In an oyster shell

In an oyster shell:
A material exploration of lime

MA Design: Expanded Practice
Goldsmiths, University of London
November 2018
Fivos Avgerinos

Typefaces:
Crimson Text & Fedra Serif

Contents

Acknowledgements

This project would have taken many more sleepless nights without the help of my sister Marialena Avgerinou, my friend Gauthier Roussilhe, and my supervisor Juliet Sprake, to whom I wish to express my sincerest gratitude.

Preface

Seashells are the pillar of human civilisation.

Sure, this might be an overstatement, but let's entertain this thought a bit further.

When we think of seashells, most of us think of the sea, food, or ornamentation—there does not appear to be much more to them. Seashells however—mostly oyster shells to be precise—are everywhere around us, regardless of how far the nearest beach or oyster bar is. They are in the water you drank today, in the toothpaste you (hopefully) used to brush your teeth, and in the walls of your room. How so? They are there in the form of lime, a material we usually associate with construction, when in reality, an array of other industrial activities our daily habits depend on, absorb most of it.

We owe so much more than we are aware of to these tiny, humble oyster shells.

Anthropocene

We are currently living in an epoch of the natural history of the Earth driven by humankind, notably 'civilised societies', viewed as the period during which human activity has been the dominant influence on climate and the environment[1]. We call it the Anthropocene.

There is debate within scientific circles on whether this is an accurate term or a product of pop culture. It is argued that in order to name geologic-time terms, one needs to define exactly what the boundary is, where it appears on the rock strata[2]. However, whether the name Anthropocene is an accurate one to define our current time in the history of the Earth, or not, makes little difference as long as we realise that what distinguishes our era is the fact that we are aware of our impact.

Two billion years ago, cyanobacteria oxygenated the atmosphere and powerfully disrupted life on Earth, yet they were not conscious of it. We are the first species that has become a planet-scale influence and is aware of that reality. As far as science can tell, there has never, until now, been a point when a species became a planetary powerhouse and also became aware of that situation[3].

fig. 1. Aerial photo of a limestone quarry

fig. 2. Bulldozer in limestone quarry

We have shaped how the Earth looks in profound ways during this past tiny fraction of our planet's long history. One could argue that geological phenomena of the past have done so in more remarkable ways over the course of millions of years. Nevertheless, it is the first time in history, that humans have exceeded the sustaining capacity of the Earth's global ecosystems. Humanity's footprint has tremendous momentum, and the insidious explosion of its impact creates a shockwave that threatens ecosystems worldwide for decades or possibly centuries[4].

At this point, it is worth acknowledging that the word 'humanity' is commonly used, although it is merely a generalisation reflecting the small minority of the human population that causes most of the damage, stemming mainly from occidental concepts of progress within capitalist states.

Furthermore, since the eighteenth century, and especially during the past sixty years, humans have been having deleterious effects on the entire planet. Our footprint on the Earth is of two kinds: ecological, the consequences of our actions on the natural world, and cultural, the abandonment and often wilful neglect and destruction of ancient agrarian traditions and knowledge, which are the umbilical cord of humans with the Earth[5].

It is this disengagement with our planet during its most recent history, that this project draws upon, aiming to bring about some insight on how the world around us is made, how seemingly unassociated objects and actions are intrinsically interconnected: our very drinking water contains particles that come from prehistoric seashells. Here, the word 'world' refers to the entirety of human activity ranging from ordinary consumer commodities and products to the built environment and what lies in-between.

"In taking good care of the Earth, basically, the first step is knowing where our things come from."

— Christien Meindertsma[6]

In doing so, this project touches on limestone—a material we all know, like so many others. There is an inherent beauty in the process of tracing how raw materials are directly or indirectly linked with human activity throughout the history of humankind. Seeking to abstain from the obnoxious educational element of a material exploration but to rather make way for the beautiful story limestone has to share, this project reveals how much more lies beneath the surface than one would expect. The aim is to harness a deeper understanding of the material world and encourage our neglected inner curiosity to resurface, by acknowledging how little we know about what the world around us is made of.

This project is also a tribute to the simplicity and subtlety of the colour white in the traditional settlements of the Cyclades—a complex of Greek islands, with a landscape defined by the use of limewash in vernacular architecture.

Cyclades

/ˈsɪklədiːz/

The Cyclades is a group of Greek islands clustered together in the Aegean Sea. The name refers to the islands forming a circle around the sacred island of Delos. They are comprised of about 220 islands; just 33 of which are inhabited.

fig. 3. Sunset over Ios

fig. 4. Illustration of the Cyclades

There is an untamed quality about these islands. When sailing from Piraeus or Lavrion towards the southeast of the Aegean Sea, one can see pieces of rocky land scattered around in the water and can almost feel this profound bond between them. They seem as if they are part of the same family, once connected by land, trying to reach one another without ever managing to do so; the violent winds and rough waves of the Aegean Sea are everlasting obstacles.

These islands however, with the dry, barren landscapes and the lack of vegetation, still share a connection that brings them close, as if the water and the elements fail to divide or isolate them. This link is their settlements of simple, cuboid, white-painted buildings. The islands have their own unique characteristics, determined by their individual history, topography and geology but it is their white vernacular architecture that bounds them all together.

fig. 5. Naousa, Paros

White

The ancient Japanese words *shiro*, *shiroshi*, *itoshiroshi* and *ichijirushi* all refer to the colour white. They are terms based on the corporeality of things: they reflect the purity of light, the lucidity embodied in a drop of water, or the force of a crashing waterfall. Over a long history, these words were absorbed into the concept of 'white' or *shiro* (白), and established as an aesthetic principle[7].

In the real world, white is always contaminated and impure. It is delicate and fragile. From the moment of its birth it is no longer perfectly white, and when we touch it we 'pollute' it further, though we may not realise it. Yet, all the more because of this, it stands out clearly in our consciousness.

a white square
within it
a white square
within it
a white square
within it
a white square
within it
a white square
within it

White Square Paper
— Katue Kitasono[8]

fig. 6. White wall

"In reality, this is what white essentially is: an aesthetic principle. We may feel that we have come into contact with white, but that is just an illusion."

— Kenya Hara[9]

Cycladic white

fig. 7. White Cycladic settlement

Although white coloured houses are found in various places across the Greek mainland, the Cyclades are comprised of almost only white architecture. Their rocky and barren landscape makes the white settlements stand out “like jewels amidst the grey fields”[10] or, when it comes to contemporary villas in the countryside outside the settlements, “like pimples, in a landscape of white measles”[11].

The frailty of Cycladic white and the struggle to perfect itself, is what has defined the islands' landscape. The houses had to look clean and well looked after. An example is the whitewashing of the walls before Easter so that they would be covered in pure white during the Epitaph—the procession of the bier of Christ—on Good Friday. Whitewashing the buildings every Christmas, Easter and mid-August—the most important dates of the local yearly calendar—reflects this aesthetic principle; this illusion. A white-painted wall remains white regardless of how much time leaves signs of wear, only to reveal its bright—but never perfect—aesthetic, once it is covered with a layer of fresh white paint.

It was primarily bioclimatic and ecological reasons that led people to paint their houses white, in order to reflect the harsh summer sun and make the houses more heat resistant. Protection from pirates was also a critical reason. Houses, pavement edges and small roads were all painted white in order to create a sense of confusion, turning the settlements into 'labyrinths'. Today, legal reasons followed by trends have established the use of white in Cycladic architecture, not just in the settlements but all across the countryside, creating a false tradition[12].

What is important to note at this point, is that walls were not *painted* with white paint, since it was only after 1905-1915 that it was mass produced: it was limewash that was used instead, to produce an almost white colour. Limewash, an inexpensive local material, was also used to highlight pavement edges, ornament small roads, as well as paint tree trunks serving as a disinfectant due to its antimicrobial properties.

fig. 8. Islanders whitewashing house

Ioannis Metaxas, a former Greek general and dictator, was responsible for propagating the whitewashing of the Cyclades with the use of lime in the 1930s, in order to deal with the epidemics of that time. The houses became white (even the coloured ones), under the strict supervision of the police. The colour white was reimposed later, mostly for blue-and-white aesthetics—to reflect the colours of the Greek flag—during the military dictatorship of 1967[13]. The white of the houses in combination with the blue of the sea re-emphasises the islands' Greek history and culture, wanting to stand in continuity with ancient Greek architecture (perceived as predominantly white until more recent studies[14]). Mandatory bleaching has continued even after the dictatorship, till today. There is currently more freedom in colour selection, yet, buildings in Cycladic settlements are still rarely painted with colours other than shades of white.

Lime

In an attempt to come closer to the colour of the islands, our research takes us to a material exploration of lime by taking a deeper look into its history, properties and uses.

Material overview

Lime is one of the oldest known materials, old as stone itself. It was used in 2600 BC for the construction of the Pyramids and the Great Sphinx of Giza in Egypt and in 447 BC for the construction of the Parthenon in Athens, Greece. It is still being used in construction today. Some notable examples of its contemporary use are the Empire State Building and the Lincoln Memorial in the United States. Although it is not as common to build with actual limestone today, lime is found in most buildings around us since it is a key component of cement.

fig. 9. National Theatre, London

It is one of the five most commonly used chemical compounds in the world and at the same time it is the cheapest and most used alkali[15]. Limestone is widely used in architectural applications for walls, decorative trim and veneer. It is less frequently used as a sculptural material, because of its porosity and softness[16].

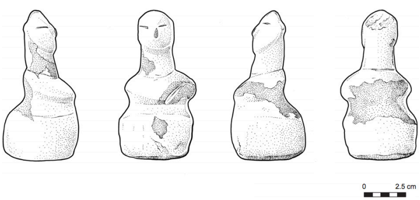


fig. 10. Illustration of anthropomorphic limestone figurine from Çatalhöyük, 7500 BC to 5700 BC

Although its name primarily refers to all types of construction applications, its use in other industrial activities absorbs the largest proportion (80%-85%). It is a material with a variety of applications in environmental protection, manufacturing, drinking water and food. You may not be aware of it, but lime is all around us[17]:

It purifies sugar.

It is used in the production of toothpaste.

It is an additive for engine oil.

It controls water pH in fish farming.

It is used in the production of chicken feed.

It makes tap water safe to drink.

It keeps fruit fresh.

It cleans gases produced by energy from waste plants.

Chemical composition

Lime can exist in three basic forms in a simple cycle. It can change from one form to the next in this cycle, and back again. The basic material is calcium with variations in what is and is not attached to it. The cycle starts at limestone.

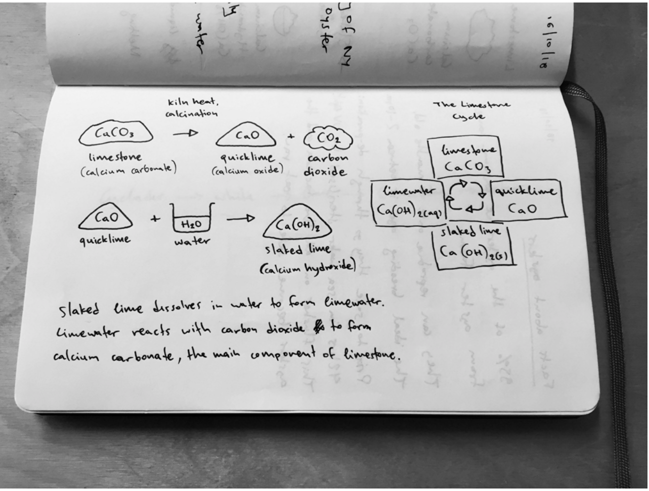


fig. 11. Limestone cycle detailed

Limestone
$CaCO_2$

↓

Quicklime
CaO

↓

Slaked lime
$Ca(OH)_2$

↓

Limestone
$CaCO_2$

Limestone

Limestone is mainly composed of a mineral called calcium carbonate $CaCO_3$—calcium with 3 carbon atoms attached to it. This compound is one of the most common minerals among the chemically precipitated sedimentary rocks[18]. It is found in various forms (limestone, shells, marble, chalk), but in chemical terms, they are all essentially the same material and that is calcium carbonate. Because stone and shell are made of the same chemical substance, they have the same chemical properties.

We all know what stone and shell are. We know that they are hard and tough. It is however more important to understand what they are not and that is chemically reactive. We can throw them in water and nothing happens—they just sit there. We can therefore see that they are stable and they resist the elements. Calcium carbonate is the most dominant form of lime and that is due to the fact that all other forms will naturally turn back into it if exposed to the environment.

Quicklime

If we heat up calcium carbonate (limestone or shells) above 898°C, we can completely drive out the carbon dioxide CO_2 from it, replacing those 3 carbon atoms with one oxygen atom, to make calcium oxide CaO (quicklime)—one calcium to one oxygen. It will look similar but its chemical structure will completely change.

During his process called calcination, limestone decomposes into quicklime while driving out CO_2. Because CO_2 is driven out and floats around in the environment somewhere as greenhouse gas, the material loses a lot of its weight and its structure changes. This process has been known for many hundreds of years.

Burned lime is highly unstable and unsafe to have around since it is very quick to react with water in any form—even with water in the atmosphere in the form of moisture. If not stored in a sealed container, it will quickly begin to react with the environment and start the process of turning back into limestone.

Slaked lime

Quicklime literally means living lime. This can be seen when it is slaked. Slaking refers to the addition of water to the thirsty quicklime which makes water instantly evaporate, through steam in a violent exothermic reaction. Water combines with the quicklime, which crumbles away, blistering. Bits of it fly off, popping in all directions, generating a lot of heat which produces steam. During slaking, the calcium oxide reacts with the water to form calcium hydroxide $Ca(OH)_2$—one calcium, two oxygen and two hydrogen.

It can be found in two forms. Lime putty is essentially the addition of water to turn the material into a putty. It is the most reactive form and the most stable way to store it. It is completely safe as long as it is kept wet with no exposure to the air. A more common form is as a fine powder, known as builder's, hydrated or simply slaked lime. It is mostly used in construction as it is easy to store and sell in the dry form, but it is less stable as some of it will turn back into limestone with exposure to the air.

fig. 12. Lime putty

The story of the humble oyster

Now that we have been provided with some essential information about lime, its various forms and the inspiration behind this project, it is finally time to get on with our story.

It all began with one humble oyster a few zillion years ago. The oyster lived a great life in some remote ocean—an ocean that does not exist anymore. In fact, this ocean has seized to exist for hundreds of millions of years—or else, it has been transformed to a different one. It could have been where one can now see the mountain Schneeberg in the Austrian Alps. It could also have been where the Jenolan Caves now are, in New South Wales, eastern Australia. It could have even been where Doi Chiang Dao is, the third highest peak in Thailand. Studies of calcium levels in places where there is an abundance of limestone can tell us where that first humble oyster once lived—and they probably have—but that is beyond the scope of our story. We can assume that it lived in an ocean which then became one of the oceans we all know today or one which has given its place to some of the planet's current highest peaks. It is not important to know where it lived, but what happened next, is.

The humble oyster gave its place to more oysters and then even more—many more—until oyster beds were formed on the bottom of the ocean. The exact same process took place in other oceans around the Earth. As the years went by (and by years we mean centuries, millennia and eons) those oysters lived happy lives giving their place to more and more oysters all around the planet.

fig. 13. The humble oyster shell

The first humble oyster however, never completely disappeared, no matter how much time has been since it died, nor did any other oyster after it. They are all still there, either deep in one of our great oceans or on the top of some beautiful mountain—or anywhere in-between, really. When they died, they fell to the bottom of the ocean and rotted. Their shells however are timeless. They are made of calcium (calcium carbonate), like our teeth, so they did not rot but just stayed there. Pressure from other shells, from the water, and from the sand being washed over them, squashed the empty seashells all together into rock. Later on, the sea changed where it was and that left all this calcium-rock (limestone) on the land in the form of limestone mountains.

Here ends the story of the humble oyster—a story that goes hand in hand with the history of the Earth—and the grand journey of its 'afterlife' (through its remains) begins. This journey is what *In an oyster shell* seeks to outline. By designing an auditory experience that goes beyond our visual sense, we are metaphorically taken into the myriad uses of the oyster shell in the form of lime.

Process

In framing the overall research project it is worth outlining some of the practical aspects of its process that went in parallel with looking into the history, theory, and ultimately the conceptualisation of the auditory experience.

Our research allows us to safely assume that limewash used in Cycladic architecture essentially comes from oyster shells.

In an effort to sidestep the Earth's natural process of turning oyster shells into limestone, our experiment was designed to create our very own (Cycladic) limewash. Waste oyster shells were obtained from a restaurant in Central London (fig. 14). They were cleaned and left to dry in the sun. More waste oyster shells were then obtained from a pile on the beach in Whitstable (fig. 15), a seaside town on the north coast of Kent. They were all fired in a kiln at 1000°C (fig. 16), to turn into calcium oxide (quicklime).

fig. 14. Crate with waste oyster shells

fig. 15. Pile of oyster shells in Whitstable, Kent

fig. 16. Firing oyster shells in a kiln

Noticeably lighter due to all the CO_2 having been driven out, the shells were left to cool down in room temperature.

Boiling water was then poured on them, and a few seconds later, a loud exothermic chemical reaction started taking place, quickly turning the solid quicklime into a putty, while producing steam (as seen in fig. 18-27 & 28-47).

This putty was stored in two ways: a sealed container maintained its somewhat liquid form, whereas an open container allowed the putty to turn back into solid.

In fig. 17 we can see three jars: one with calcined oyster shells, one with slaked lime in a form of a putty, and one with slaked lime in solid form after being left without a lid for one week.

fig. 17. Quicklime & slaked lime as a putty as well as in solid form

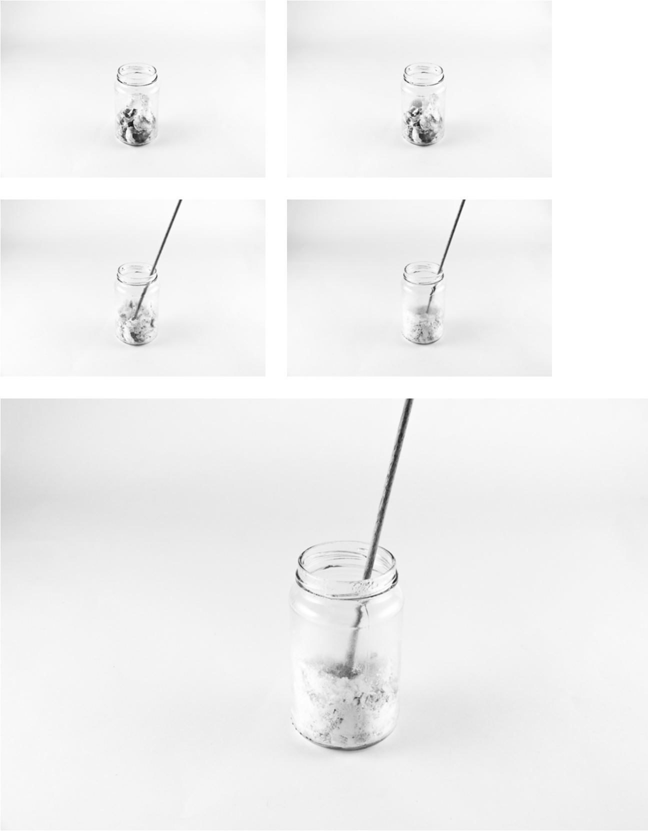
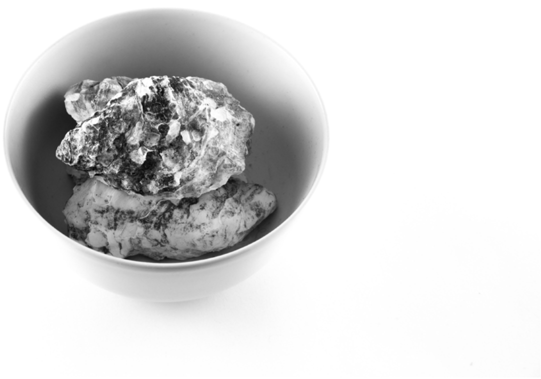


fig. 18-27. Slaking in a jar



In an oyster shell

In an oyster shell

In an oyster shell

In an oyster shell

In an oyster shell

fig. 28-47. Slaking in a bowl

fig. 48. Limewash

More water was added to the lime putty in order to make a more liquid form of lime—essentially limewash (fig. 48).

Our experiment of using limewash produced from waste oyster shells, to paint one brick (fig. 49), demonstrates this link between seemingly unrelated materials, such as white paint and an oyster shell.

fig. 49. Painting a brick white using slaked lime made out of calcined waste oyster shells

Conclusion

Sensing

Our seemingly independent senses ultimately complement each other: our sense of smell or sight complement our sense of taste—we can often already 'taste' our food just by looking at it or smelling it. The same principle applies to the rest of the material world, with all its different elements, ending up being a world of unified augmented materiality, a world where seemingly unrelated elements and objects are indivisible and dependent upon one another.

The sound of drinking is not conventionally related to the sound of drilling. One can however easily imagine connections between lime powder and a block of concrete, simply by looking at the two materials. It would be more straightforward and obvious to layout a presentation of samples of limestone's various forms. It is however through stimulating our sense of hearing, that more gravity is attempted to be given to how seemingly unrelated objects share the same roots. To emphasise and communicate this idea of material interconnectedness, a shift from the conventional way of presenting a material's properties is attempted, away from the senses of sight and touch. Speculating on how one perceives her surroundings through sound, an auditory experience is designed, exploring the sound of lime through its multiple forms and uses.

ASMR

Autonomous Sensory Meridian Response (ASMR) is a calming, soothing feeling accompanied by a tingling sensation which originates in one's head and spreads to the spine and limbs in response to stimulation[19]. This stimulation is triggered for example by listening to soft or crisp sounds like whispering, brushing, scratching, tapping and even chewing. Dr. Franziska Apprich has been researching about several aspects of

ASMR, including its benefits in education. She argues that it helps people be "more in tune with the world, more focused"[20].

An auditory experience

In an oyster shell utilises this technique in its educative form. Through this experience, the listener has the chance to listen to sounds of oysters and their shells, sounds of limestone as a sedimentary rock, and finally sounds of lime being used in ordinary activities we all undertake daily, like brushing our teeth.

The essence of this project revolves around the idea of examining our surroundings by allowing ourselves the knowledge of what lies beyond what we see, beyond what we know for a fact is there. It is an effort to unlock our imagination and look at the (material) world through a more holistic and open prism.

In a nutshell, the ultimate goal of this auditory experience is for the listener to ‘feel’ the materiality of limestone and appreciate the presence of the humble oyster shell by listening to the material’s very soul.

fig. 50. Illustration of an oyster shell as a headphone

Endnotes

1 Steffen, Will, et al. "The Anthropocene: Conceptual and Historical Perspectives." *Philosophical Transactions Of The Royal Society A-Mathematical Physical And Engineering Sciences*, vol. 369, no. 1938, 2011, pp. 842–867.

2 Autin, Whitney, and Holbrook, John. "Is the Anthropocene an Issue of Stratigraphy or Pop Culture?" *GSA Today*, vol. 22, no. 7, 2012, pp. 60–61.

3 Revin, Andrew. "Confronting the 'Anthropocene'." *Natural Resources and the Environment - Dot Earth Blog,* 11 May 2011, *The New York Times*, www.dotearth.blogs.nytimes.com/2011/05/11/confronting-the-anthropocene. Accessed 10 Nov. 2018.

4 Dodds, Walter. *Humanity's Footprint: Momentum, Impact, and Our Global Environment*. Columbia University Press, 2008.

5 Vallianatos, E. G. "Humanity's Ecological Footprint." *Mediterranean Quarterly*, vol. 17, no. 3, 2006, pp. 65–85.

6 Meindertsma, Christien. "How pig parts make the world turn." *TEDGlobal 2010,* Jul. 2010, www.ted.com/

talks/christien_meindertsma_on_pig_05049.
7 Hara, Kenya. "The Discovery of White." *White*, Translated by Jooyeon Rhee, Zurich, Lars Müller Publishers, 2015.
8 Katue, Kitasono. "Monotonous Space." *Oceans Beyond Monotonous Space: Selected Poems*, Translated by Karl Young, Edited by John Solt, Highnoon, 2007.
9 Hara, Kenya. "The Discovery of White." *White*, Translated by Jooyeon Rhee, Zurich, Lars Müller Publishers, 2015.
10 Platia, Nikoleta. "The Mystery Behind the Greek Cyclades Islands." *GoUNESCO - Make Heritage Fun!*, 3 Nov. 2015, www.gounesco.com/the-mystery-behind-the-white-architecture-of-the-greek-cyclades-islands. Accessed 8 Nov. 2018.
11 Stasinopoulos, Thanos. "The white measles: Buildings in the Aegean countryside." *GreekArchitects*, 15 Jun. 2010, www.greekarchitects.gr/en/levelling/the-white-measles-id3139. Accessed 13 Feb. 2018.
12 Stasinopoulos, Thanos. Skype Interview. By Fivos Avgerinos. 13 Feb. 2018.

13 Stasinopoulos, Thanos. "The white measles: Buildings in the Aegean countryside." *GreekArchitects,* 15 Jun. 2010, www.greekarchitects.gr/en/levelling/the-white-measles-id3139. Accessed 13 Feb. 2018.

14 Haynes, Natalie. "When the Parthenon had dazzling colours." *BBC - Culture,* 22 Jan. 2018, *BBC,* www.bbc.com/culture/story/20180119-when-the-parthenon-had-dazzling-colours. Accessed 18 Nov. 2018.

15 Tsimas, Stamatis. "Τι είναι ο ασβέστης." *Ελληνικός Σύνδεσμος Ασβέστου* ["What is limestone." *Hellenic Lime Association*], 2007, www.lime-association.gr/lime.html. Accessed 14 Nov. 2018.

16 Hwidi Rajeb Salem, et al. "Characterization of Limestone as Raw Material to Hydrated Lime." *E3S Web of Conferences,* vol. 34, 2018.

17 British Lime Association. *Lime: The versatile mineral that supports our vital industries*. London, 2013, Mineral Products Association. PDF file. Accessed 16 Nov. 2018.

18 Cornelius, Hurlbut, and Cornelis, Klein. *Manual of Mineralogy (after James*

D. Dana). New York, Wiley, 1977.

19 "ASMR." Dictionary.com, *All The Words*. www.dictionary.com/e/slang/asmr. Accessed 17 Nov. 2018.

20 Apprich, Franziska. Interview. By Richard Craig. "Researcher studies the effects of ASMR on studying and learning." *ASMR University: The Art & Science of Autonomous Sensory Meridian Response*, 30 Nov. 2016, *www.asmruniversity.com/2016/11/30/apprich-research-asmr-studying-learning-education*. Accessed 17 Nov. 2018.

Further reading

Asaroglou, Vasiliki, and Mponarou, Anna. "Ασβεστώστε τους τοίχους." ["Limewash the walls."] *decobook.gr*, www.decobook.gr/texnika-arthra/vafes-epixrismata/asvestoste-tous-toixous. Accessed 18 Oct. 2018.

Edholm, Steven. "BuildCult Ep.1, Seashell Lime Burn in "The Pet", Primitive Straw Kiln" *YouTube*, 22 Jan. 2016, www.youtube.com/watch?v=jOxaOTUGuKo. Accessed 18 Oct. 2018.

Gibson, Richard. "Limestone." *History of the Earth*, 4 Jun. 2014, www.historyoftheearthcalendar.blogspot.com/2014/06/june-4-limestone.html. Accessed 22 Oct. 2018.

Grimanelis, Dimitris. *Η γένεση των πόλεων στις Κυκλάδες. [The birth of towns in the Cyclades.]* 2015, University of Thessaly, MA Dissertation, ir.lib.uth.gr/bitstream/handle/11615/47203/14579.pdf Accessed 28. Oct. 2018.

"limestone." *Britannica Concise Encyclopedia*, Encyclopaedia Britannica, Britannica Digital Learning, 2017. *Credo Reference*, search.credoreference.com/content/entry/ebconcise/

limestone/0?institutionId=1872. Accessed 15 Oct. 2018.

Liu, Xiting. "Introduction to limestone classifications." *Sedimentology and paleoclimatology*, 8 Mar. 2010, www.xitingliu.blogspot.com/2010/03/special-publication-89.html. Accessed 28 Oct. 2018.

Smith, Nicky. *Introductions to Heritage Assets: Pre-industrial kilns*. May 2011, *English Heritage, Historic England*. PDF file. Accessed 18 Oct. 2018.

Figures

fig. 1 Alexeyev, Yulian. Aerial photo of a limestone quarry. *Unsplash*, 29 Nov. 2017, www.unsplash.com/photos/jNncSH3XfqA. Accessed 10 Nov. 2018.

fig. 2 Caspari, Jonny. Bulldozer in limestone quarry. *Unsplash*, 19 Sep. 2017, www.unsplash.com/photos/1je5j4aN2RI. Accessed 10 Nov. 2018.

fig. 3 Balázs, Benjamin. *Sunset over Ios. Flickr,* 26 Jul. 2018, www.flickr.com/photos/brenkee/28770756957. Accessed 10 Nov. 2018.

fig. 4 Avgerinos, Fivos. *Illustration of the Cyclades*. 2018. SVG file.

fig. 5 Varthakouris, Mihail. Naousa, Paros. 2018. JPEG file.

fig. 6 Wong, Augustine. White wall. *Unsplash,* 9 Apr. 2018, www.unsplash.com/photos/GcmPfRIcaL4. Accessed 11 Nov. 2018.

fig. 7 Unknown. White Cycladic settlement. *Γιατί στα χωριά «ασπρίζουν» τις αυλές το Πάσχα; [Why do people in the villages* *'whiten' the yards during Easter time?]*, 18 Apr. 2017, www.dailyreport2017.wordpress.com/2017/04/18/γιατί-στα-χωριά-ασπρίζουν-τις-αυλές. Accessed 29 Oct. 2018.

fig. 8 Staveris, Spyros. Islanders whitewashing house. *Δυό ταξίδια στη Νίσυρο. Το 1982 και τώρα. [Two trips to Nisyros. One in 1982 and one now.]*, 25 Aug. 2018, www.lifo.gr/articles/photography_articles/111958/dyo-taksidia-sti-nisyro-to-1982-kai-tora. Accessed 30 Oct. 2018.

fig. 9 Nicholson, Mirko. National Theatre, London. *Unsplash*, 11 Sep. 2017, www.unsplash.com/photos/2IvusDCbmlQ. Accessed 18 Nov. 2018.

fig. 10 Swogger, John. Anthropomorphic limestone figurine from Çatalhöyük. *Figurine Worlds at Çatalhöyük*. Carolyn Nakamura, and Lynn Meskell, *Substantive Technologies at Çatalhöyük: Reports from the 2000–2008 Seasons*, vol. 9, 2014,

p. 207.

fig. 11 Avgerinos, Fivos. *Limestone cycle detailed*. 2018. JPEG file.

fig. 12 Unknown. Lime putty. Artisan Stucco: Lime Mortars & Materials, www.artisanstuccomortars.com/en/original_lime_putty. Accessed 13 Feb. 2018.

fig. 13 Avgerinos, Fivos. *The humble oyster shell*. 2018. JPG file.

fig. 14 Avgerinos, Fivos. *Crate with waste oyster shells*. 2018. JPG file.

fig. 15 Avgerinos, Fivos. *Pile of oyster shells in Whitstable, Kent*. 2018. JPG file.

fig. 16 Avgerinos, Fivos. *Firing oyster shells in a kiln*. 2018. JPG file.

fig. 17 Avgerinos, Fivos. *Quicklime & slaked lime as a putty as well as in solid form*. 2018. JPG file.

fig. 18-27 Avgerinos, Fivos. *Slaking in a jar*. 2018. JPG file.

fig. 28-47 Avgerinos, Fivos. *Slaking in a bowl*. 2018. JPG file.

fig. 48 Avgerinos, Fivos. Limewash. 2018. JPG file.

fig. 49 Avgerinos, Fivos. *Painting a brick*

white using slaked lime made out of calcined waste oyster shells. 2018. JPG file.

fig. 50 Avgerinos, Fivos. *Illustration of an oyster shell as a headphone*. 2018. JPEG file.