century. One of the main tensions of the Anthropocene is that, while questioning the possibility of finding an untouched territory that promises a new era of abundance, this coexists with the prolongation of the dependence that the daily social reproduction and our desires for personal fulfillment show with a perpetuation of the extractivist and imperial relation that we maintain with Nature (particularly that of the Global South), in which the use of fossil fuels (strongly linked to liberal imaginaries of affluence) has played and continues to play a central role.[26]

Based on the explanation thus far, we can infer that the connection between fossil fuels, coloniality and capitalism had an aesthetic component, in that it was arranged as a civilizing worldview. Whereas Heidegger stressed that modernity was characterized by being the age of the image of the world, I am interested in determining the specific role that the

24 Jason W. Moore, Op. cit., 172-173.

25 Donald Worster, *Shrinking the Earth. The Rise and Decline of American Abundance* (Oxford: Oxford University Press, 2016).

26 Ulrich Brand and Marcus Wissen, *The Imperial Mode of Living. Everyday Life and the Ecological Crisis of Capitalism* (New York: Verso, 2021).

productivist vision of the cosmos played in the unfolding of this historical process. This vision has gone from a delusional idea to realization on an unprecedented geographical scale, conditioning forms of desire and expectations of welfare in advanced capitalist societies. Although it is not the only explanatory variable, it is impossible to understand this transition from the idea to its realization without the appearance of fossil fuels. We are petrocultural beings because dependence on hydrocarbons is inscribed aesthetically (that is, in a sensible way) in what our bodies do and imagine.

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References

Berman, Marshall. *All That Is Solid Melts into Air: The Experience of Modernity*. London: Verso, 1983.

Brand, Ulrich and Wissen, Marcus. *The Imperial Mode of Living. Everyday Life and the Ecological Crisis of Capitalism*. New York: Verso, 2021.

Castelar, Emilio. "Proyecto de monumento a Colón, ideado por el ingeniero D. Alberto Palacio," *La Ilustración Española y Americana* 35, 31 (1891): 99-100

Castoriadis, Cornelius. *Sujeto y verdad en el mundo histórico-social. Seminarios 1986-1987. La creación humana I*. Buenos Aires: Fondo de Cultura Económica, 2004.

Crutzen, Paul J. and Stoermer, Eugene F. "The Anthropocene," *Global Change Newsletter* 41 (2000): 17-18.

Crutzen, Paul J. "Geology of Mankind," *Nature* 415 (2002): 23. https://doi.org/10.1038/415023a

Daggett, Cara New. *The Birth of Energy. Fossil Fuels, Thermodynamics and the Politics of Work.* Durham/ London: Duke University Press, 2019. https://doi.org/10.1215/9781478005346

Eagleton, Terry, *Culture*. Yale: Yale University Press, 2016.

Fernández Durán, Ramón and González Reyes, Luis. *En la espiral de la energía. Historia de la humanidad desde el papel de la energía.* Madrid: Libros en acción, 2018, I.

Fisher, Mark. *Capitalist Realism: Is There No Alternative?* Alresford: Zero Books, 2009.

Fisher, Mark. *Ghosts of My Life: Writings on Depression, Hauntology and Lost Futures.* Alresford: Zero Books, 2014.

Heidegger, Martin. "The Age of the World Picture," in *Science and the Quest for Reality*, edited by Alfred I. Tauber. London: Palgrave Macmillan, 1997.

Jameson, Fredric. "Future City," *New Left Review* 21 (2003): 76.

Kropotkin, Piotr. *Mutual Aid. A Factor of Evolution*. Manchester: Extending Horizons Books/Porter Sargent Publishers, 1970.

Lövbrand, Eva, Mobjörk, Malin and Söder, Rickard "The Anthropocene and the Geo-political Imagination: Re-writing Earth as Political Space", *Earth System Governance* 4, 2020. https://doi.org/10.1016/j.esg.2020.100051

Malm, Andreas. *Fossil Capital. The Rise of Steam Power and the Roots of Global Warming.* London: Verso, 2016.

Malm, Andreas. "Who Lit This Fire? Approaching the History of the Fossil Economy", *Critical Historical Studies* 3, 2 (2016): 215-248. https://doi.org/10.1086/688347

Marx, Karl. *Collected Works.* Moscow: Progress Publishers, 1975-, V.

Mitchell, Timothy. *Carbon Democracy. Political Power in the Age of Oil.* London: Verso, 2011.

Moore, Jason W. *Capitalism in the Web of Life.* London: Verso, 2015.

Polanyi, Karl. *The Great Transformation: The Political and Economic Origins of Our Time.* Boston: Beacon Press, 2001.

Prieto, Eduardo. *Historia medioambiental de la arquitectura.* Madrid: Cátedra, 2019.

Stiegler, Bernard. "The Proletarianization of Sensibility," trans. Arne de Boever, Lana Turner. *A Journal of Poetry and Opinion*, 4 (2011): 124-140.

Traverso, Enzo. Left-Wing Melancholia. *Marxism, History and Memory.* New York: Columbia University Press, 2019.

Worster, Donald, *Shrinking the Earth. The Rise and Decline of American Abundance.* Oxford: Oxford University Press, 2016