

# ATMOSPHERIC VISIONS

## Mirages, methane seeps and ‘clam-monsters’ in the Yellow Sea

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**ABSTRACT:** Mirages seen at sea have a long history of being interpreted as distant islands and mythological realms. Hot and cool pockets of air refracting light can make boats and islands appear as if floating in air. These atmospheric visions can be studied as physical phenomena and as cultural imaginaries, an extension of what Philip Hayward has called the ‘aquapelagic imaginary’. In alliance with Donna Haraway’s mythology-inspired Chthulucene, this article will use the Chinese folklore of the *shen* (蜃) (‘clam-monster’) to consider ecological issues around deepsea mining. In the ancient etiology of the *shen*, its breath was thought responsible for visions of Penglai, the fabled island home to the Eight Immortals believed to lie somewhere in the Yellow Sea. The search for Penglai and its rumored elixir of life has now been supplanted by exploration for methane, a largely untapped fossil fuel seeping up from the ocean floor. The clams and multi-species communities that cluster around these emissions, alongside mythological sea creatures, give shape to changing affects and atmospheres on the horizon.

**KEYWORDS:** atmospheres, mirage, Chinese folklore, *shen*, ecology, deep-sea

### Fleeting visions

*In the cloudy sea off to the east,  
there is emptiness on emptiness,  
where immortal hosts appear and vanish  
in an empty radiance.*

Su Shi, ‘The Ocean Mirage at Deng-zhou’ (Owen, 1996, p. 672)

These lines, taken from a poem by the 10th century Chinese poet Su Shi, were written after his visit to the temple at Deng-zhou to see the ocean mirage for which it was made famous. On his third and final pilgrimage to the viewing platform of the temple he was gifted with a vision of buildings adrift in the sky. In a sign of changing attitudes about such atmospheric phenomena, he draws a self-reflexive parallel between the ephemeral image before him and the fleeting significance of his own poetry (Cheang, 1998). Poets and sailors struggled with what to make of such superior mirages (in which a mirage appears to be located above an actual object) for centuries. The physics of the refracted light that creates them was not clearly laid out until Christiaan Huygen’s *Traité de la Lumière* (‘Treatise on Light’) in 1690; nonetheless, folklore and mythology have continued to offer alternate reasons why distant ships, buildings and even whole islands appear as if floating in the sky.

Deng-zhou, now known as Penglai, a district in the city of Yantai, is positioned at the mouth of the Bohai Sea, itself part of the Yellow Sea that links China to Korea and opens out to the East China Sea, with Japan its eastern boundary. In Chinese mythology, it was said to be the site where the Eight Immortals set off on return to their mythical island home of Penglai, or Horai as it is known in Japanese. This fantasy island plays an out-sized role in the history of Chinese and Japanese art, literature and folklore. Its mountainous landscapes shrouded in mist and fog are a familiar subject in traditional Chinese and Japanese landscape paintings. It is also importantly not a singular island. As Bin Luo and Adam Grydehøj point out, “Chinese paradise was an archipelago, not a single, more-or-less symmetrical island like More’s Utopia or Medieval and Early Modern Europe’s ideal island cities” (2017, p. 34). More than an isolated vision or island, it is perhaps best understood as an assemblage, simultaneously a real place and an unattainable imaginary.

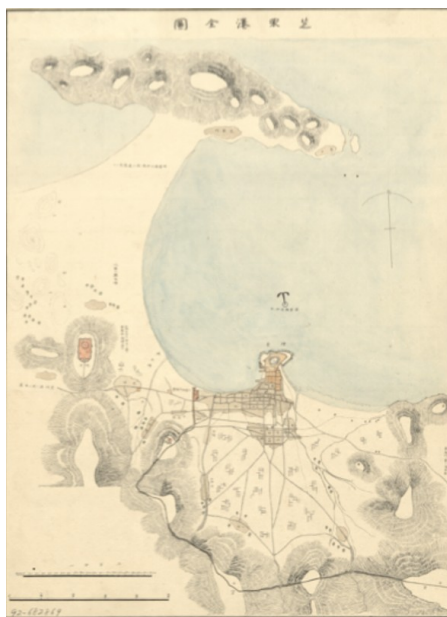


Figure 1 - Zhifu island pictured at top connected by a tombolo to Yantai. (Saitō, M. [1883] - Shifu-Kō Zenzu [Meiji 16]).<sup>1</sup>

The coastal conditions of Yantai have made it particularly predisposed to the formation of superior mirages and the atmospheric phenomena known as advection fog. Advection fog forms when moist air moves over cold waters creating a thick layer of low hanging fog. The resulting atmospheric blanket can make distant landmasses and buildings look as if suspended in clouds. This is similar to the now well-known optical phenomena of superior mirages and their refraction of light through different temperature layers in the atmosphere. Both of these atmospheric conditions form what I propose to call here, atmospheric visions. To name them as such is to declare that there is more at stake than just their physical and optical properties. They have played host to a wide range of mythological creatures and realms, giving shape to a long history of human desire and

<sup>1</sup> Retrieved from the Library of Congress: <https://www.loc.gov/item/92682869/>

aspiration. Whether the search for immortality or the search for new energy reserves, atmospheric visions are an emblem of speculation. They are a theory about what the future might hold. Understood in this way, they are comprised of affects as much as water molecules and other particulate suspended in air. People feel atmospheres, whether they are seen at a distance or experienced up close. Isolation, remoteness, and meteorological transience are all properties associated with the sea and islands. To extend this into the realm of imagined islands in the sky is to consider what is at stake when speculating and desiring distant destinations. Atmospheric visions are more than just fantasy islands, literary tropes, or mythological places meant to be dispelled. New atmospheric visions coalesce at the limits of scientific observation and exploration. They give shape to a future and space we cannot quite see clearly much less grasp. Their ephemeral, fleeting qualities are also an important reminder that they forever remain at this limit.

The distant and diffuse quality of atmospheric visions also makes them particularly hard to find. In the third century BCE, China's first emperor Qin Shi Huang, who was famously obsessed with avoiding his own mortality, travelled to Deng-zhou in search of Penglai and an indigenous plant rumoured to be an elixir of eternal life. His visit to the nearby Zhifu, an offshore island now attached to the mainland, failed to discover any key to immortality (Figure 1). He subsequently commissioned alchemist, shaman and explorer Xu Fu to set out and find the proper island home of the immortals. The first well-funded expedition in 219 BCE is said to have consisted of a few thousand boys and girls and years' worth of food<sup>2</sup> but ultimately failed to reach Penglai. In various rumoured accounts, this young crew were also said to be virgins. Whatever the exact composition of the expedition, its sheer size points to the physical challenges of mounting long sea voyages at that time such that they were only possible with the Emperor's investment (Zheng, 2011). On return from his first failed attempt, Xu Fu complained that his ships' progress had been thwarted by a sea creature. After another failed expedition in 210 BCE Xu Fu never returned to report his findings but some believe that he instead accidentally discovered Japan and became its first emperor.

Whatever Xu Fu's fate, the *Shan hai jing* ('Classics of Mountains and Seas') the earliest compendium of ancient Chinese beliefs and geographic knowledge from the 4th century BCE, recounted stories of offshore islands inhabited by exotic creatures, peoples, and deities (Strassberg, 2002). The Penglai mirage and its origin in the breath of *shen* (蜃), a type of clam or shape-shifting dragon, was not outlined until later. According to the *Liji* ('Book of Rites'), *shen* were thought to be pheasants who entered the sea and transformed into giant clams (1885). The *Bencao Gangmu* ('Compendium of Materia Medica') from 1578 classified the *shen* as a *jiaolong* or water dragon. More recently, Edward H. Schafer in his discussion of this tradition translates them as a kind of 'clam-monster' (1989). Whether clam, dragon or clam-monster, it was understood that on rare occasion the *shen*'s breath would reach out above the sea forming telescoping towers in the sky. More than mere illusion, these floating islands arising from the breath of the *shen* were seen as confirmation of Penglai. The Chinese characters, 海市蜃楼 - *hǎi shì shèn lóu* literally translate as 'sea city, clam tower'. The word for mirage in Japanese, 蜃気楼 - *shinkirō*, also points to this same mollusc-inspired origin story (*shin* being a large clam, *ki* - breath and *ro* - high buildings).

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<sup>2</sup> It is recorded that Xu Fu, after a sacrificial fast and bath, proposed this peculiar composition of the crew as a necessary part of a successful search for these mythical islands (Luo & Grydehøj, 2017, p. 29).

The ancient search for the island paradise of Penglai in the marginal seas of China has now been replaced with exploration for oil and gas reserves. At first glance it would appear that these two pursuits have little to do with one another. What they do share, however, is that both involve speculative theories about the natural world; and in an unexpected twist, the lowly clam is also witness to both these epochs. The clam that was once thought responsible for the mist shrouded visions of eternal life on Penglai is now also witness to ROVS, remotely operated vehicles, scanning the ocean floor in search of cold seeps where methane gas is being slowly released. These seeps indicate where large deposits of natural gas are trapped under the ocean floor. Clams, mussels, and a whole host of symbiotic micro-organisms have been discovered clustering around these nutrient rich emissions. These pockets of life are called chemosynthetic communities because they are bonded by a dependence on chemical sources of energy rather than more common photosynthetic sources from the sun. The prevalence of these oases of life in the otherwise barren benthic zones of the sea has promoted a wave of speculation about their energy and economic potential. Atmospheric phenomena and methane-based ecosystems both hint at some previously unseen world of untold resources. Glimpses of these distant environments drive speculation, exploration and risk.

### Affects and atmospheres

The proliferation of folklore about mirages is confirmation that they are “good to think with” in that classic Levi-Strauss phrasing in which he describes “animals as good to think” – or “good to think with,” as has more commonly been translated (Levi-Strauss, 1964, p. 89; Haddon, 2014). Atmospheric observation presents an object that is always changing. Witnessing a mirage is confirmation that something is happening on the horizon even if it is not always clear what. The depths of the ocean, like distant horizons and offshore islands, similarly provide ample space for the projection of fantasies. The undersea world is full of currents and turbulence, not to mention sea monsters, merfolk and other rumoured and real creatures. Atmospheres and the deepsea, in their relative inaccessibility, beg similar questions about what inhabits them and how we might understand our relationship to these dynamic environments.

Cultural theorists and cultural geographers have contributed to a growing body of scholarship that links atmospheres and affects. It can all sound quite meteorological, with its focus on changing forces, pressures, and cities understood as “roiling maelstroms of affect” (Thrift, 2004, p. 57). For Ben Anderson, “the concept of atmosphere is good to think with because it holds a series of opposites – presence and absence, materiality and ideality, definite and indefinite, singularity and generality – in a relation of tension” (2009, p. 80). Like a mirage, atmospheres possess the odd quality of being both present and absent, tangible and intangible. Mirages are an atmospheric physical expression and also a projection of cultural imagination that goes beyond the physical phenomena.

The “atmospheric turn” that Tonino Griffero (2019) has traced across anthropology, philosophy and geography can be extended into Island Studies and applied to both the physical expanses of sea and sky that surround islands and feelings of ‘islandness’ (Godfrey, 2004; Griffero, 2019). The prevalence of atmospheres and affects in such new scholarship is related to the fact that both are encountered spatially. They are things in the air, that we feel as we have a physical experience in a place not just in an interior subjectivity. Such feelings can be ambient and diffuse; or they can be sharp and shocking like a bolt of lightning that strikes out of the blue. More than just a series of extended metaphors, the

link between affects and atmospheres is a reminder that any theory of either should consider the physical spaces and cultural contexts in which they are encountered. In writing about the design of zoos, Hauskeller & Rice propose that “atmospheric thinking” involves considering what kinds of atmospheres “might be best for all concerned, animal residents as well as visitors and keepers?” (2019, p. 157). Thinking about atmospheres in the context of Island Studies involves thinking ecologically about potentially overlooked interdependence within these multispecies environs.



Figure 2 – ‘The Immortal Island of Penglai’, by Chinese artist Yuan Jiang (1708) (held by the Palace Museum in Beijing).

There are all kinds of atmospheres too; some are condensed and easily felt, like rain and hail, but others are amorphous, hazy and indistinct. Some atmospheres are humid, like Penglai, hung in clouds and mists, obscured and resistant to being taken in all at once. The

affects that accompany them can paradoxically be both elusive and pervasive too. They can surround us and appear on the horizon forever out of reach.



Figure 3 - *Shen* featured in *Gazu Hyakki Yagyō* ("The Illustrated Night Parade of a Hundred Demons") by Toriyama Sekien, 1776.

Writing in an anthropological context about atmospheres, Timothy Choy and Peter Zee (2015), have highlighted how both people and things can be held in a state of suspension. Choy's (2011) work on air pollution and environmental policy in Hong Kong has shown that thinking atmospherically is not just a question of careful measure of airborne particulate; it is also a question of how people feel about these quantities and how they make use of them to mobilise their own environmental and political agendas. The very same atmosphere can create feelings of being unsettled and disturbed or might be imperceptible or insignificant for others. Zee's (2017) work on the anti-desertification campaigns in the Gobi Desert of China traces sand from mere windswept particulate to its role in a whole timeline of state planning and imagined futures. It is notable that some of this same fine-grained desert sand eventually settles on the surface of the Yellow Sea, giving it its name. Atmospheres are not just abstractions or representations; they are physical material that connects different spaces and actors. Writing together, Choy & Zee propose suspension as a structuring set of concerns that "attends to the techniques, experiments, and practices animated by the problems and potentials presented by living as an element among others in the turbulences and volatilities of a ubiquitous air" (Choy & Zee, 2015). There are a series of questions that come with thinking atmospherically: how are things stirred up, how do things settle and accumulate and what impact does this have on others? Air loaded with industrial dust, pollutants and sand can affect people to varying degrees. They can be just a minor

annoyance, or they can scale up to very real medical problems and environmental anxieties about the future. Choy and Zee's ethnographic work reminds us that it is not just the body of an idealised subject that is at stake but also various state, institutional and corporate entities that also experience atmospheres and measure their composition through a different economic and political calculus.

The language of atmospheres is also present in a vein of German language writing that seeks to consider aesthetics not as a Kantian form of critique but instead as an embodied relationship to the world. Atmospheres for Hermann Schmitz, Peter Sloterdijk and Gernot Böhme are physical spaces that link perception and matter. Schmitz's 'felt bodies' position corporeality in 'atmospheric spaces' (Kazig, 2016). Much like the Penglai mirage renders the otherwise invisible visible, Sloterdijk draws attention to the aureoles depicted surrounding saints in classical paintings (2011, p. 150). Similarly, Böhme (2017) uses Benjamin's concept of the aura as a jumping off point to think the body's relationship to space. For Böhme, atmosphere "can only become a concept if one succeeds in accounting for the peculiar intermediate status of atmospheres, between subject and object" (2017, p. 14). The interstitial spaces surrounding mythological and religious figures highlight the important role of atmospheres in blurring the boundaries between individuals and their surroundings. Across these scholars and their eclectic references, atmospheres are shown affecting bodies in the world. They are a reminder that we are inside the world and not just removed observers.

Our embodied relationship to the natural and built worlds around us can be easily forgotten in daily routines and habits. In even the most mundane spaces, however, we can also be struck by the feeling that something is going on that cannot quite be seen. In considering the everyday spaces of America, from West Virginian mining camps to suburban neighbourhoods and daily commutes, Kathleen Stewart speaks of "atmospheric attunements", adjustments made on the fly to changes in the air (2011). These are done with a kind of sixth sense, without instruments of measure other than the feeling that something needs to be done or that something just isn't right. Impromptu micro-adjustments are made; we shift our weight from one foot to the other, try pivoting a bit in a new direction, just enough to set ourselves on a new course to avoid calamity. Whether at sea or walking through a suburban or urban landscape, we are negotiating different atmospheres, staying attuned to different pressures and emerging forces that appear on the horizon, even if only for an instant.

Thinking atmospherically also blurs the boundary of the island. It softens the distinction between physical and imaginary borders. Much like Hayward's concept of the "aquapelagic imaginary" (2018) that extends the island into its surrounding waters, an atmospherically attuned approach involves extending the study of islands into the air and sea around them. These zones, like the island itself, can be studied as physical places and as sites where different and sometimes competing imaginaries stake claims about what lays above and below. Drawing from two key literary works set in the Azores, Vale (2017) has written about the "co-visibility" of the sea, sky and land with humidity and other environmental factors blurring the boundary between them all while creating a unique sense of place. Hayward's (2019) work on sanctuary zones designated around salt diapirs in the Gulf of Mexico provides another example of thinking the shifting boundaries of state designation and cultural imaginaries about subaquatic and subterranean spaces. Island Studies scholarship has also shown that even phantom islands and imaginary archipelagos can have very real political, social and historical impact (Leisemer, 2018). Desires for conquest, discovery and colonisation have been driven by fantasies of virgin land and endless resources. Thinking

atmospherically about these colonial legacies means keeping an eye open for new projects that would seek to expand human reach into distant realms and the new or old rationalisations that are used to justify them.

Islands, like atmospheres, are more than just isolated destinations, material resources or idyllic representations. They are ecosystems, spheres of influence and sites of collision between competing systems: of the colonial and indigenous, the geologic and oceanic, the gaseous and the liquid. To study these environs involves thinking about their relationship to wider networks and assemblages, both real and imagined. This involves laying bare underlying fantasies about islands and hidden resources that have driven a long history of colonial conquest and global mobility. Thinking atmospherically about all this involves keeping in mind how bodies experience the world (Griffero & Tedeschini, 2019). It is not just a question of real and imaginary worlds and how we may or may not feel about them; it is also about the other species and bodies in these worlds and how they touch, bump into and live off of one another.

Understanding atmospheres also involves consideration of how they are made visible, how they are measured and how they are tracked. The optics of atmospheres are also cultural. Backyard fireworks and roadside flares can make atmospheres briefly visible. They might trumpet in a new year or signal an accident ahead but in other moments they are forms of protest, signs of resistance and even war. As Sloterdijk (2009) has shown, airspace itself has become a battleground. Airs and airspace, like coast lines and offshore exclusion zones, are a reminder of the difficulty of marking clear borders. This is not just a question of national borders but also boundaries between the human and the animal, boundaries between the land and sea. Environmentalist discourses have also staked a claim on the atmosphere. Atmospheres are subjected to competing interpretations and motivations. The measure of global warming and ozone by scientists makes a global atmosphere visible as an endangered habitat. Atmospheres can transform something invisible into a feeling of precarity and environmental dread.

Atmospheres also bring with them a question of time. There is the geological time frame of the Anthropocene and all the other epochs that have come before us. There is also a speculative time frame of what things might be on the horizon in the future. Atmospheres work across both, they are visible in the material record of the Earth and they exist in this future time of what may come. Seen on the horizon, they can draw us forward or push us back in retreat. And like a ship's log, it can feel like our only recourse is to just jot down the changes in the weather, all while attempting cautiously to plot the safest course forward. Instruments and robotics, soundings and submersibles can be used to chart a way forward, a way to make the oceans' depths visible. Where the limits of vision and mobility run out, imagination enters and folklore confirms that monsters lie in wait. The ocean that once worried sailors with its threat of sea monsters now poses other worries in the form of global warming and potentially catastrophic climate change. To think atmospheres and the deepsea is much like the contemplation of a mirage. It involves pursuit of a place that might never be reached but that, nonetheless, motivates very real desires and fears.

#### Cataloguing anomalies

Well before modern scientific taxonomies, mythological origin stories were an early catalogue of the natural world. Such folk etiologies were particularly drawn to anomalies, atmospheric disturbances and sub-aquatic oddities that provided a wealth of exceptions



that needed to be explained. Whether through stories of divine intervention or sea monsters, these folk tales made rare, naturally occurring phenomena understandable as part of a larger interconnected world.

Of particular interest in many early stories about the natural world are animals and creatures that transition from one form to another or from one environment to another. The shape-shifting transmogrification of the *shen* outlined in the *Shan hai jing* was thought present in other winged creatures too. As they grew older, pheasants, swallows and bats were believed to transform into smaller molluscs like mussels and oysters. Prior to any greater understanding of migration, this ancient belief gave a logical explanation for the seasonal disappearance of birds. A similar theory about swallows was also ventured by Aristotle in his *Historia Animalium* from the 4th century BCE (1862). He speculated that some birds turned into other species in his own attempt to account for their absence. Later Olaus Magnus, in *Historia de gentibus septentrionalibus* (1555), suggested that swallows hibernated underwater, echoing the same air-to-sea journey chronicled in the life of the *shen*. Rather than ancient misconceptions, these examples of parallel thinking suggest that understanding of the natural world was informed by studied observation and speculation.

The *shen* were also believed to be a type of dragon (*long* in Chinese), themselves imbued with the power to take on many different forms and to swim equally through sea and air. Some have theorised that the Chinese alligator was the natural inspiration for these mythological creatures (Fauvel, 1879). The wild habitat of the Chinese alligator (*Alligator sinensis*) is now limited to the Yangtze River but at one time they were found in the rivers that feed into the Yellow Sea. Their numbers in the wild have been greatly reduced due to rice cultivation, the flooding of the Yangtze and other changes to their ecosystem. The *long* were also thought responsible for the coming of the rainy season in the spring. This theorised relationship to the atmosphere had to do with their disappearance during winter months and re-emergence in the spring with the seasonal rains. Speculation about the causal relationships between mythological sea creatures and the weather presages the kinds of questions that still circulate around emergent ecological relationships between human activity, animals and climate change.

Chinese and later European medieval bestiaries collected anecdotal accounts of animals, both real and imaginary, in an attempt to lay out their interrelationships in encyclopaedic forms. These early accounts of anomalies can also be read as manifestations of fears about the unknown. Sea and land-based monsters also gave a face to the very real threats of a natural world that had yet to be more fully documented, much less understood. In Europe, such catalogues of monsters were informed by fears about the East in general. The medieval bestiary *Marvels of the East*, from around 1000 AD, began a long history of orientalist fixation with threats perceived to exist in the Middle East and North Africa (Said, 1978). In this graphic catalogue, tribes of people with long ears, giants and cannibals were recorded alongside mythical monsters from dragons to phoenixes. Trade and colonial projects further exacerbated this process of othering and compartmentalising difference into categories of the monstrous and strange.

An orientalist bias is also present in European responses to mirages. In his book, *The waterless sea: A curious history of mirages* (2018). Christopher Pinney compiles different cultural histories of the mirage. His comparative approach and the history he studies could both be described as a kind of mirrored catoptric box “through which anomalous phenomena are placed with a matrix of other similar observations in order to establish similarities and differences” (Pinney, 2018, p. 21). His research highlights European

suspicion of illusion and distrust of the East in general. Seen through this lens, the mirage confirms that images cannot be trusted because they can be distorted and exaggerated. European travelers approached mirages of water in deserts with particular suspicion. Pinney shows how this extended to a broader belief that Eastern civilizations, cities, and peoples were not informed by a European notion of enlightenment and bureaucratic transparency. In the case of China and Japan, on the other hand, the mirage of paradise emerging from the *shen* promised something other than illusion. The mirage, in this context, was more a confirmation of the existence of a mythological realm and not a trick or trap to be avoided.

Cross-cultural comparisons, whether of mirages or monsters can, of course, lead to all kinds of problems of translation and possible false equivalence. Cultural interpretations of mirages vary even if the images themselves do not. In Italy, mirages were seen as the result of fairies or sirens, like the Fata Morgana in the Straits of Messina.<sup>3</sup> For sailors at sea, mirages have confirmed a whole host of legends and beliefs in ill omens such as the Flying Dutchman, the merchant ship famously lost off the Cape of Good Hope. Legend has it that this phantom ship haunts sailors with the threat of severe bad weather on the horizon. And off the coast of Kyushu in Japan, multiple fire mirages called *Shiranui* (不知火) ('unknown fire'), were thought to be the lights of the Dragon God. *Shen* are more than just natural oddities and isolated theories of optical phenomena. They are linked to an ecology of beings and creatures that were thought to populate the sea.

The study of sea monsters and other mythological creatures has the challenge of translating these beliefs across cultures. In the emerging field of monster studies, the monster is often a figure of the misunderstood, a warning or threat, embodied in some strange form. Collections like *Monster anthropology in Australasia and beyond* (Musharbash & Henning Presterudstuen [Eds.], 2014) underline the challenges of bringing, "analyses of locally specific monsters into conversation with research more commonly concerned with vampires, werewolves, Frankensteinian creations, and other members of the folkloristic and textual monster genealogies of the West." (Musharbash 2014, p. 2). If the *shen* are monsters, what fears and anxieties might they embody? What might they be able to teach us about the link between the undersea world they inhabit and atmospheric visions seen floating on the horizon?

### Giant clams and other monsters

The mirage's optical doubling of distant ships and landmasses is similar to the classical theory that sea life was a double of land-based life. In his *Natural History*, Pliny "states that the liquid and nutrient-rich environment of the sea generates many monstrosities, including counterparts of everything we find on land" (Hendriks, 2018, p. 127). The sea held all kinds of variants and monstrosities lying in wait just beneath the surface. Our understanding of the sea and sea life has expanded since these early speculations but it remains partial. The monstrous threats of the ocean, sea-serpents and kraken, have also morphed from fear of a specific creature, imagined or real, into a more diffuse concern for climate change and ecological disaster. For many coastal communities warming ocean

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<sup>3</sup> Fata Morgana is the Italian name for Morgan le Fay (meaning 'Morgan the Fairy' in English). In Arthurian legend King Arthur's sister Morgan was believed to be a powerful sorceress who could change shape and was ruler of the mythical island of Avalon. Norman conquest in the 10th century brought these legends to Southern Italy where they came to be associated with the superior mirages frequently seen in the Strait of Messina between the island of Sicily and mainland Italy.

temperatures, arctic ice and snow melt and potential sea rise look much more menacing than the jaws or tentacles of any giant sea monster.

Donna Haraway's project of *Staying with the trouble: Making kin in the Chthulucene* (2016) is an engaged stance with the difficulties of the present and a resistance to the speculative loops of the future and past. Her proposal for a Chthulucene seeks to correct a humancentric bias in the theorisation of the Anthropocene (Crutzen, 2002). She troubles things by communing with animals and mythological figures that were once feared. Her Chthulucene has less to do with H.P. Lovecraft's (1928) monstrous Cthulhu (1928) than it does with the Greek *Kthonios*, meaning 'of the Earth' (Haraway 2016). She revels in what she calls "tentacular thinking." Together with the tendrils of Medusa, gorgons and their even earlier basis in Sumerian riverine mythology, she writes of a sensing, feeling subject that is multiple and attached. Haraway shows that ancient mythology and fables can provide new ways of thinking and being in the world that differ from classical human-centric narratives.

*Shen* and clams don't have tentacles, but they can tell us different stories about the world. To be with a clam deep in the ocean is to consider what it would be like to live forever in one spot, to never see the sun and to live for hundreds of years. In 2006, researchers off the coast of Iceland collected samples of clams and on counting their growth, recorded in lines on their shells, they discovered that one of the clams they had dredged up was the oldest living, non-colonial, thing in the world (Farrar, 2007). This particular Ocean Quahog (*Arctica islandica*) was calculated to have been born in 1499. The initial name given to the clam by the British press was 'Ming' because it was born during the Ming dynasty in China. Icelandic researchers subsequently renamed it *Hafrún*, an Icelandic female name that means 'the mystery of the ocean.' This anecdote is more important than just an interesting bit of science trivia. With a bit of imagination, we can imagine *Hafrún's* life there deep in the cold waters of the north Atlantic and try to feel what life was like living for 500 years in the dark.

Speculations about the life of a clam are flights of fancy. Haraway would call them "scientific fabulations," a distinction she makes to avoid the already populated body of literary criticism around speculative fiction (2013). Like folklore and fables, her 'SF' stories are full of animals, multispecies symbiotic relationships and hidden worlds. These stories have radical potential to take us outside of ourselves, to challenge our assumptions about the boundaries between bodies, environments and our own tenuous place in the world. This is not a process of just making things up or ignoring science. It is instead about taking the facts and insights of science and running with them. Unlike much speculative fiction, Haraway's multiple re-namings of 'SF' – what she has at times called, "Science Fiction, Speculative Fabulation, String Figures, and So Far" – are not only about some possible future; they are about a complicated now (Haraway, 2013). Stories about methane eating microbes and the deepsea communities that form around them have the added value of making the immediate stakes of climate change visible. Even if one is already vividly aware of the precarity of the world, learning from the monsters of the deep is better than being scared by them.

The study of monsters and folklore also involves the study of their transformation over time. As film and television series testify, vampires and werewolves can adapt and find new homes in the modern world. And as we know from advertising, they can also sell cereal and become friendly ghosts, costumed characters that are no longer meant to scare. In the case of the *kappa* in Japanese folklore, it transformed from "a malicious and unpleasant water

deity into harmless lovable mascot” (Foster, 1998, p. 1). Foster refers to this shift as a change from folklore to folklorism that involves traditional folk elements being used out of context or with newly invented narratives attached to them. Like islands and atmospheres, monsters are ‘good to think.’ They do so many things. Like the clam and *shen*, they are also best understood not as isolated oddities but rather as part of an evolving continuum of cultural traditions, speculative theories and changing attitudes.

So, what then has happened to the *shen* or clam-monster? How has it evolved over time? It was there in the 19th century ukiyo-e wood block prints of Utagawa Kunisada and it still shows up in *Naruto*, *Pokémon* and a handful of other anime and manga. Variations of it can be seen in the multitude of dragons, sea monsters and shapeshifters that populate video games and film. The giant clam, *Tridacna gigas*, might be the closest to a living embodiment of these mythological sea creatures. In Hollywood adventure films of a certain era, giant clams were presented as a recurring surprise threat. In films like *White shadows in the South Seas* (Willard Van Dyke, 1928) and *Wake of the Red Witch* (Edward Ludwig, 1948) unsuspecting divers ran the fatal risk of getting a foot or stray limb caught inside the jaw-like shell of a giant clam. Like quicksand, it became a movie trope, a potential danger to pearl divers and ocean swimmers in the tropics. Both embodied the danger of nature laying in wait ready to ensnare hapless adventurers in an instant. In reality, the muscles of these largest of the bivalve molluscs do not move fast enough to cause any real threat. Their slow closing retraction is simply triggered by photosensitive receptors and has little to do with any blood lust.

The giant clam also made an appearance in Jules Verne’s *Twenty Thousand Leagues Under the Sea* (1870) (Figure 4). During a tour of an undersea cave, Captain Nemo points out “an oyster of extraordinary dimensions, a titanic giant clam, a holy-water font that could have held a whole lake, a basin more than two meters wide, hence even bigger than the one adorning the Nautilus’s lounge” (Verne, 1991, p. 191). The clam here is a decorative object, something to be caught and brought inside as a piece of furniture. As the story continues, Nemo proceeds to rather dramatically wedge his dagger between the clam’s shell and pull out an equally giant pearl. He had been knowingly cultivating the pearl so that, “with each passing year the mollusc’s secretions added new concentric layers” to this “wonderful fruit of nature” (Verne, 1991, p. 191). Cultivated pearls are now commonplace and traditional pearl diving is no longer common practice; nonetheless, the pearl and giant clam still occupy a place in the cultural imagination about the treasures and dangers that can be found in the ocean.

Giant clams, in fact, do not live 20,000 leagues under the sea. They are commonly found close to the surface, just some 20 meters below. This proximity to the surface has to do with their symbiotic relationship with *zooxanthellae* which are a kind of single cell algae that produce nutrients that benefit the clam. In turn, through the opening and closing of its shell, the clam provides a kind of adaptable shelter that regulates the amount of light that reaches the *zooxanthellae*. Through this symbiotic partnership the mantle of giant clams can produce iridescent colours that bend light just as light rays are bent passing through different layers of the atmosphere to form mirages. This multispecies story is yet again a reminder that the monsters of the deep do not exist in isolation. They are part of a whole ecosystem of complex relationships, whatever the fantastical stories humans may have told about them.



Figure 4 – Illustration from Jules Verne's *Twenty Thousand Leagues Under the Sea* (1866-69) by Neuville and Riou.

### Buried treasure

Just like the sea monsters that guard them in folklore and fables, treasure too looks different in different times and cultures. Islands, however, would appear to have remained a persistent location for hiding fortunes and buried treasure. Because of their perceived remoteness and relative inaccessibility from Eurocentric frames of reference, Pacific islands in 19th century children's and popular literature catered to a whole host of fantasies. These adventure narratives confirmed that islands hide buried treasure, it was there on the map, 'x marks the spot'. Islands now also house retirement fantasies of leisure, success and seclusion. Financial capital is also buried in hidden offshore islands, in tax shelters and anonymous accounts. The island and its buried treasures are both physical places and part of evolving cultural imaginaries.

Pearls, giant clams, and people's fantasies about them have fuelled a whole host of stories and folklore. In addition to the mist shrouded mountains of Penglai, with its promise of eternal life, pearls, like the infamous Lao Tzu Pearl taken from a giant clam, continue to fuel speculation about buried treasure in the sea. The shells of the *Tridacna* themselves have also become a commodity that is harvested, often illegally, as a replacement for the diminished availability of the ivory used in traditional Chinese carvings. Whether pearls, its own shells or immortality the humble clam would appear to offer a whole host of unique treasures.

Buried treasure now also extends to the mineral and natural gas resources buried beneath the ocean floor. The movement of tectonic plates and undersea volcanoes cause gaseous emissions that link the deepsea to the surface. Organic matter compressed over millennia on the ocean floor have created huge pockets of natural gas. Because of their location, these deposits were not discovered in their naturally occurring form until the 1960s in Siberia. For a world still dependent on fossil fuels they are a new kind of buried treasure.

The search for material resources in the sea can no longer rely on folded antique treasure maps; they have been replaced by remote imaging, lidar and subaquatic drones. These technologies have brought a new ability to scour the recesses of the ocean floor in search of methane bubbles that indicate where deposits of natural gas can be found (Figure 5). Unlike more volatile thermal vents, these cold seeps are typically steadier, longer lasting emissions. In addition to this gaseous form, methane is also found in a solid compound composed of methane gas and water called methane hydrate. In the right conditions, methane gas becomes trapped within a crystalline structure of water molecules forming what has been called 'flammable ice' due to its ice-like appearance and ability to be lit on fire. Deposits of this highly unstable material are sensitive to pressure and temperature changes so can only be found buried in specific zones of the ocean floor. The very inaccessibility of much of the methane gas and the volatile nature of the methane hydrate deposits makes them both particularly difficult to extract. For energy hungry countries and industries this means that a huge reservoir of previously untapped fossil fuel lies, tantalisingly, in wait just offshore.

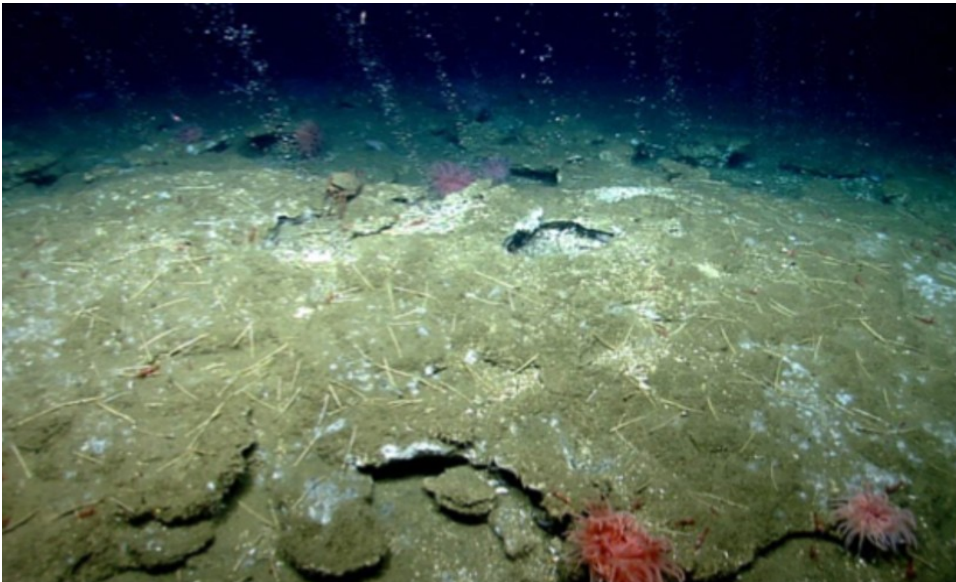


Figure 5 - Methane bubbles out of the seafloor (NOAA Office of Ocean Exploration and Research, CC BY 2.0).

This potential energy source has become a particular target for deepsea mining off the coasts of Japan and China. Retrieving this natural gas is a costly process but the promise of a new swath of energy reserves has driven investment and competition. Its discovery along the edge of the continental shelf in unexpected areas also means that it may be more prevalent than initially thought (Sharke et al, 2014). Nutrients from these cold seeps also importantly support entire ecosystems that would not otherwise be possible deep in the dark reaches of the ocean. Clusters of clams, mussels and tubeworms flourish in the moderate temperatures of these cold seeps. The prospect of mining methane from the ocean floor is not just a story about potential endangerment to deepsea ecosystems. It is not some innocent treasure that promises a solution to global energy needs. Methane is a greenhouse gas that when released into the atmosphere has a potential to exacerbate global

warming. While found in less proportion in the atmosphere than carbon dioxide, it has a stronger ability to trap heat. For this reason, any additional increase of methane in the atmosphere has a huge potential to impact the global climate. As temperatures rise in the world's oceans, there could also be an exponential speed up as more and more methane gas is destabilised and released into the earth's atmosphere.

Most of the bubbles from methane emission never reach the surface as they dissolve into the ocean along the way. Nonetheless, it is tempting to imagine these methane bubbles as the *shen's* breath. Perhaps even Xu Fu's encounter with a sea monster was just such a natural phenomenon. The link between undersea gas and the refracted images of the mirage has not proven to have any scientific validity but this mythological theory did get something right. It predicted the interrelated worlds of the sea and sky. And just as the pheasant was believed to transform into a clam, the volatile transformation of methane hydrate solids into a gas reminds us that the world is always changing.

### Living on air

Discovery of the chemosynthetic communities living around cold seeps in the Gulf of Mexico off the coast of Florida in 1983 was the first time something other than detrimental effects of gas leaks were considered (Paull et al, 1984). These naturally occurring multispecies communities can prompt a reconsideration of the potential for life in post-industrial landscapes and other areas where human waste materials, irrigation runoff, and chemical dumping have radically altered the environment. As Shapiro and Kirksey put it in their multispecies ethnography, there is a need to "think with care about chemosociality - the longstanding relationships and emergent social forms that arise from chemical exposures and dependencies" (2017, p. 484). Kirksey's own work on green frogs in the post-industrial wastelands of Sydney's Olympic Park and the BK BioReactor project mapping microbes in the Gowanus Canal in Brooklyn, New York suggest that sites previously thought barren are rich with examples of emergent life that has not been previously studied (Kirksey, 2020; Martin, 2016). The questions here are not just biological but also cultural and political: how do researchers, commercial interests and local communities safely engage with and potentially live with these chemical communities?

There is a conscious intention in such research to reframe from anthropocentric exceptionalism in favor of thinking multispecies assemblages (Dransart, 2013; Kirksey, 2014). Whether in research around domestic companion species or the microbial biomes of postindustrial landscapes, linkages between different species also extend to chemosocial relationships, assemblages formed by a shared chemical connection. Our dependence on fossil fuels links

us with the clam and other species living around cold seeps. Unexpected chemical relationships are also newly being discovered as in the case of Tanner crabs (*Chionoecetes bairdi*). Sold commercially as 'snow crabs,' this heavily fished species has been seen clustering around methane seeps and feeding on methanotrophs that act as a food chain intermediary, a way to convert the energy of the methane into a consumable food source (Seabrook et al, 2019). In fact, there are a variety of clams and tube worms that have adapted to harbour methane eating bacteria in a chemosymbiotic relationships. These methanotrophic bacterial symbionts can teach us a lesson about mutually beneficial support.

If we consider the connections that link us to such deepsea communities it quickly becomes apparent that we are dependent on scientists, remote sensing drones, multibeam sonar and other imaging technologies attached to research vessels and funding proposals to even make them visible at all. These technologies and research projects are in turn also tied to national interests and ambitions to achieve energy independence in a competitive market of depleting fossil fuels and the race to develop domestic energy sources. Any one person's connection to the deepsea is dependent on this chain of science, technology and state and corporate interest. This is different from the kind of post-industrial landscapes that we can find directly in the neighbourhoods of so many cities. The very distance and inaccessibility of the deepsea makes it a different kind of atmosphere to which to be attuned. Buried so deep at sea, it can be hard to even fathom the sheer size of the areas being considered for future deepsea mining much less the impact of future mining.

### Making air visible

In Guangzhou in 2015 a mirage was seen by thousands of local residents. Video footage appeared on local television and circulated online, leading to speculation about the origin of this atmospheric phenomenon and associated questions about the validity of the footage itself. Online commentators ascribed the cause of the mirage to a whole host of different powerful forces. Whether the conspiratorial attribution was to NASA, Google or the Chinese media, all of this speculation reveals a distrust in the simplest of natural justifications. A distrust in the integrity of the image has developed alongside the development of new ways to manipulate, reproduce and distribute images. Questions about authenticity and the origin of an image can lead to gross and wild speculation, conspiracy theories about unseen forces and clandestine powers secretly controlling the images we consume and the very atmosphere around us.

One of the difficulties of environmental discourse has been how to make atmospheric changes visible, how to make global warming seen and believed. Glacier falls, flooding and mega-storms are confirmation of changes happening to global ecosystems but for some the atmosphere remains too intangible for them to believe. Changes to the sea are also too easily ignored by publics indifferent to changes happening beneath the surface. While oil rigs and offshore drilling platforms seen from shore can look like distant cities floating on the horizon; it is only in catastrophe or collapse that these technologies and infrastructures clearly become visible as a threat to human and marine life. In fact, the project of making air visible was a challenge for early scientists. They experimented with different ways to confirm its very existence. The discovery of colourless, odourless methane gas drew on folk knowledge and rumour as much as studied lab experimentation. The same methane that spews from beneath the sea also escapes from marshes, swamps and lakes where plant matter has been compressed and decomposing for millennia. When ignited by spontaneous composition or stray lighting, the resulting flames presented an odd spectacle for early observers. Benjamin Franklin wrote about his first encounter with it in a swamp in Pennsylvania; but he never wrote it up as a scientific experiment or paper (Priestly, 1774). Inspired by the accounts he had read from Franklin, Alessandro Volta discovered the same flammable swamp gas on the shores of Lake Maggiore in Italy (Volta, 1777). His subsequent lab experiments confirmed the existence of methane. In his *Experiments and observations on different kinds of airs* (1774), Joseph Priestley also experimented with different kinds of air and the problem of seeing them. Colourless, odourless gases had to be confirmed by some other means than the senses of sight and smell privileged by the Enlightenment. The



emission of plants and decaying bodies were confirmation that air was doing things, even if we can't see it.

The very real threat presented by a global rise in atmospheric methane gas has been presented at times as a kind of comedic fart joke due to the large percentage contributed by industrial cattle farming and cow flatulence. Less commonly discussed is the fact that – along with cows – mussels, clams and other molluscs also emit methane as a result of their digestive process (Bonaglia et al, 2017). These other animal sources of methane, combined with the large masses of it at the bottom of the sea, have remained largely outside of the public imagination. Methane is only recently appearing on the horizon as a source of new energy and as an environmental threat.

### Deepsea mining

The stakeholders of the energy industry and national governments keen on finding new domestic sources of energy are driving the development of deepsea mining technology. Concern and anxiety are already in the air around fossil fuels and the effects of methane released into the atmosphere. In considering the specific case of deepsea mining we need to ask what specific histories, cultural imaginaries and practical concerns come together when we think about the deepsea.

For now, deepsea mining is largely a speculative industry interested in extracting precious metals and rare earth materials from the sea floor. In addition to the methane gas already discussed, manganese nodules and other rare earth materials are found in large deposits on the sea floor. While the amount of potential precious materials is large, the scale of the ocean floor is even more immense. The potential terrain for undersea mining is so massive that it begs questions about how to efficiently mine it. The vast scale also raises questions around ownership, international free trade zones and national interests. On top of all this is the massive potential for destruction and disturbance of the sea floor and the ocean itself (Washburn et al, 2019). Mining companies are proposing systems that would scour the seafloor with the equivalent of giant industrial vacuum cleaners that would directly destroy the environments in their path while leaving huge plumes of particulate in their wake. The extracted mud and desired materials would be pumped to the surface and any excess material pumped right back into the middle of the ocean. The DISCOL, DIS-turbance and re-COL-onization experiment, led by Henri Thiel, showed that any such methods would create a massive change to the ocean environment (Schriever, 1995).

The governing body that regulates mining claims in the ocean is meant to be an impartial steward of the environment. The International Seabed Authority “provides an international and transparent forum to regulate and manage all mineral resources related activities and ensure protection of the marine environment in the ‘Area’, the deepseabed and subsoil beyond national jurisdiction, for the benefit of all humanity” (ISA, 2021, p. 8). It was established under the 1982 United Nations Convention on the Law of the Sea (UNCLOS), along with the concept of exclusive maritime zones that drew a 200-mile exclusive economic zone off of the coast of countries. Demarcation and enforcement of these zones is complicated by overlapping claims and offshore islands. This combination of exclusive zones and vast stretches of the planet would appear to make the ISA task particularly difficult.

This difficulty of management and monitoring is further complicated by the fact that the deepsea has historically been a kind of dumping ground, a place to dispose of pollutants and radioactive waste as well as toxins, anxieties and fears. Sea monsters no longer come to the surface but they have been replaced by climate change as the biggest existential threat to humanity. Fear has shifted from distinct bodies with teeth, scales and fins to the threat of destruction of the maritime environment by economic systems. Attunement to this atmospheric condition of anxiety and endangerment is part of the work of feeling where we are now and thinking about what we might do to avoid catastrophe.

#### Conclusion: undersea speculation

In Rachel Carson's first published article 'Undersea' (1937) that later became the seed for her seminal ecological treatise, *Under the sea-wind: A naturalist's picture of ocean life* (1941) she reminds us that none of us have known what it is like to live undersea, to experience the "surge of the tide that beats over the crab" much less "those six incomprehensible miles into the recesses of the abyss, where reign utter silence and unvarying cold and eternal night" (1937, p. 322). In imagination and folk tales we can plunge to those depths; but it remains difficult to comprehend the complex interactions of living things and geological forces in these undersea realms. And it is even more difficult still to make the relevance of these other lives felt by a public busy with other worries and concerns.

Carson returns us to the poetic project of Su Shi, the atmospheric thinking of cultural geographers and the experimental writing projects of Haraway (2013 & 2016) and other multispecies researchers: how can we adequately write a complex changing world that we might only glimpse from a distance? The question is not so much if the images before us can be trusted in so far as it is more so a question if we can be trusted to adequately evoke them. This challenge of articulating observation is there in poetry and in ethnographic writing. In the chapter 'Sunset' from his famous *Tristes tropiques*, Levi-Strauss attempts to describe a sunset as his ship sets sail from France to Brazil (see Rutkoff, 2008-2009 for discussion). His struggle with the poetic futility of adequately representing the sunset is similar to that of Su Shi when faced with the mirage, and Carson in contemplating the underwater realms she cannot inhabit. An island mirage presents the same challenge; what are we to make of the warping visions before us? The very blankness of the atmosphere, the otherness of the sea and sky remain no matter how much we try to make sense of them.

Atmospheric visions occupy a particular space of the future. They invite a speculative geography about what could be. They hint that there is something out there to be discovered. More than just a trigger for wanderlust, they are confirmation of the imaginary. The mirage, deepsea and imagined distant islands can feel forever out of reach. They all promise that there is something out there and confirm with every move forward that it cannot be so easily grasped.

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