Coming up for Air: A mining town's aspirational and biological commons

By

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A0160162U

Architectural Design Research

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National University of Singapore

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Department of Architecture

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Architectural Design Research

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Volume 1:

Architectural Design Research

Thesis Statement

The Coming up for Air: A mining town's aspirational and biological commons is cautionary tale of cement factory town community where the control and freedom of natural biological life such as environment and health has been traded off for commercial rules, status and aspirations. It subverts and questions the idea of "the good life' in the setting where the basic human right of air, water and food becomes luxuries and the view that one have to trade biological life for luxurious life, where the by-products or intrinsic or leftover spaces of luxurious life are re-imagined as unexpected centers that celebrate biological life.

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Coming up for Air:
A mining town's aspirational and biological commons

Abstract

The Apache Cement Factory[1] (est. 2012) in Mandalay, Myanmar, exploits natural, non-renewable limestone mountains, mining these for raw material to manufacture cement powder. The mining process has depleted the mountain range, which has resulted in a landform rapidly dematerialising into dust.

Dust adversely affects the people, the environment, the nearby forest and water bodies. It also taints the image of the mining corporation which is projected as socially and ecologically responsive. The mining town run is also where the teak loggers, who are guardians of the forest reserve, go for their supplies and amenities.

The mining town is boon and bane – it provides as much as it takes away. It creates and sustains aspirations and community life. At the same time, it destroys the environment. The town is conflicted in its configuration.

A byproduct of the mines, dust robs residents of clean air and water. These basic conditions for life are traded for short-term gains including social status, comprehensive amenities, and the promise of prosperity and luxury. As the natural landscape is depleted and polluted, clean air and water become sought-after commodities. Ripe for exploitation, this demand creates a new market of these biological commons.

The thesis examines the ethical production and consumption of this luxury commons. The research is couched in the realm of political ecology. The mining town is a dystopia where an aspirational life of luxury and recreation are enabled in return for a degradation of biological life. The thesis intervenes at the loss of biological life. It promotes one's liberal access to clean water, clear air and unpolluted crops. Architecturally, the infrastructural amenities and processes of creating or harvesting clean air, water and food are juxtaposed against the lustre of once aspirational spaces such as the golf, the table tennis club, the swimming pools and tea shops.

Keywords: biological commons, aspirational life, dust, mining town

[1] Apachecement.com. (2019). About Us | Apache Cement | Shwe Taung Cement Co., Ltd. [online] Available at: https:// www.apachecement.com/about-us/ [Accessed 8 Nov. 2019].

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Table Tennis & Fertiliser Production
Golf Course & Air purification

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Myanmar's Limestone Quarry and Cement Factory represents a bitter sweet memory of my childhood. It was a place to play and yet the conditions caused health conditions in my father's lung. Today, my father has a hole in his lungs. He has traded off his health for the family's aspirations and future.

Myanmar's Natural Resources : Blessing or Curse?

Myanmar has been undergoing political and economic reform after being freed from economic isolation under military rule from 1962 to 2011[2]. Being a country with rich natural resources, the recent boom in foreign investment has been concentrated in the extract sector of oil, gas and hydropower sectors with mining coming in 4th position by value 6.13% of overall investment in the country[3] . Rapid urban growth fueled by investments have led to an increase in demand for cement to sustain the development of infrastructures and road constructions.[4]

Most of the Myanmar's cement is imported from Thailand, Indonesia, Malaysia and Bangladesh due to an under supply in the local market [5]. Relatively small cement plants, lack of equipment and skilled workers contribute to a low quality and high price-domestically produced cement[6]. Despite Myanmar being the country with the second largest distribution of karst (limestone) area of 80,000 kilometre square after Indonesia with 145,000 kilometre square in the Southeast Asia Region[7] where limestones is the key ingredient for the cement production.

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[2] BBC News. (2019). *Myanmar country profile*. [online] Available at: https://www.bbc.com/news/world-asia-pacific-12990563 [Accessed 22 Nov. 2019].

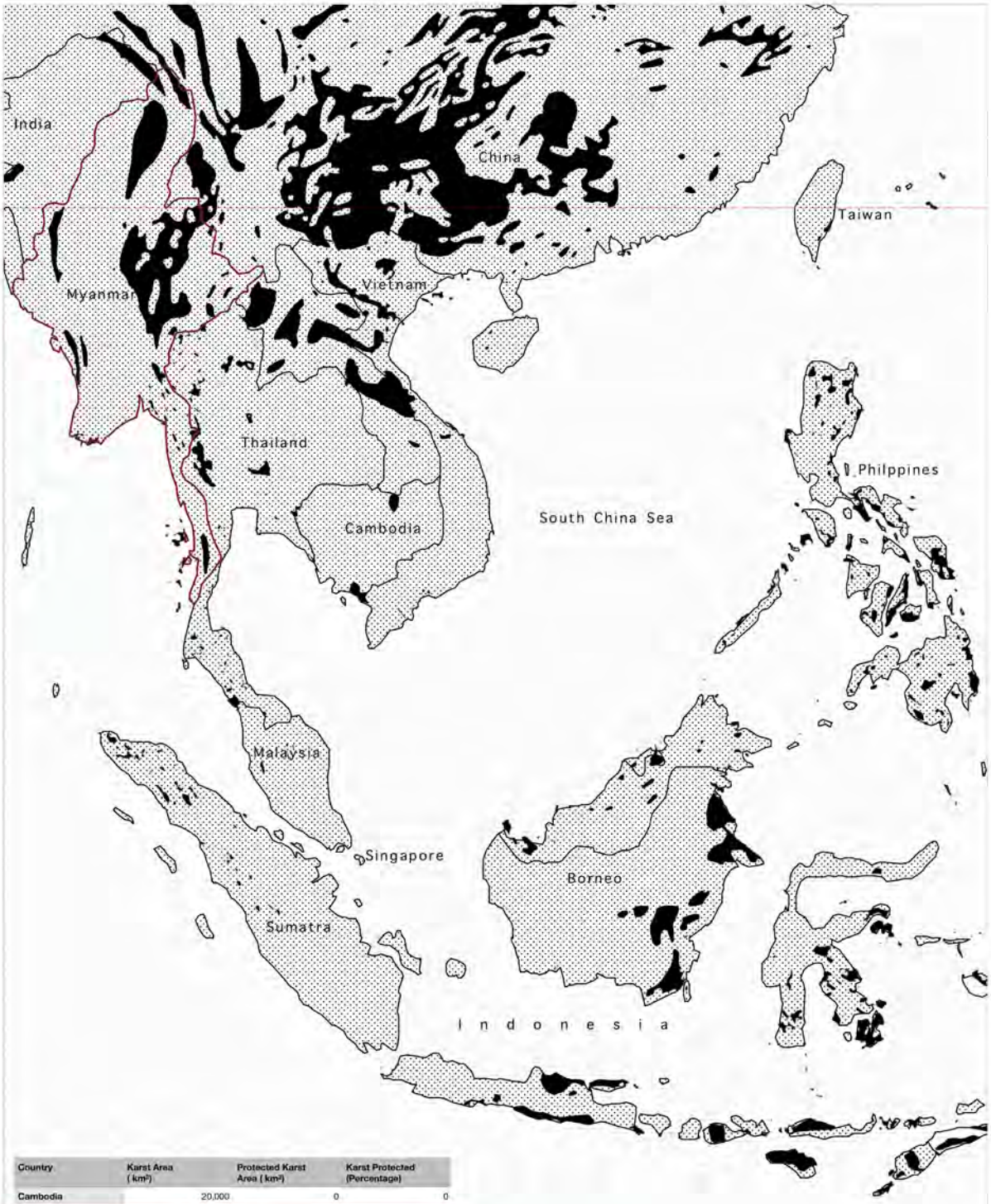
[3] Findlay, R., Park, C. and Verbiest, J. (2015). Myanmar: Unlocking the Potential. A Strategy for High, Sustained, and Inclusive Growth. *SSRN Electronic Journal*.

[4] Anon, (2019). [online] Available at: https://www.globalnewlightofmyanmar.com/can-myanmars-cement-industry-contribute-to-the-conservation-of-biodiversity-in-limestone-karst-areas/ [Accessed 22 Nov. 2019].

[5] Amy Saunders, G. (2019). *The cement industries of southeast Asia*. [online] Globalcement.com. Available at: https://www.globalcement.com/magazine/articles/922-the-cement-industries-of-southeast-asia [Accessed 22 Nov. 2019].

[6] Amy Saunders, G. (2019). *The cement industries of southeast Asia*. [online] Globalcement.com. Available at: https://www.globalcement.com/magazine/articles/922-the-cement-industries-of-southeast-asia [Accessed 22 Nov. 2019].

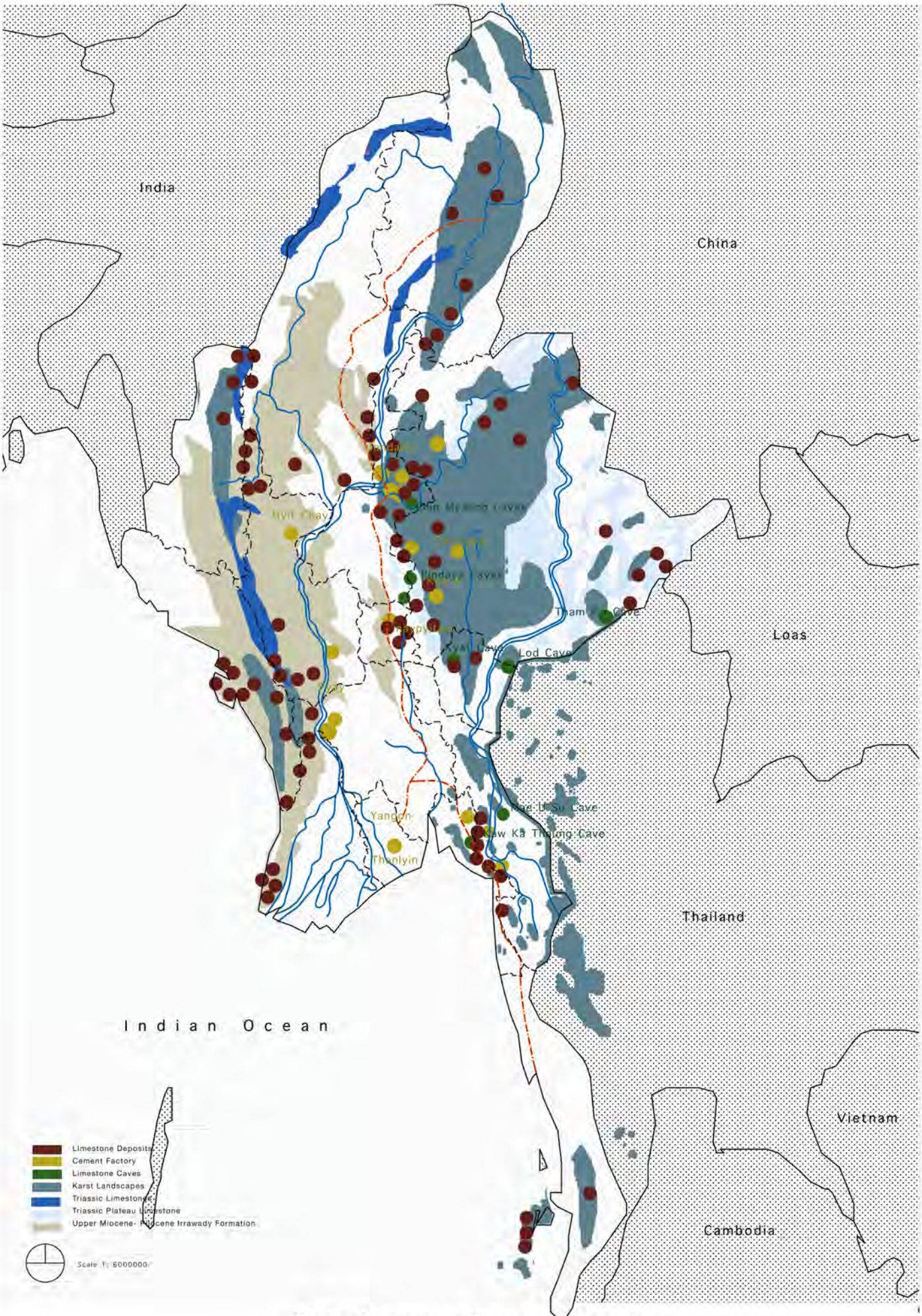
[7] CLEMENTS, R., SODHI, N., SCHILTHUIZEN, M. and NG, P. (2006). Limestone Karsts of Southeast Asia: Imperiled Arks of Biodiversity. *BioScience*, 56(9), p.733.



Country	Karst Area (km²)	Protected Karst Area (km²)	Karst Protected (Percentage)
Cambodia	20,000	0	0
Indonesia	145,000	22,000	15
Laos	30,000	3000	10
Malaysia	18,000	8000	44
Myanmar	80,000	850	1
Philippines	35,000	10,000	29
Thailand	20,000	5000	25
Vietnam	60,000	4000	7
Total	408,000	52,850	13

Limestone Karsts Distribution in Southeast Asia (black)

Leopoldamys neilli (distribution according to Latinne et al. , 2011, 2012), Niviventer hinpoon (Lekagul & McNeely 1988), Saxatilomys paulinae (Musser et al. , 2005), Tonkinomys daovantieni (Musser et al ., 2006).



Study of Limestone (Quarry) in Myanmar

The combination of the low market supply and rich resources breed a hotbed for investments and opens up opportunities for commercial exploration of these limestone resources. Besides Myanmar Investment Commission, being eager for economic development allowed for more new cement plants to be built, approving plans from a variety of investors in recent years. The cement production is expected to reach 10.5Mt/yr compared to 540,000t in 2012.[8] As such Limestone Mountains which are located mainly in Shan, Kayah, Kayin states, and in Mandalay and Taninthayi Regions of Myanmar has been **sold off as commodity** for cement production.

With the expansion and excessive quarrying to meet the demand, the biodiversity of limestone ecosystems, both surface and cave systems which has highly unique characteristics flora and fauna that can survive on the extremely alkaline environment, dry soil and rock conditions, and species confined to caves will be lost and can lead to rapid extinction.[9] Moreover, Myanmar's caves also have tremendous archaeological and cultural values and rich heritage. Yet, these beautiful limestone mountains with unique ecology and cultural values has been **traded off** for Myanmar's economic development.

[8] Amy Saunders, G. (2019). *The cement industries of southeast Asia*. [online] Globalcement.com. Available at: https://www.globalcement.com/magazine/articles/922-the-cement-industries-of-southeast-asia [Accessed 22 Nov. 2019].

[9] Anon, (2019). [online] Available at: https://www.globalnewlightofmyanmar.com/can-myanmars-cement-industry-contribute-to-the-conservation-of-biodiversity-in-limestone-karst-areas/ [Accessed 22 Nov. 2019].

A Tale of Trade off : Apache Cement Factory & Kuybin Village

The Apache Cement Factory[10] (est. 2012) in Mandalay, Myanmar, is located on 1.84 square kilometre within a valley of the Pyae Mountains range. It exploits natural, non-renewable limestone mountains range, mining these for raw material to manufacture cement powder. The mining process has depleted the mountain ranges and its Karst unique ecology. The open-pit limestone quarrying and coal-fuel powered cement production resulted in various detrimental environmental issues, such as Land degradation, land occupation, dust pollution and water pollution in the nearby mining areas[11] and results in a landform rapidly dematerialising into dust.

This by-product dust adversely affects the people, the environment, the nearby forest and water bodies where the local Kuybin villagers of 56 households resides. Kuybin Village (est. 1995) [12]is located in Kuybin forest reserve which only 3.5 km away from the Apache Cement Plant and its mining town. This village is accessed via a road that bypasses the plant and connects with the main access road to the site.[13]

Geographical location of the site, Cement factory and Kuybin village are sandwiched between the mudstone quarry to the west and the limestone quarry to the east worsening the effect of the dust pollution. The prevailing wind North-east direction is in the direction of Kuybin Village and the village is known to be covered in a thin layer of dust during summer season.[14]

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[10] Apachecement.com. (2019). About Us | Apache Cement | Shwe Taung Cement Co., Ltd. [online] Available at: https:// www.apachecement.com/about-us/ [Accessed 8 Nov. 2019].

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[13] Social impact assessment. (1982). Environmental Impact Assessment Review, 3(4), p.405.

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Limestone Quarry & Cement Corporate Town - Plan & Cross Section AA'

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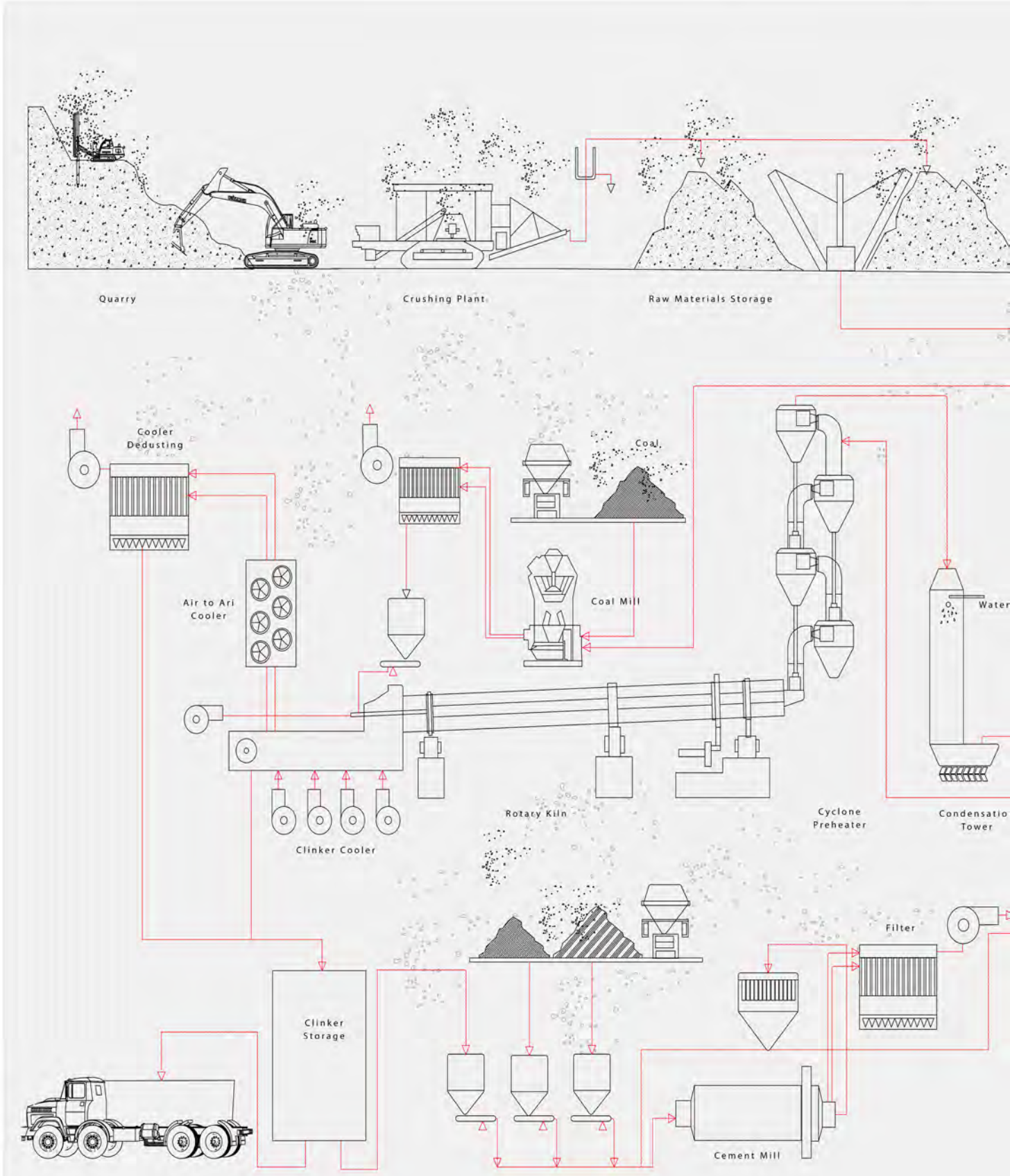
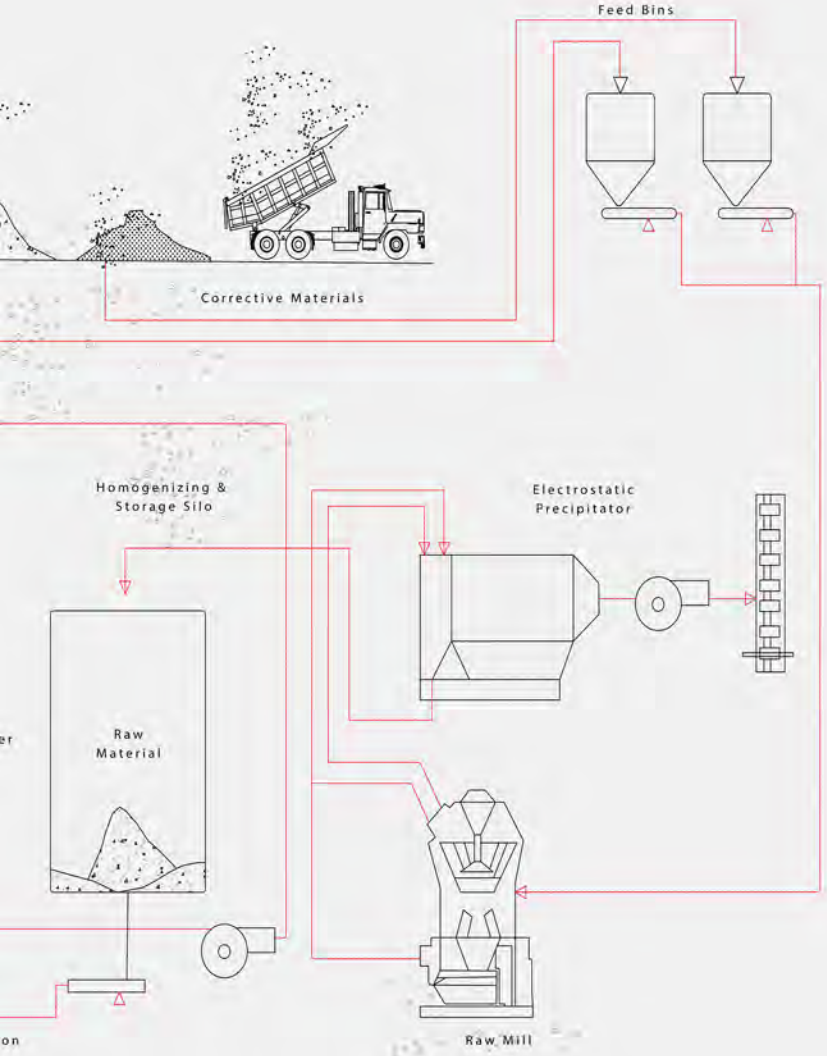
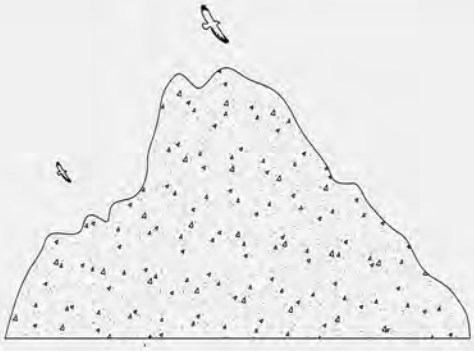
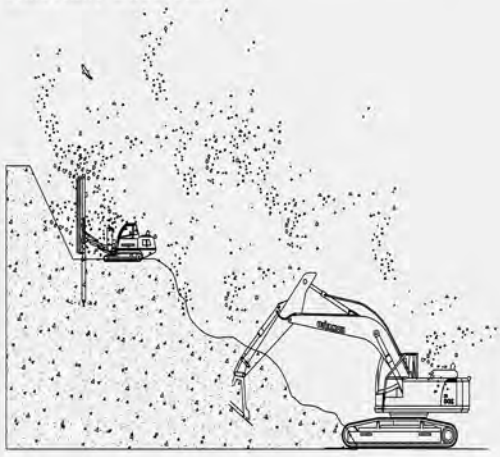


Limestone Mountains to

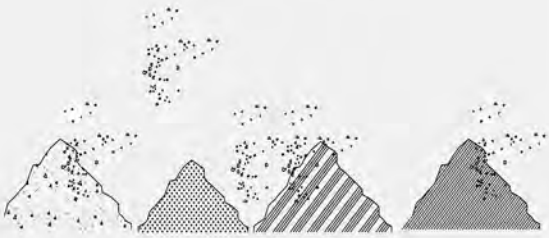




Limestone Mountains

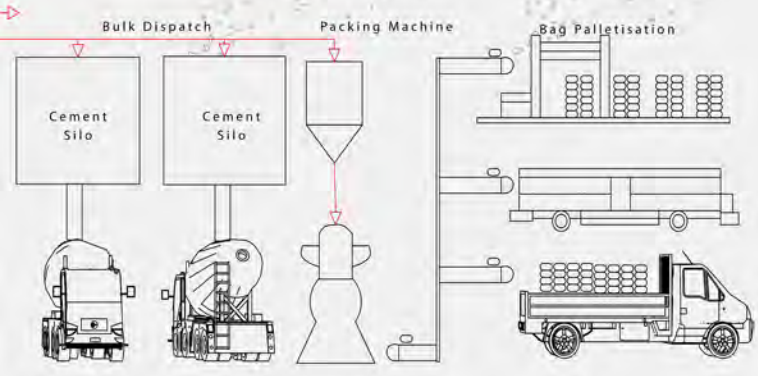


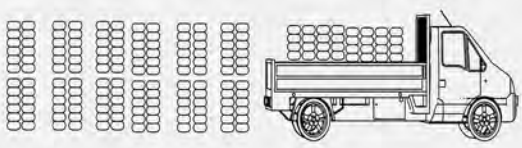
Quarrying of Raw Materials



Limestone Mudstone Laterite Gypsum

Cement Production : Raw Materials





Cement Packages

Cement Power in Packages

Amopohrous dust, a form of particulate matter produced from quarrying, transportation, stockpiles of raw materials, kiln operation, clinker cooling and milling pose various detrimental effect on on human health, and livelihood. If it is inhaled for a long time the dust can cause serious respiratory illness. If it is settled on the leaves of the crops it can harm the crops and decrease the yield since it block the amount of sunlight the plants take in. Sulphur dioxide combines with the water in the clouds creates acid rains which can gradually weaken and damage forest and aquatic ecosystems, killing the fish and trees.[15] Benzene which is realised from the coal fuelled plant and exposure to it lead to headaches as well as eye, skin and respiratory tract irritation which can lead to development of cancer, blood disorders and reproductive problems in a long- term exposure.[16]

Therefore, the mining not only create health conditions in the Kuybin villagers[17], it affects their role as a guardian of the forest too since the village is established to take care of logging of the teak plantation.[18] The only source of water, Kuybin River is polluted due to the waste drainage and dry up during the dry season since the Apache cement factory depend on it for the factory usage too.[19]

There has been protests by the Kuybin villagers in the 2017.[20] This also taints the image of the Apache mining corporation, funded by International Finance Corporation which projects the images of socially and ecologically responsible. Apache solved the situation by adopting the strategies of trying to raise the living standard of the region and providing solutions for current health and water shortage issues.[21] .

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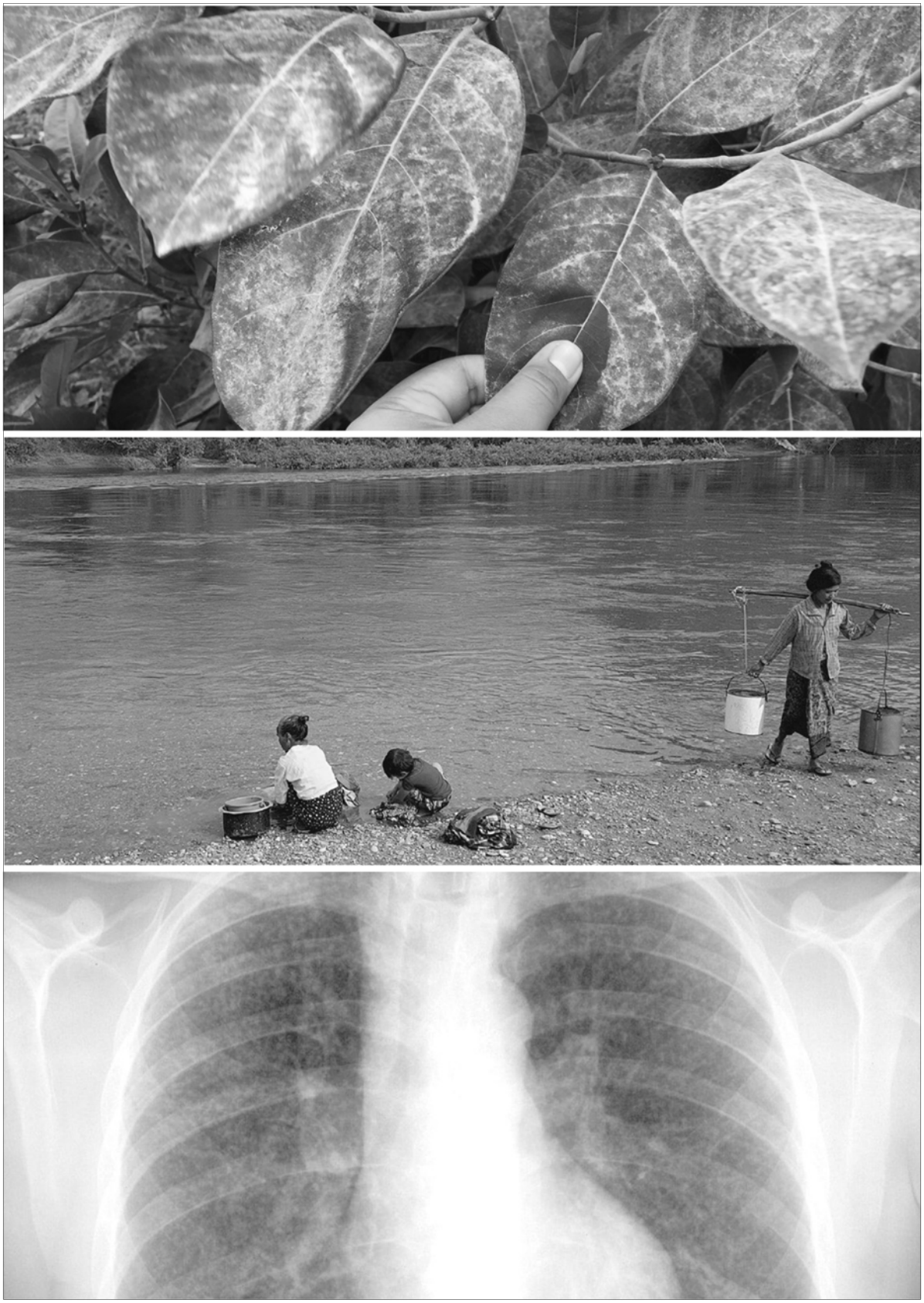

MYANMAR

At a controversial cement plant project, waiting for the dust to settle

"It happened to my son soon after he was born. I think it happens because of the water we use to shower him," Khin Nyo said. "Even though we apply medicine it is not cured yet and I don't know what to do."

Residents in Ku Pin, in the far east of Mandalay Region's Tharzi Township, attribute the skin ailments to dust and debris from the recent expansion of a nearby cement plant just a few kilometres south of their homes.

The health issues are one of a number of complaints area residents have leveled at the plant operator, Shwe Taung Cement, a subsidiary of the Shwe Taung conglomerate headed by Wa businessman U Aik Htun.

The land question

Mya Oo lost five of his 24 acres when Shwe Taung took the land for a staff housing project. But he is far from alone; when *Frontier* arrived in Pyin Nyaung, we wer greeted by around a dozen area residents, most from neighbouring Mone Pin and Ye Baung Sone village, who wanted to tell us about their land disputes with the company. Discussion of the details continued well into the night, long after everyone else in the village had gone to sleep.

U Sein Toke from Pyin Nyaung told *Frontier* that three of his 14 acres had been taken by Shwe Taung when the company widened the road, and he too had not received compensation.

Ruling party tensions

The project has created tension within the National League for Democracy, particularly grassroots members and local lawmakers. Residents have lobbied their local Amyotha Hluttaw representative, U Kyaw Thiha (NLD, Mandalay-12), to help them get compensation for the land they lost.

They have been told they will be invited to a meeting with Kyaw Thiha, who chairs the Amyotha Hluttaw National Resources Committee, and officials from the environmental department in Nay Pyi Taw, but no date has been set.

They are unlikely to receive a warm welcome from Kyaw Thiha, who told *Frontier* that he supported the expansion of the cement plant and believed civil society and the media were "creating problems". He said he doubted that those seeking compensation were really affected by the project, because they are quite far from the plant.

https://www.mmtimes.com/national-news/nay-pyi-taw/20291-limestone-mountains-need-protection.html

The mining town is boon and bane – it provides as much as it takes away. It creates and sustains aspirations and community life. It creates infrastructure such as road, schools, library, playgrounds, and clinics on the top of donation of clean waters.[22] The mining town becomes a go place for Kuybin Villagers for their supplies and amenities in exchange for unchecked mining and silence. At the same time, it destroys the environment.[23]

A byproduct of the mines, dust robs residents of clean air and water. These basic conditions for life are traded for short-term gains including social status, comprehensive amenities, and the promise of prosperity and luxury. As the natural landscape is depleted and polluted, clean air and water and unpolluted crops become sought-after commodities. Ripe for exploitation, this demand creates a new market of these biological commons.[24]

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APACHE
PORTLAND CEMENT
THE STRENGTH TO BUILD

THE STRENGTH TO BUILD

"Apache Scholarship program" has been implemented in Thazi Township since 2014. The scholarship program making things it possible for a large number of students to live their dreams about education and carrier aspiration. And then, Apache also donated stationaries and other learning support accessories during the school opening period once every year since 2013 to encourage the improvement of basic education system.

ENGLISH | MYANMAR
HEARTBEAT OF THE NATION
MYANMAR TIMES
TUESDAY, OCTOBER 15, 2019

Limestone mountains need protection

SWAN YE HTUT | 13 MAY 2016

He added that Myanmar had no separate law for land use governing the conservation of limestone mountain caves and ecosystems. But conservation and forestry laws dating back to 1992 and 1994 could be applied to businesses being conducted in forest areas, while laws to protect culture could be used to preserve ancient buildings.

U Nyi Nyi Kyaw said cement production had the biggest environmental impact on limestone mountains and ecosystems. The effects included increased earthquake activity, the destruction of species inhabiting limestone regions and the loss of watershed areas and springs. The environment was being damaged and local people faced health difficulties.

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The production of lime, granite, gypsum and cement essential for construction work was increasing, he said.

U Thant Zaw, coordinator of Mon State's environment and resources lovers association, said, "The main disadvantage of the production of stone and cement is the effect on the environment. The companies concerned should check if their mining could affect the environment and nearby buildings, including religious buildings. The gas and dust from mining works could damage health and undermining could cause the collapse of buildings. Tailings can destroy farmland. But the companies do not seem to consider these facts."

https://www.mmtimes.com/national-news/nay-pyi-taw/20291-limestone-mountains-need-protection.html

Coming up for Air:

A mining town's aspirational and biological commons

Thesis - Coming up for Air: A mining town's aspirational and biological commons examines the ethical production and consumption of this luxury commons - clean air, clean water and unpolluted crops.

Lauren Berlant wrote that "a relation of cruel optimism exists when something you desire is actually an obstacle to your flourishing. It might involve food, or a kind of love; it might be a fantasy of the good life, or a political project. It might rest on something simpler, too, like a new habit that promises to induce in you an improved way of being. These kinds of optimistic relation are not inherently cruel. They become cruel only when the object that draws your attachment actively impedes the aim that brought you to it initially." [25]

Similarly, in this mining town, people have trade of their biological rights to clean air, water and unpolluted crops in hope for economic gains for their families-to escape poverty for a better life. At the same time, living and working in this cement town has its own benefits-in the form of basic amenities such as health care, education and transport infrastructure. This is the present state of the existing situation in this trade off. The mining town is a dystopia where an aspirational life of luxury and recreation are enabled in return for a degradation of biological life in a form of cruel optimism where their very hope for luxurious life has led to the loss of the very basic minimums in their standard of living . Thesis questions if the sacrificial nature of biological life for the aspirational life.

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Coming up for Air:

A mining town's aspirational and biological commons

Towards luxurious life mean the trade off of basic human life conditions such as clean air, clean water and unpolluted crops in order to achieve this aspirations. The rest of the chapter is written from the view of a daughter who is writing a letter to the father in hospital in her realisation that he has lung cancer and he is one and the same who had trade off his own biological life for the aspirational life of his family and his daughter.

Dear Dad,

How are you? I hope the procedure at the hospital are going well and you are doing fine.

I have arrived at the site of Apache cement factory safely. The sad thing I noticed is that people here are very focused on the luxurious life. They are chasing after the short terms economic gain and losing out their biological life.

I really don't want these people to experience the same things as you did. So, how could I just focus on the original client brief of building recreational infrastructures knowing that the people might end up like you?

Could there be a way to make things better for the people here?

I will give you a call later tonight Dad! Update me on the result of procedures too...hopefully everything go well.

With love,
Su.

“ Dust does not Transgress: It invades and Pervades. Dust is as such a general part of everyday life that we must concentrate to even notice it.”, [26]Teresa Stoppani

Dear Dad,

The quote above resonates with us isn’t it ? I just had site visit to cement factory and there is dust everywhere! The thought occur that is there any way I can use this dust ?

But dad I see the light!!! Being in the cement factory remind of the phenomena that I observed back in the old cement factory that you used to work. It is that the dust with the right conditions could be reconstituted back to solid form.

I came across this book called Subnature by David Gissen..He discussed about the natural occurance of elements such as dust and smoke and constructed nature of such elements as the motor of narrative … I thought it is interesting that how such elements could be use as part of architectural project Dad!

And this got me reading more into dust! Upon research over the last few hours, I see a way in which I could possibly make use of the dust. Dust could be used as in agriculture as liming material for fertilisers, in plastics and paper industry as filler, in iron and steel industry as flux, for flue gas desulphurisation and for wastes neutralisation.[27]

And this could be proposed as an economic opportunity for apache cement factory! Let me draft out a proposal to include these systems into the design!

Oh my I was so excited that I didn’t even greet you properly…how is your day dad? Let me go draft out the proposal first ! I will give you a video call later ok?

With love,
Su.

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[26]Gissen, D. (2012). *Subnature*. New York, NY: Princeton Architectural Press.

[27] Galetakis, M. and Raka, S. (2004). Utilization of limestone dust for artificial stone production: an experimental approach. *Minerals Engineering*, 17(2), pp.355-357.

Cement Klin Dust Accumulation (After 2 years)

Underground Disused Railway Tunnel Mushroom Farming

Dear Dad,

It is going to be good day! More procedures but hang on there ok?! Everything will be fine!

I just had meeting. Apache side seem to be keen on taking up the idea of turning the by-product dust as fertiliser[28] since it would open up economic opportunity for them. So Apache was pretty keen on exploring such opportunity! So I am thinking of other way which I can make the situation better for people.

And I thought of an idea dad!

Usually when we design the recreational infrastructures, people usually neglected certain type of spaces such as service spaces... so I am thinking could the spaces possibly be used for biological life which the people here have lost through their chase for aspiration?

Could there be opportunities for this biological life be reinstated?

I will discuss the idea again tomorrow meeting! Wish me luck dad!!!

And please try to get some sleep! I will update you again!

With love,
Su.

[28] Galetakis, M. and Raka, S. (2004). Utilization of limestone dust for artificial stone production: an experimental approach. *Minerals Engineering*, 17(2), pp.355-357.

Dear Dad,

I heard that there is a chance that you might not have to undergo operation! It is good new Dad since you didn't want to do it anyway !!! I am so happy to hear that ! Let's hope everything go well ...

Sorry that I didn't manage to write for a while! But good new dad, everything went well and the construction is under way... swimming pools , tennis club, lake side tea house and golf club construction are progressing quite well!! I asked the contractors to pay extra attention to services spaces of the club since they will be key to how the various processes will come together and each require specific conditions... I am excited to see how things will turn out especially the integrations of mushroom farming with pool service room! I hope water harvesting, air purification plantations and fertiliser production are going to be a success too! With this new infrastructures I hope that villagers will not have to experience the same kind of pain that you are experiencing now Dad!

I hope you are coping well too! I will send you the images of the spaces after it is done construction ! Look forward to it Dad!

With love,
Su.

Underground farm built in abandoned tunnels beneath London

Alyn Griffiths | 18 February 2014 | 10 comments

News: two British entrepreneurs are constructing a hydroponic farm in a network of tunnels under south London that could supply local restaurants and retailers with fresh herbs and vegetables.

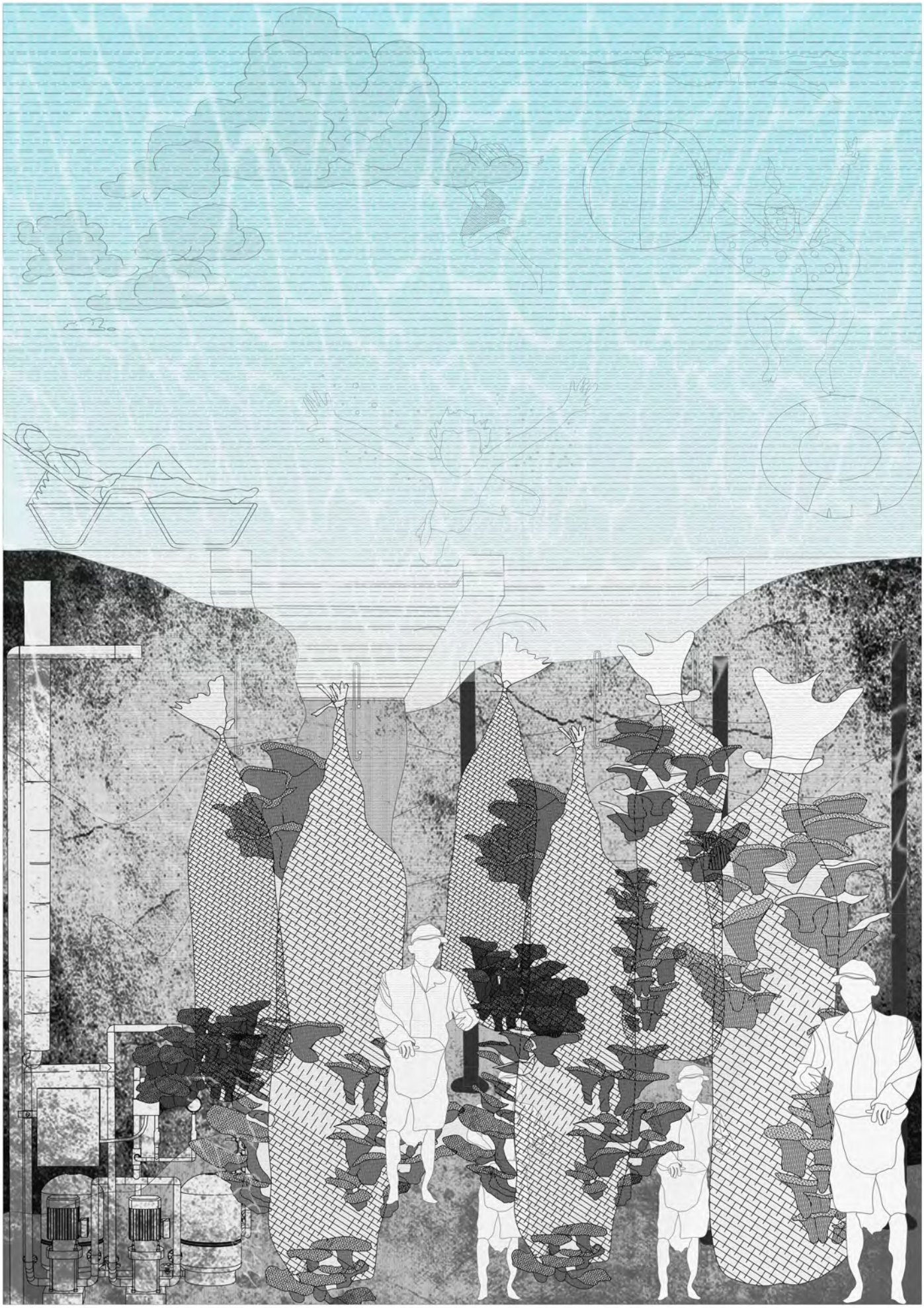
Richard Ballard and Steven Dring's Growing Underground project is located in tunnels beneath the London Underground's Northern Line that were originally built as air-raid shelters during the Second World War.

The farm's carbon neutral credentials are achieved by utilising low energy LED grow lights, locally sourced green energy, a recirculating water system and the 33 metres of earth above the tunnels, which helps maintain a consistent temperature.

The first crops grown at the farm will include pea shoots, rocket, mizuna, broccoli, red vein sorrel, garlic chives and mustard leaf, as well as edible flowers and miniature vegetables. Following further development it will become possible to grow crops including mushrooms and heritage tomato varieties.

Full-scale farming is set to commence in March, with the first produce expected to be available in late summer.

Underground Disused Railway Tunnel Mushroom Farming



SWIMMING POOL / SPA

MUSHROOM FARMING

Dear Dad,

How was your day? I hope you are feeling good today!

I just had a swim at the new pool. It is great and refreshing to swim after the long day at work. It is a great escape from the dusty air outside. And Dad, it feel great to see all the workers and enjoying the swim after a long day at work and families from the nearby villages enjoying themselves in the pools, and spa!

As I was swimming, one of the uncle approached me and questioned,

" Do you know who are these people coming out of that place, pointing to the door leading to the mushroom frame ?"

He further went to comment ,

" They don't look like they are member of the club though..." ..

He looked amazed when I replied him that these workers are actually working in this development which has incorporated the use of the pool pump room as a mushroom farm !

He was like.." no wonder the mushroom fried rice that I had for lunch is so delicious ! Must be cos it is the fresh produce!!!" You should try the mushroom Dad! When you come to visit!! They are delicious...

We think mushroom farm is working Dad! The Apache also commented how delighted they are that now they can spend less money on the produce as they now they are now producing their own ingredient and further more they even make money from selling them when there is enough harvest !

What I am happy the most is that this is creating new job opportunities for the local and new revenue for them Dad!!!

Isn't it time for you to take medicine? I will talk to you later then.

With love,
Su.

Dear Dad,

Today, Uncle Aung came to visit me today! We met at Lake side Tea house. You know uncle Aung love fishing right ?! He enjoys the day fishing while enjoying the tea leaves salad at the lake side.

As we rode the Sanpan among the lotus farms and kelp farming under the water harvesting towers, he said " Usually this season there is a drought and it is quite nice that people no longer have to suffer with the lack of water...." . Uncle Aung also told me that my intervention works, because he can see that the kelp plantation[29] are actually doing the job in cleaning the water.

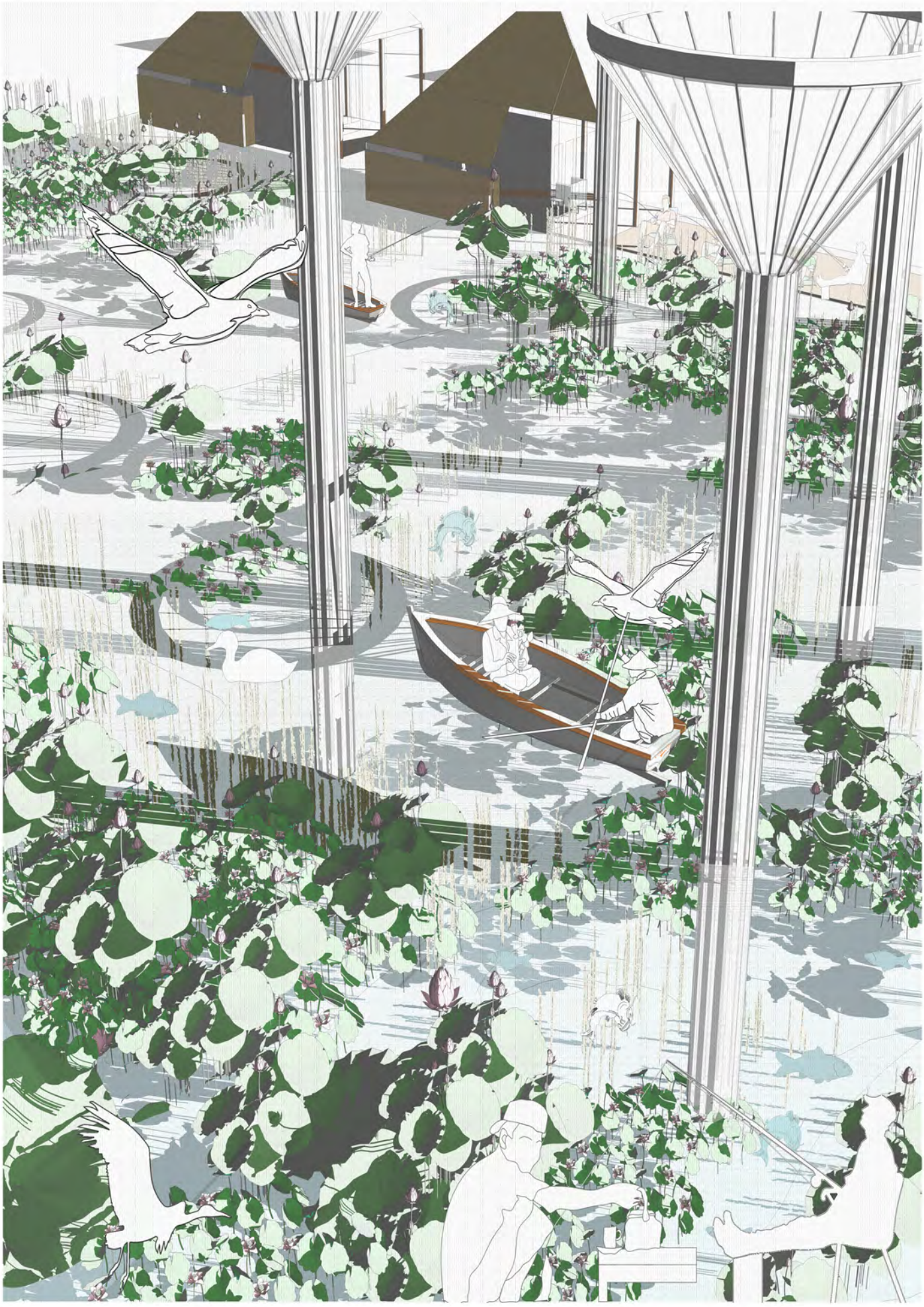
It is really great felling Dad when the worker who tends to the pond of the tea house thank me and said his Wife was particularly happy that he could bring lotus back as snack for her and his kids after work !

We had a great time today. He was worried about you too. He hopes that he can visit this place together with you one day after your health gets better and play golf. Tomorrow since it is Sunday , I will bring him to play golf before he head back home.

How are you today, Dad? Is your cough getting better? I hope you are getting a good night sleep nowsaday.

With love,
Su.

[29] The Conversation. (2019). *How farming giant seaweed can feed fish and fix the climate*. [online] Available at: https://theconversation.com/how-farming-giant-seaweed-can-feed-fish-and-fix-the-climate-81761 [Accessed 22 Nov. 2019].

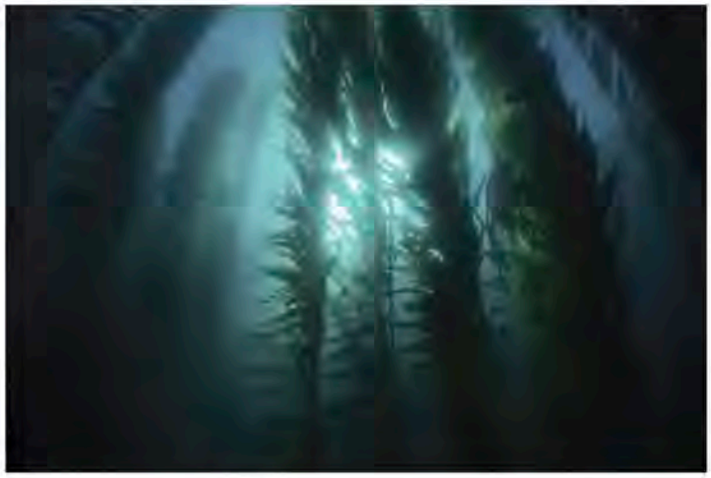


Lotus Lake Tea Shop

Lotus & Kelp Farming, Rain Water Harvesting

Seaweed/ Kelp Farming for Water Purification

THE CONVERSATION
Academic rigour, journalistic flair



Giant kelp can grow up to 60cm a day, given the right conditions. Joe Belanger/shutterstock.com

How farming giant seaweed can feed fish and fix the climate

July 31, 2017 2.38pm AEST

This is an edited extract from ***Sunlight and Seaweed: An Argument for How to Feed, Power and Clean Up the World*** *by Tim Flannery, published by Text Publishing.*

Author

Tim Flannery
Professorial fellow, Melbourne Sustainable Society Institute, University of Melbourne

Bren Smith, an ex-industrial trawler man, operates a farm in Long Island Sound, near New Haven, Connecticut. Fish are not the focus of his new enterprise, but rather kelp and high-value shellfish. The seaweed and mussels grow on floating ropes, from which hang baskets filled with scallops and oysters. The technology allows for the production of about 40 tonnes of kelp and a million bivalves per hectare per year.

The kelp draw in so much carbon dioxide that they help de-acidify the water, providing an ideal environment for shell growth. The CO_2 is taken out of the water in much the same way that a land plant takes CO_2 out of the air. But because CO_2 has an acidifying effect on seawater, as the kelp

Dear Dad,

I heard from mum that you couldn't sleep well at night these days. It must be hard for you. I hope you are eating properly or at least try to eat properly. Let's not lose more weight Dad. Please try to eat! I will send over your favourite food from here soon! Hope that would pick up your appetites!

Uncle Aung commented that the air was fresher inside here and I was so delighted to see the great effect that the planting choice of banana and rubber tree[30] has in purifying the air !I had my doubts when I was doing research on these air purification plants but it works a lot better than expected!!!

As I finished my game of golf, I see a few familiar face of workers heading out in the direction of newly built table tennis club...Uncle Aung asked curiously why they are heading towards the tennis room direction ... I told him that they are heading there to collect the fertiliser and I offered him if he wanted to follow me to see the newly built fertiliser factory since I had the meeting with table tennis club comity with regards to newly dust catching implemented system which I had designed for them and how they could use the facility.

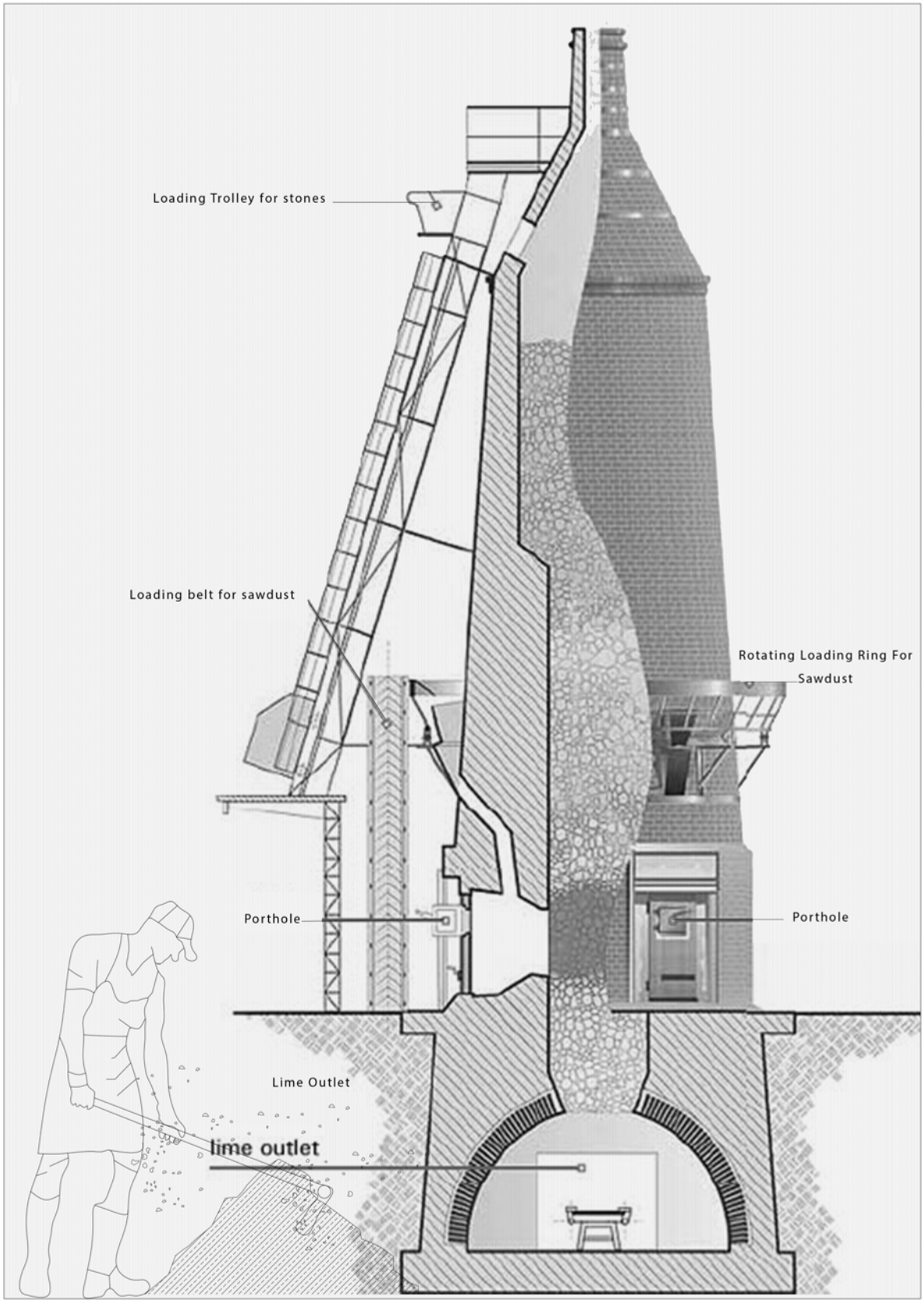
You should come and visit here Dad after you get better dad! We can play Golf and table tennis together! Three of us!

With Love,
Su.

[30] Slideshare.net. (2019). *Air Purifying Plants*. [online] Available at: https://www.slideshare.net/gauravhtandon1/air-purifying-plants-75776446 [Accessed 22 Nov. 2019].

Golf Park

Banana & Rubber Farming// Air Purification Plantation



Fertiliser Lime Production

Cement Kiln Dust - Granular Calcium Fertilizer

Lime (Wastewater Treatment Sludge) - Granular Calcium Fertilizer

Limestone - Granular Calcium Fertilizer

Air purifying plants

The **NASA Clean Air Study** was led by the National Aeronautics and Space Administration (NASA) in association with the Associated Landscape Contractors of America (ALCA). Its results suggest that certain common indoor plants may provide a natural way of removing toxic agents such as benzene, formaldehyde and trichloroethylene from the air. Helping neutralize the effects of sick building syndrome.

The first list of **air-filtering plants** was compiled by NASA as part of a clean air study published in 1989, which researched ways to clean air in space stations. As well as absorbing carbon dioxide and releasing oxygen, as all plants do. These plants also eliminate significant amounts of benzene, formaldehyde and trichloroethylene. The second and third lists are from B. C. Wolverton's book and paper and focus on removal of specific chemicals.

BAMBOO PALM

Chamaedorea seifrizii

Resistant to pests, this palm filters pollutants and also lends your home a tropical flair. Safe for pets.

FICUS TREE

Ficus benjamina

A ficus tree is undemanding and removes formaldehyde exuded by furniture, paint, and carpeting. But it is toxic to cats and dogs.

DEVIL'S IVY

Epipremnum aureum

This climbing plant filters xylenes, formaldehyde, and benzene from the air. But it is toxic to cats and dogs.

FLAMINGO FLOWER

Anthurium andraeanum

This flowering tropical plant is excellent at neutralizing contaminants. However it is not safe for pets.

MONKEY GRASS

Liriope spicata

This evergreen plant likes half-shade and will repay your care with clean air. Safe for pets.

PYGMY DATE PALM

Phoenix roebelenii

This palm likes bright rooms and will neutralize xylenes and formaldehyde as well as the flammable solvent toluene. Safe for pets.

BOSTON FERN

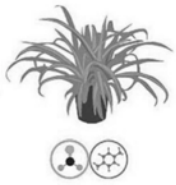
Nephrolepis exaltata Bostoniensis

One of the oldest plants in the world, this fern is a fine humidifier. It also filters out formaldehyde and xylenes. Safe for pets.

KIMBERLY QUEEN FERN

Nephrolepis obliterata

This fern is good to place in a bathroom, where it filters out the contaminants from cosmetics, deodorants, and perfumes. Safe for pets.



SPIDER PLANT

Chlorophytum comosum

Spider plants store water in their roots and can take a bit of thirst. They lower the formaldehyde levels in the air and are safe for pets.

CHINESE EVERGREEN

Aglaonema modestum

This plant likes light and temperatures between 64 and 72°F. It's an excellent air filter, but it's toxic to cats and dogs.

LADY PALM

Rhapis excelsa

An ideal indoor plant, the lady palm is very good at removing ammonia from the air and is also safe for pets.

GERBERA DAISY

Gerbera jamesonii

Gerbera daisies like it bright and sunny. They remove contaminants and raise the humidity level. Safe for pets.

CORNSTALK DRACAENA

Dracaena fragrans

This robust plant likes partial shade and removes trichloroethylene from the air. Toxic to cats and dogs.

RUBBER PLANT

Ficus Robusta

Their Large Leaves can absorb airborne chemicals and break them dwon rendering them harmless. They absorb carbon dioxide and convert it to breathable oxygen.

SANSEVIERIA

Sansevieria trifasciata

Sansevieria likes a partially shady spot, where it filters out trichloroethylene and formaldehyde from the air. Toxic to cats and dogs.

NASA List of Air Purification Plants

Dear Dad,

I just had the discussion with them after a good game of table tennis! t

I check up on fertiliser production which the farmers are asking me about too and introduce Uncle Aung the fertiliser production plant! The new head of the table tennis club was happy that he could have additional avenue from the fertiliser. He even ask me the options to increase the dust catchers in the future.

Uncle Aung also mention that It is interesting how this dust caster act as air purifiers too ! I am glad this system work out Dad.

You really should come and visit Dad!

With love,
Su.

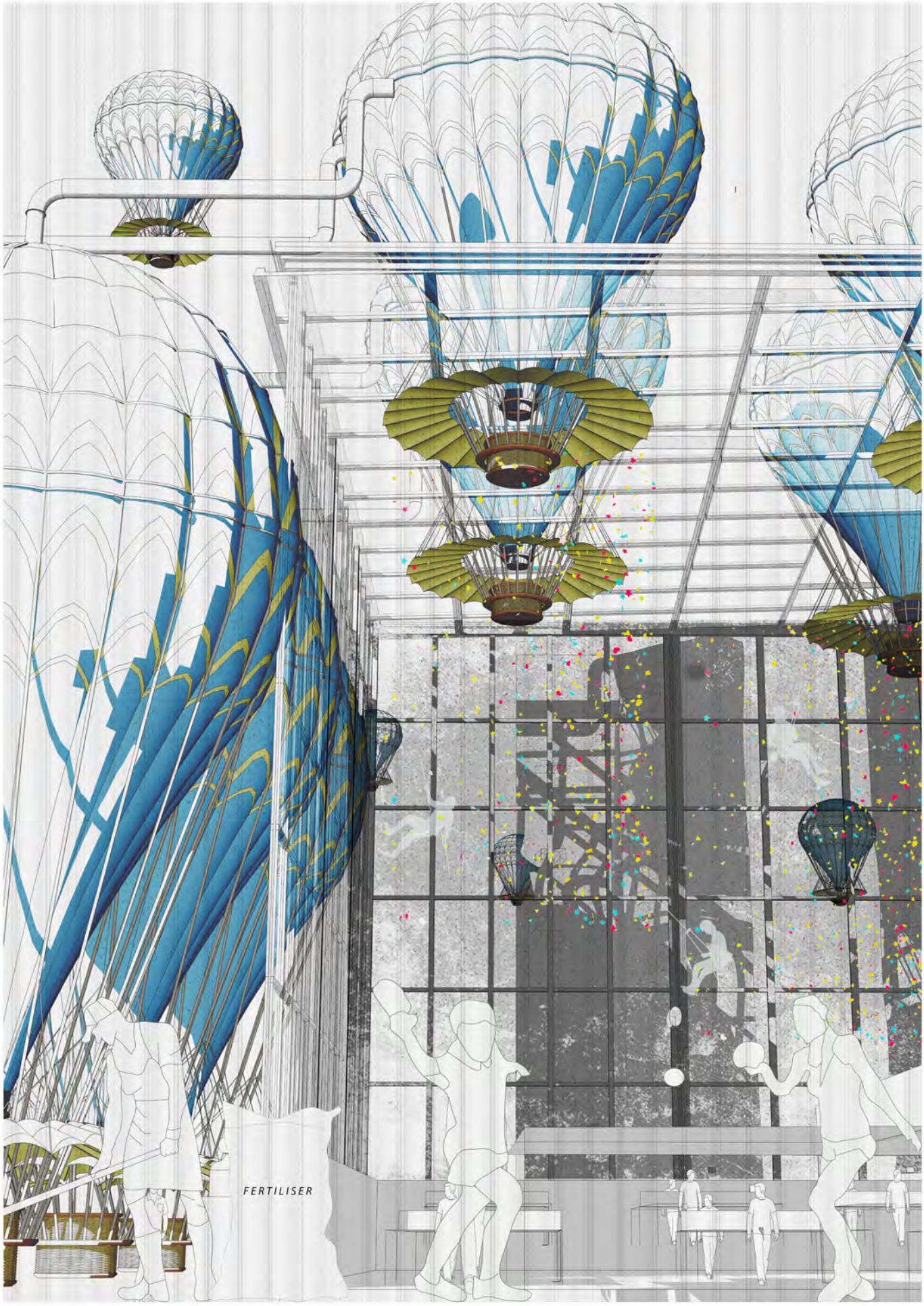


Table Tennis Club

Dust Catchment and Fertiliser Production

Epilogue

Epilogue

Limestone quarries and cement factories are not unfamiliar places to me. I spend most my childhood in Cement Factory Town while following my Dad around travelling across Myanmar. Those times are of my fond memory even if I am spending time in dusty landscape since I am together with my family. However as I get older even after my family migrate to the Singapore, the trace of the quarry follow and haunt us as my Dad cough day in and out and fight with the Lung cancer resulting from the prolong exposure to limestone dust ! My dad's health condition makes me obsess with the limestone mountains cement production, and implications that it came with it especially the Dust!

As I embark on the thesis prep journey, despite having spent the childhood in the mining town, I had trouble remembering the specifics of the place except traces of the bits and pieces of memory. The research online did not prepare me for the phenomenas that I observed during my study trip. The observations are both fascinating and heartbreaking.

It is really fascinating to see mining and cement production in action and at the same time witness Dust phenomena - one that could be reconstituted back to solid given right direction. The shocking and sad observation is that people live the normal life as if nothing is wrong in those dusty landscape without protection. It hit me that these people has done the same thing that my Dad has done, they had trade off their lungs and health for the immediate economic and financial needs! Through the activating of fiction as a framework, thesis will attempt to address this notion of trade off.

Emergence of Resilience Landscape

The thesis intervenes at the loss of biological life. It promotes one's liberal access to clean water, clear air and unpolluted crops. Architecturally, the thesis will adopt the aspirational life under a capitalistic structure.The corporation provides for the locals community-golf courses, table tennis clubs, swimming pools and tea shops recreating these spaces as a new typology where it is not just a place of leisure but instead provides scenarios where there are opportunities for creating or harvesting clean air, water and food could happen.

In these spaces there will be a tradeoff between biological life and aspirational life where one is prioritised over another, thereby subverting the view that one would have to trade biological life for luxurious life.The byproducts and interstitial/leftover spaces of luxurious life are reimagined as unexpected centres that celebrate biological life.

Although up till this point in the thesis-prep there are gaps which have yet to be bridged, the research gives rises to the interesting spatial, atmospheric implications of possible trajectories and time-based architecture to fill these gaps with the notion of tradeoff as a conceptual framework to develop architecture of different time scales.

The speculation intervention will be fragmented into three states: finding opportunity and promoting one's liberal access to biological commons the clean air, clean water and unpolluted crops, an appreciation of context and the strategies to heal nature and rehabilitate the ground and lastly the rise of resilience post-industrial mining landscape which is sustainable landscape and nature reserve. This these phase will coincide with the timeline of the mining, the disappearance of mountains and cement factory and will address the idea of trade off in time based manner.

This new landscape will conveys the notion of resilience and tomorrow where the project instigates urban and ecology regeneration and provides the framework which cultivates unconventional approach and methods of to create new farming methods, generate sustainable water systems and air purification. It will champions the re-appropriation and retrofitting of the degenerated mined mountains-capes creating a resilience landscape.

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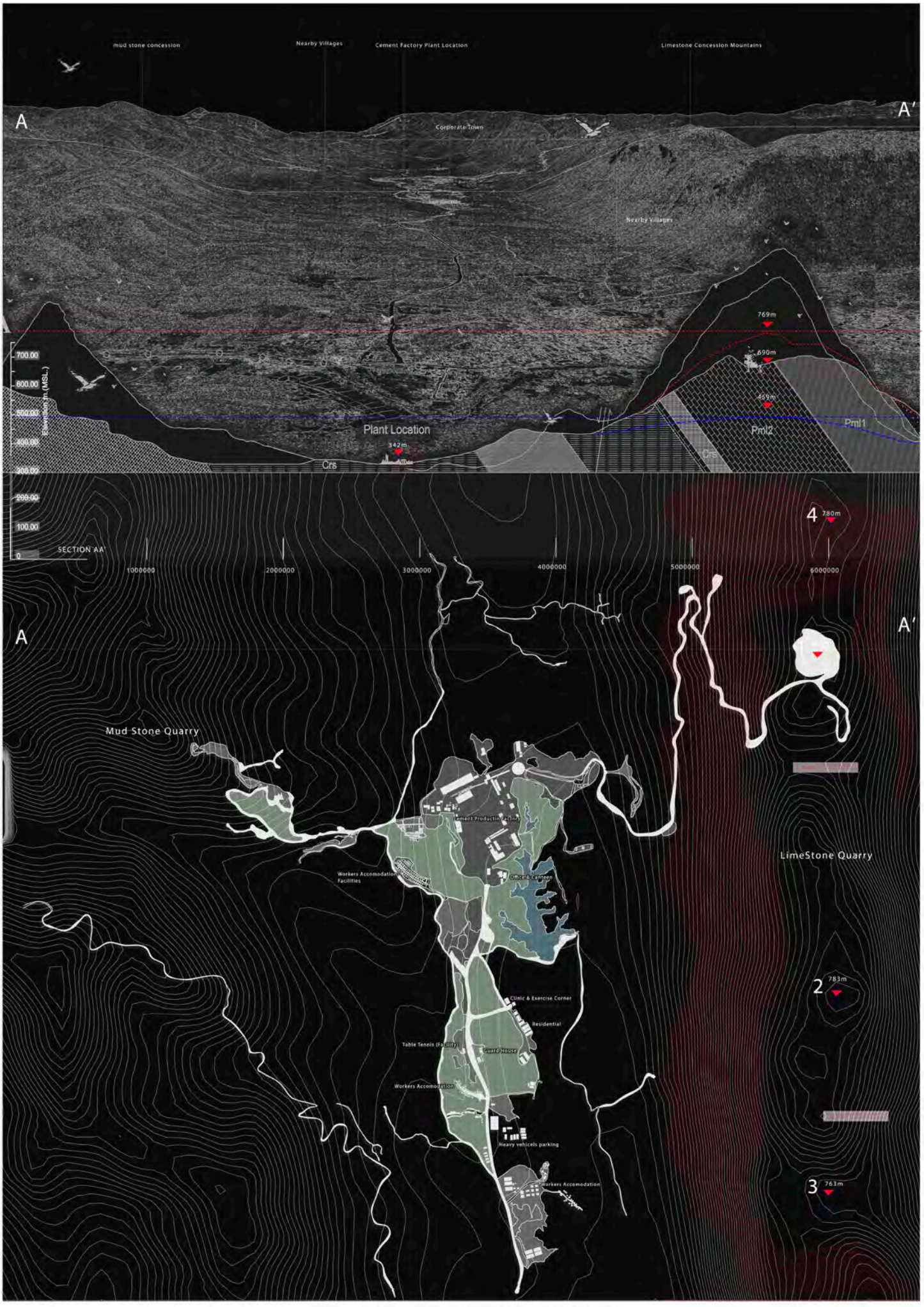
Appendix



Limestone Quarry & Cement Factory Corporate Town - Plan and Section AA'

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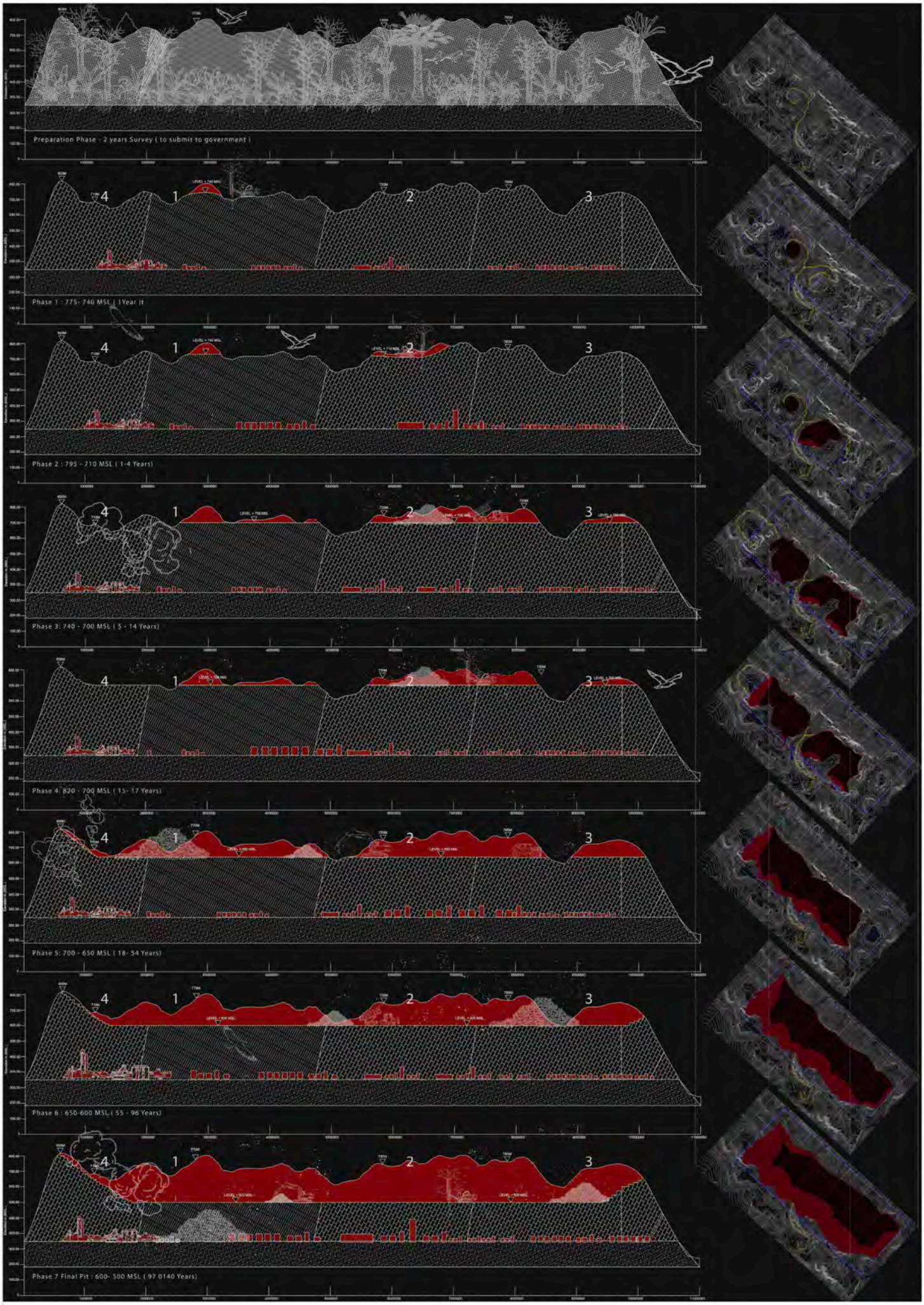
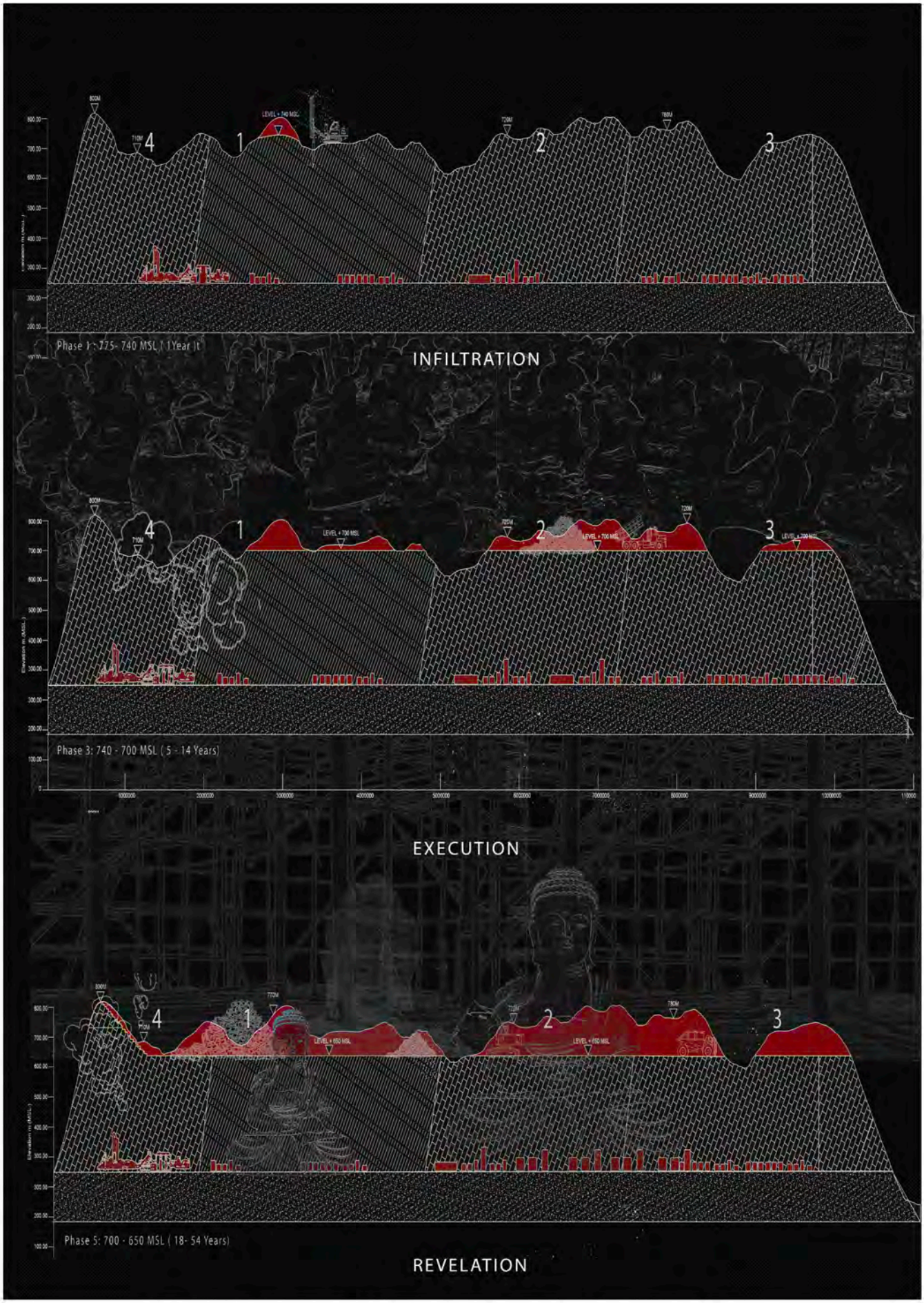
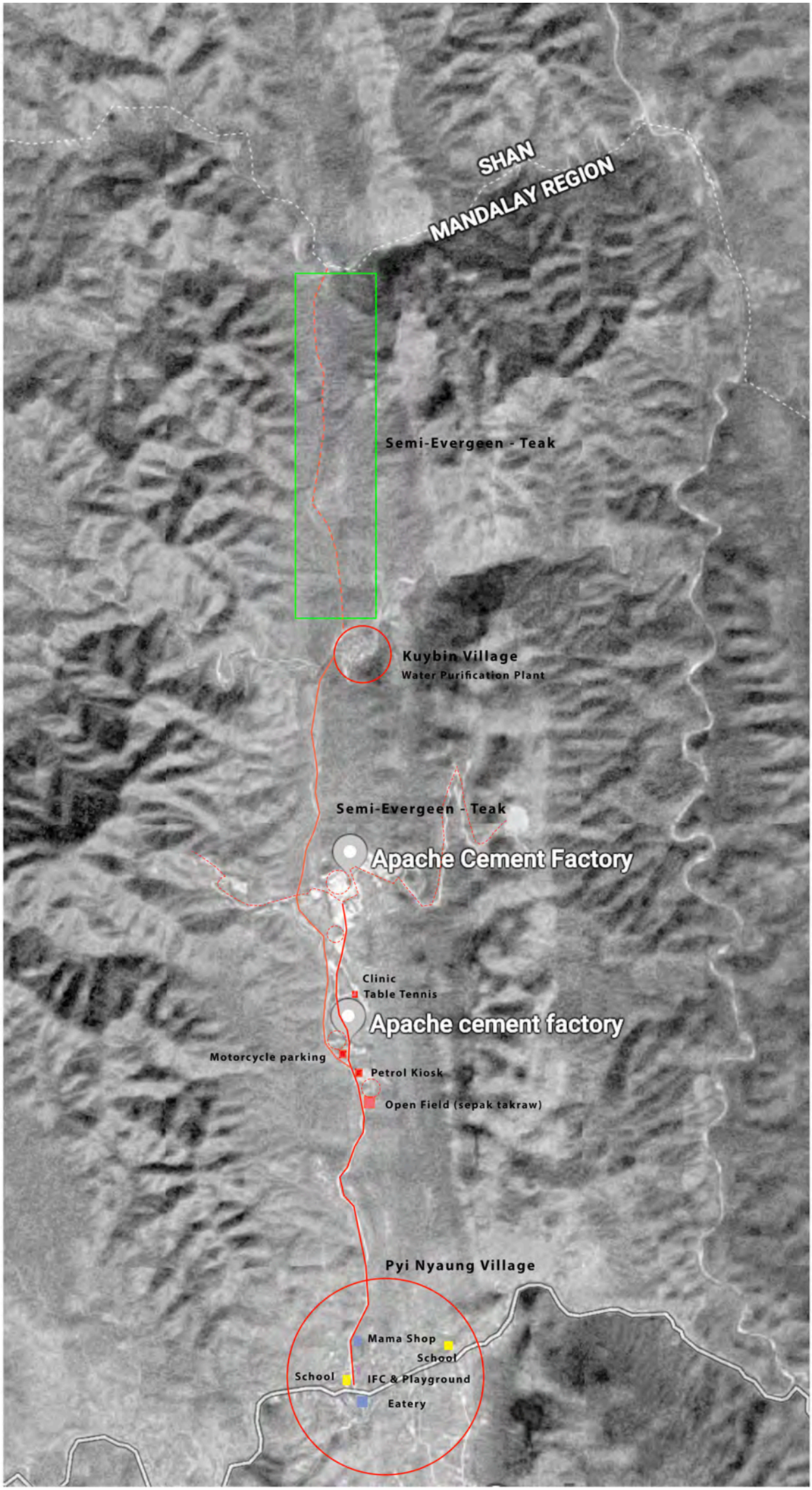


Cross Section Study of Limestone Mountains

20.874857 N 96.407884 E

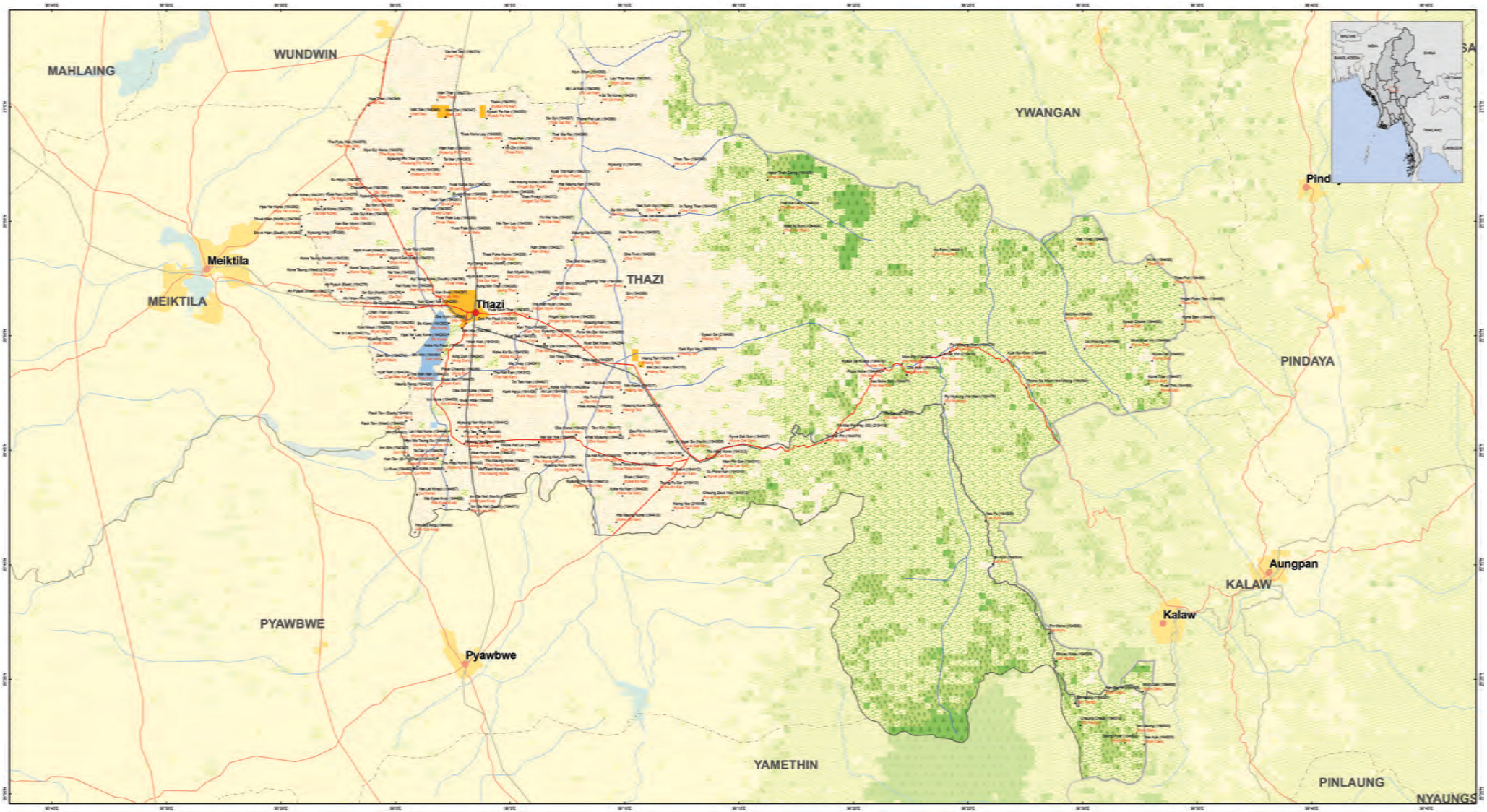


The Secret Proposal : A collective Deceit to Reinstate Paradise


SHAN
MANDALAY REGION
Semi-Evergeen - Teak
Kuybin Village
Water Purification Plant
Semi-Evergeen - Teak
Apache Cement Factory
Clinic
Table Tennis
Apache cement factory
Motorcycle parking
Petrol Kiosk
Open Field (sepak takraw)
Pyi Nyaung Village
Mama Shop
School
School
IFC & Playground
Eatery

Myanmar Information Management Unit

Thazi Township - Mandalay Region



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Data Source:
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Landcover - LP DAAC - MCD12Q1 2011 V.5 IGP (Type1)
Place name - Ministry of Home Affair (GAD)
translated by MIMU

Map produced by the MIMU - E-mail: info.mimu@undp.org
Website: www.themimu.info

Legend

- Village
- Town
- Road
- Railway
- Shore
- Township Boundary
- District Boundary
- State Boundary
- International Boundary
- Non-Perennial/Intermittent/Fluctuating
- Perennial/Permanent

Landcover

- Crop and Vegetation
- Forest
- Mixed Forest
- Grassland
- Shrubland
- Snow Ice
- Urban Build-up
- BareLand
- Wetland
- Water

Ting Kawk (166214)
(Ting Kawk)
- Village Name
- Pcode
- Village Tract Name

N

Kilometers
0 3 6 12

Myanmar Information Management Unit (MIMU) is a common resource of the Humanitarian Country Team (HCT) providing information management services, including GIS mapping and analysis, to the humanitarian and development actors both inside and outside of Myanmar.

NOTE : Due to the limited space of label for Villages, some Village's name will not be appeared on this map.

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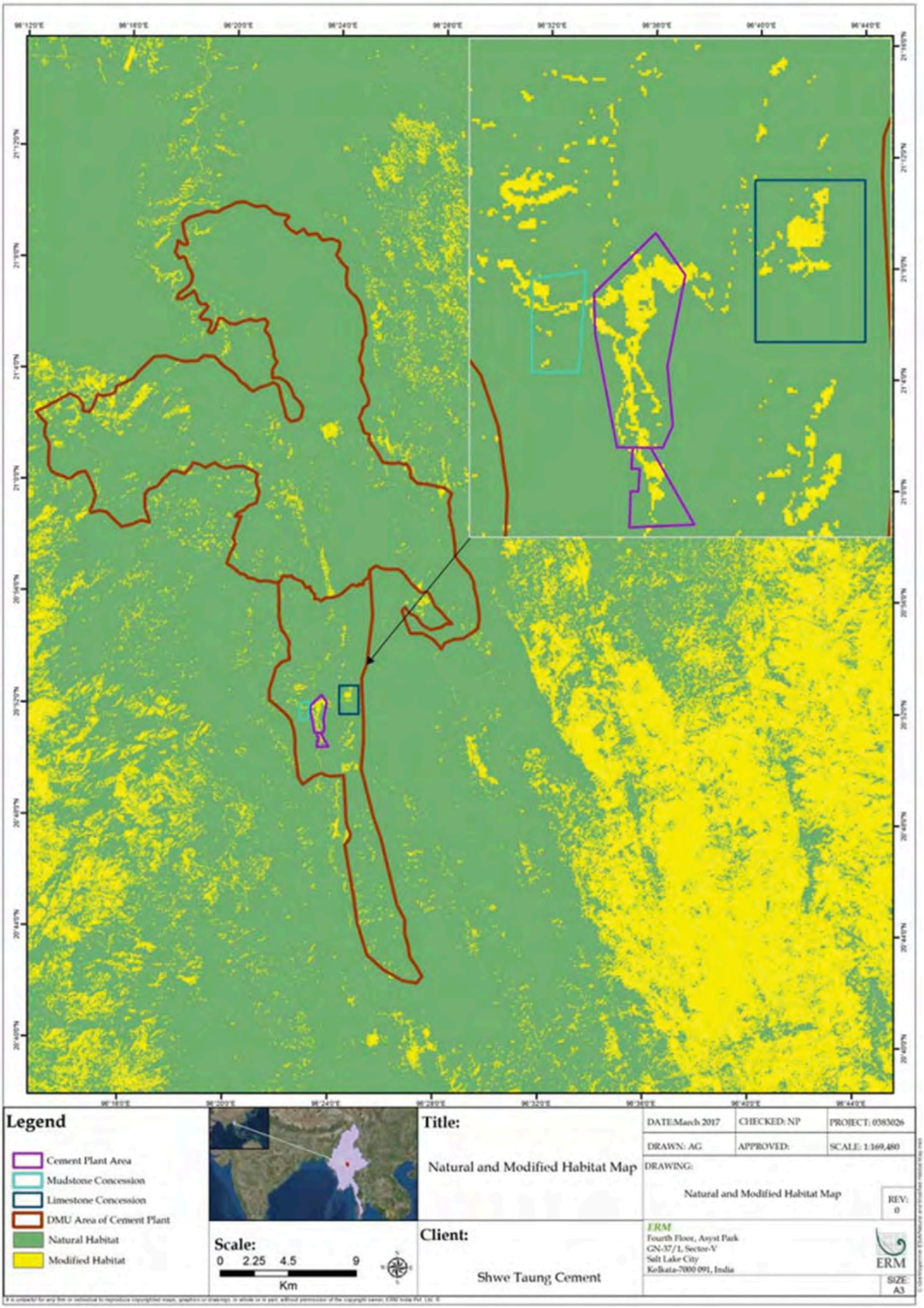
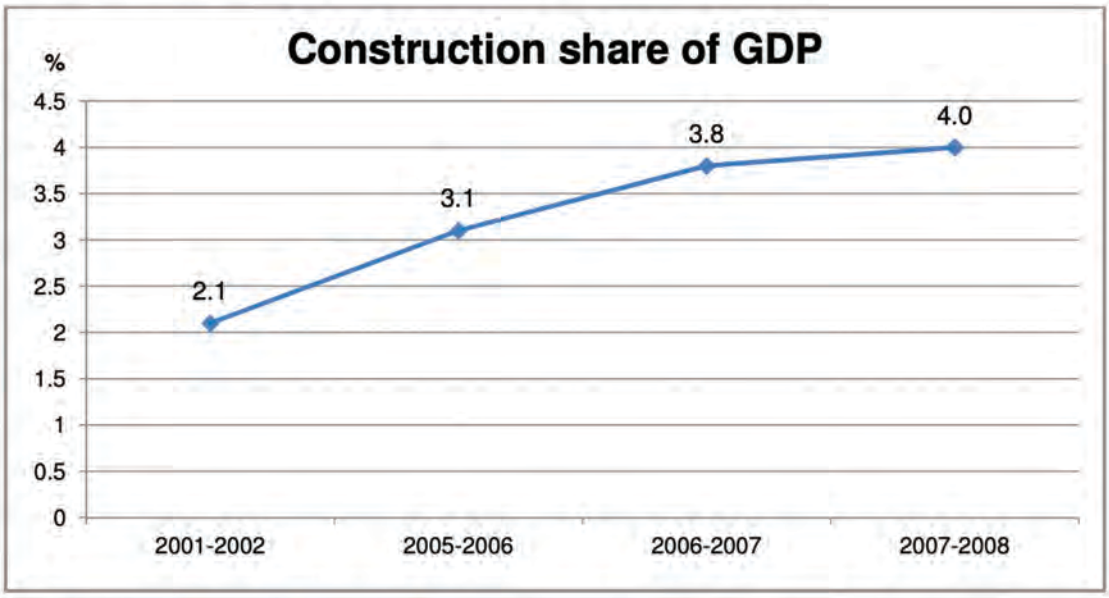
Disclaimer: The names shown and the boundaries used on this map do not imply official endorsement or acceptance by the United Nations.

Figure 6.32 Natural and Modified Habitat Limestone Concession



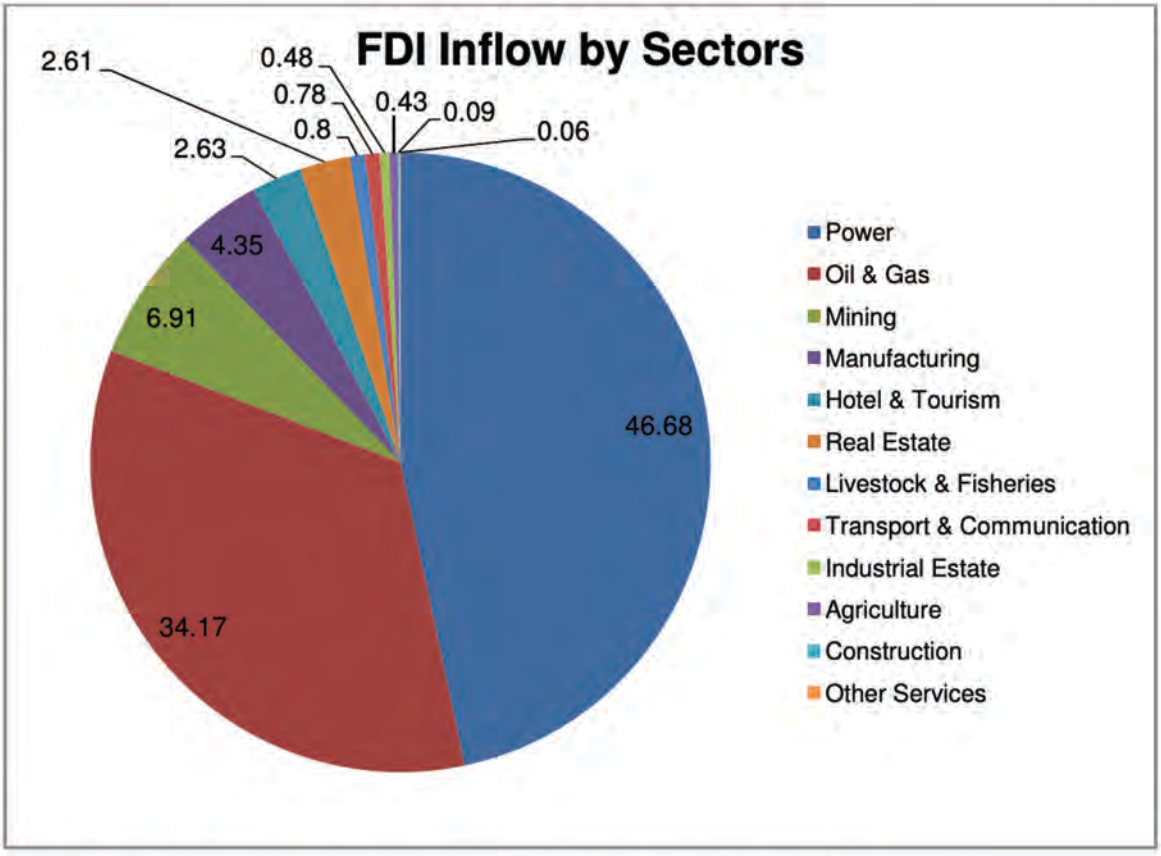
III The Construction Industry

Construction Share of GDP and Growth



Source: Ministry of National Planning & Economic Development

Fig. 9 – Construction Share of GDP in Myanmar at Different Time Periods [12]



Source: http://www.oecd.org/investment/investmentfordevelopment/49972522.pdf

Table 1. Exports of Myanma forest products

Fiscal year	Teak			Hardwood			Plywood	Total (Mil $)
	Tonnes	Average Price ($)	Value (Mil $)	Tonnes	Average Price ($)	Value (Mil $)	Value (Mil $)	
2001/2002	200500	1182.5	237.1	285600	266.8	76.2	17.7	331.0
2002/2003	205600	1124.5	231.2	308000	261.4	80.5	16.2	327.9
2003/2004	281100	884.7	248.7	390800	237.5	92.8	14.1	355.6
2004/2005	319200	790.4	252.3	496800	243.2	120.8	15.4	388.5
2005/2006	333100	862.2	287.2	636700	268.9	171.2	19.0	477.4

Source: CSO, Selected Monthly Economic Indicator October 2007.

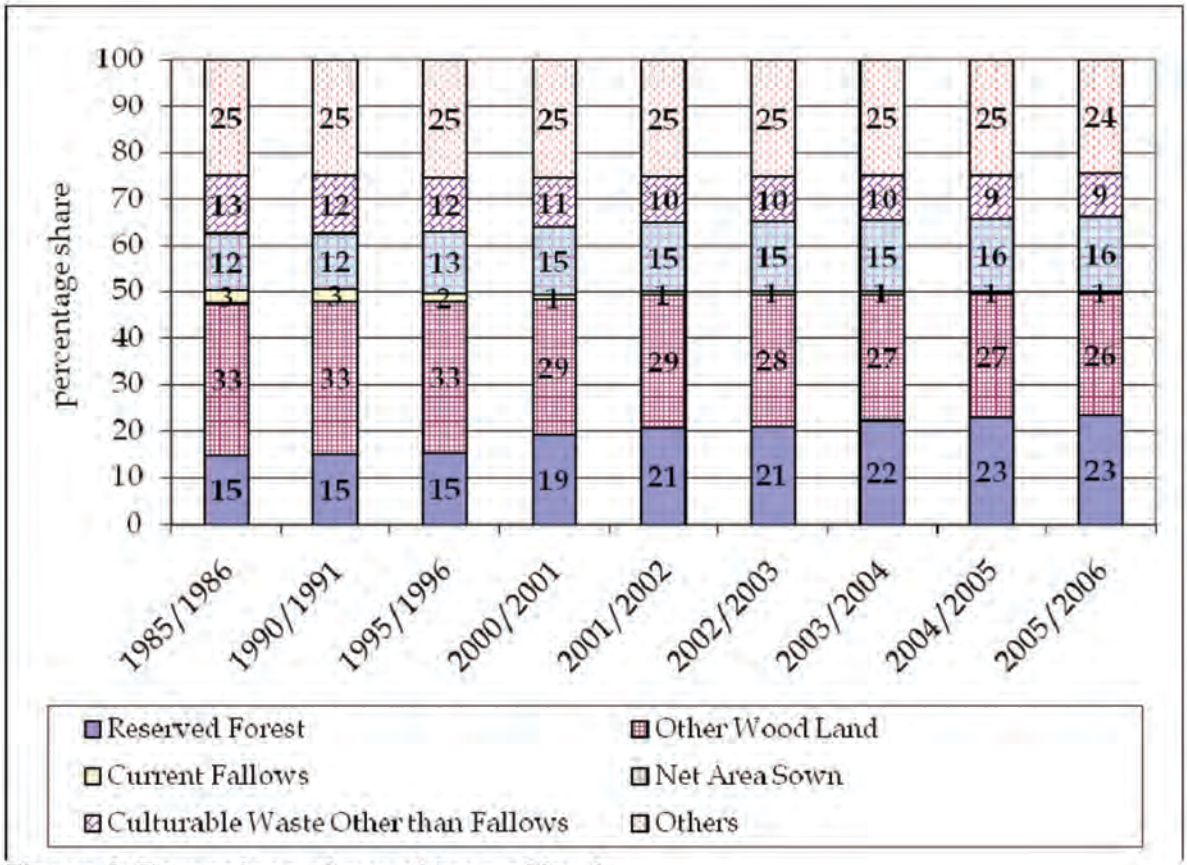


Figure 1. Percentage share of type of land

Source: Statistical Yearbook (2003), (2004), (2005) and (2006).

Teak alone contributed to 60-70 percent of the total export earnings from forest products .

Agriculture and fisheries generated 45 percent of Myanmar GDP in 2007.

7.1 SOCIO-ECONOMIC CONDITIONS

7.1.1 Demographics and Population

The socio-economic baseline is derived from engagement with village leaders, groups of farmers and women and a survey of 100 households from five villages in the vicinity of the Project sites.

Basic information concerning the surveyed households and villages is summarised in ***Table 7.1*** and ***Table 7.2***.

Table 7.1 Population Data of Surveyed Households

Village Name	Number of respondents	Ethnic Group - Bamar	Ethnic Group - Karen	Average number of members per HH	Total number of residents in village	Male / Female Respondents (%)	Average Age of Respondent (years)
Kubyin	25	19	6	4.84	271	12%/88%	42
Pyi Nyaung	25	25	0	4.80	2,569	48%/52%	49
Chaungzon	20	20	0	4.15	80	60%/40%	37
Paluzawa	11	11	0	4.27	253	36%/64%	49
Nanmawke	19	19	0	5.21	75	16%/84%	35

Table 7.2 Economic Data of Surveyed Villages

Village Name	Average Monthly Income (Kyat per HH)	Average Monthly Expenditure (Kyat per HH)	Land Holdings (number of HH / surveyed) (1)	Average Land Holding (acres) (1)	Total Land Holding of the Surveyed HH (acres) (1)
Kubyin	284,400	52,020	16 (of 25)	1.81	29
Pyi Nyaung	264,400	180,520	18 (of 25)	3.56	64
Chaungzon	243,350	189,975	18 (of 20)	2.39	43
Paluzawa	201,818	126,682	10 (of 11)	2.27	25
Nanmawke	247,895	116,842	15 (of 19)	2.97	56

Note:

(1) The farmland is state owned forest area which villagers cleared to grow crop, except for Kubyin Village. The farmers of Kubyin Village are farming government owned forest, which is a replantation area under the management of the Forest Department.

7.1.2 Health

The residents consulted in the five villages stated that they considered themselves healthy and do not face any serious diseases. Malaria was noted as the main cause of adult mortality, however, villagers have not suffered new cases of malaria for a long time. In the dry season, sometimes they suffer from minor skin irritation due to the water shortage.

7.1.3 *Education*

Of those consulted in January 2017, the majority were illiterate. Only one village (Pyi Nyaung) has people that had attended university education. The illiteracy rate in the households consulted ranged from 21 to 44%. Data collected area presented in *Table 7.3*.

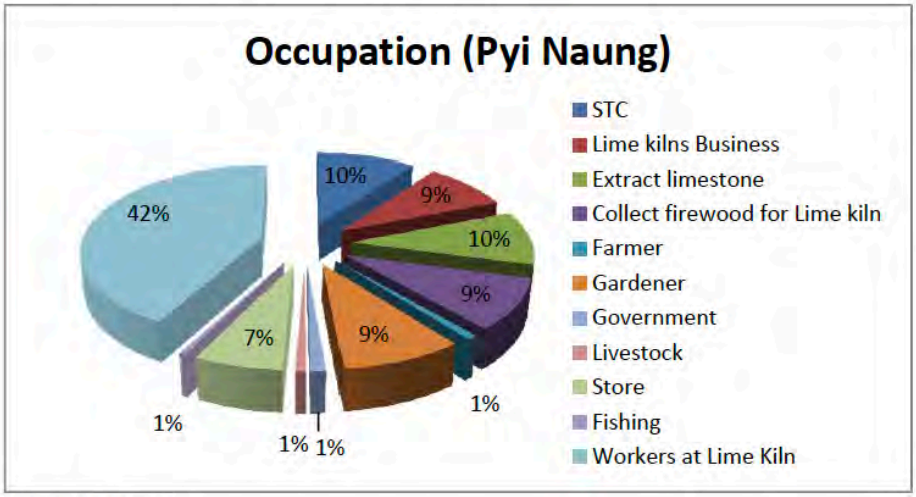
Table 7.3 ***Number of Households (surveyed) within Education***

Village Name	Illiterate	Primary	Middle School	Secondary School	University
Kubyin	11 (44%)	9 (36%)	5 (20%)	0	0
Pyi Nyaung	8 (32%)	8 (32%)	6 (24%)	1 (4%)	2 (8%)
Chaungzon	6 (30%)	12 (60%)	2 (10%)	0	0
Paluzawa	6 (55%)	4 (36%)	0	1 (9%)	0
Nanmawke	4 (21%)	4 (21%)	11 (58%)	0	0

7.2 *CEMENT PLANT*

The Project is located within Pyi Nyaung Village of Tharzi Township in Mandalay Region. The populations of Pyi Nyaung and Kubyin are 2,569 (53% male) and 271 (50% male), respectively. The household surveys indicate that most of the people in both villages are of the Bamar ethnicity and are predominantly Buddhist. There are a six ethnic Karen (Christian) households in Kubyin (of the six households; four were met) and one was met in Pyi Nyaung. Consultation with officials and the community revealed that there are no areas or sites of special cultural importance within the Project area.

Figure 7.1 Employment in Pyi Nyaung Village



Source: ERM, 2017

While limestone production, including the extraction of limestone and firewood, is reportedly the main source of income for residents of Pyi Nyaung, an unknown number of residents are involved in logging of teak and other hardwood timber and its transportation to the nearby towns of Taunggyi, Thazi and Meikhtila.

The average monthly income is Kyat 264,400 with 5 households earning double and one more than triple that amount, from his business. The median monthly income of those surveyed is Kyat 210,000. One respondent declared earning double the average from "other sources".

Over half of the respondents (56% or 14 households) stated having taken a loan for their business (28%), to buy food (16%) or for education or medical expenses (12%) but only two-thirds (36%) of those declaring loans mentioned repaying a loan as part of their expenditures.

Table 3.1 *Noise Level Guidelines outside the Project Site Boundary*

Receptor	One Hour LAeq (dBA)[a]	
	Daytime 07:00 – 2:00 (10:00 – 22:00 for Public holidays)	Nighttime 22:00 -07:00 (22:00 – 10:00 for Public holidays)
Residential, institutional, educational	55	45
Industrial, commercial	70	70

Source: WBG EHS General Guidelines (2007)

Note: [a] Equivalent continuous sound level in decibels

Table 3.2 *Air Emission Levels for Cement Manufacturing*

Pollutants	Units	Guideline Value
Particulate Matter (new kiln system)	mg/Nm^3	30
Dust	mg/Nm^3	50
SO_2	mg/Nm^3	400
NOx	mg/Nm^3	600
HCl	mg/Nm^3	10
Hydrogen fluoride	mg/Nm^3	1
Total Organic Carbon	mg/Nm^3	10
Dioxins-furans	mg TEQ/Nm^3	0.1
Cadmium + Thallium	mg/Nm^3	0.05
Mercury (Hg)	mg/Nm^3	0.05
Total Metals[a]	mg/Nm^3	0.5

Source: WBG EHS Guidelines for Cement and Lime Manufacturing (2007

Note:
1. Emissions from the kiln stack unless otherwise noted. Daily average values corrected to 273 K, 101.3 kPa, 10 percent O_2, and dry gas, unless otherwise noted.
2. Total Metals = Arsenic (As), Lead (Pb), Cobalt (Co), Chromium (Cr), Copper (Cu), Manganese (Mn), Nickel (Ni), Vanadium (V), and Antimony (Sb)

Figure 6.9 *Wind Rose 2012 - 2016*

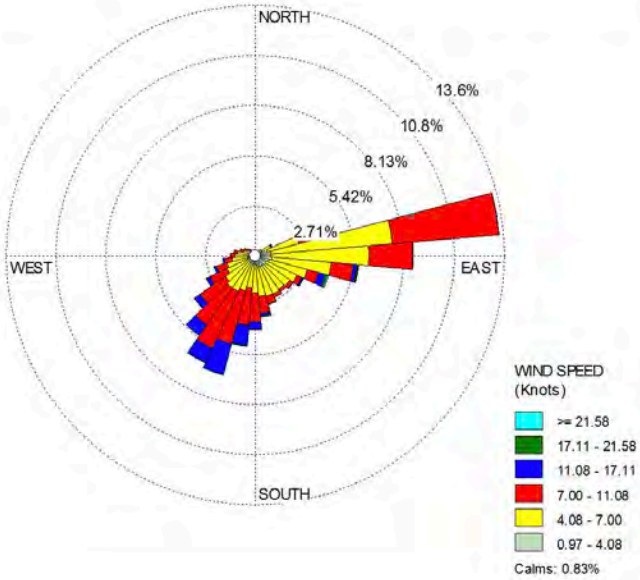


Figure 6.7 *Mean Monthly Temperature*

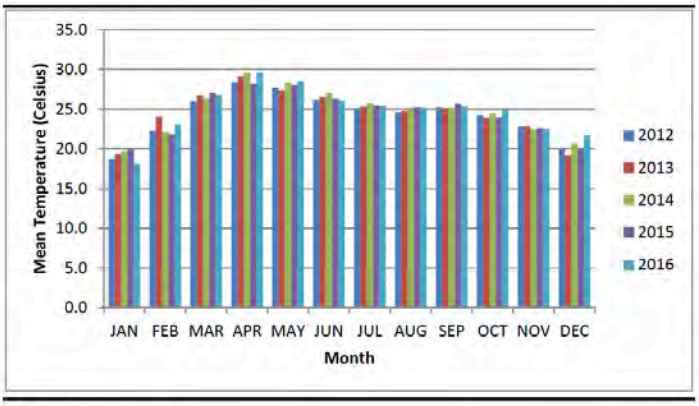


Figure 6.8 *Mean Wind Speed*

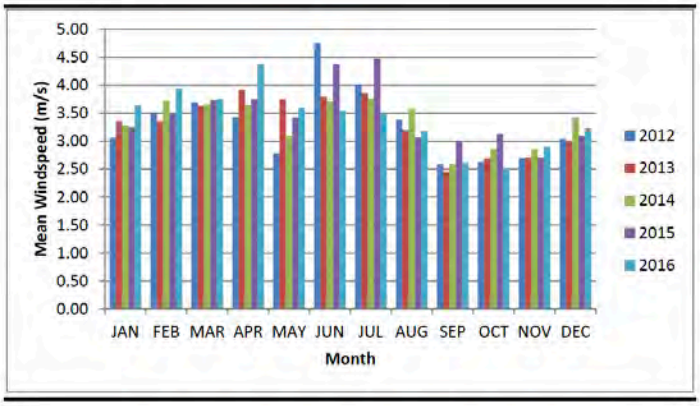


Fig. 1 – Karst in the western Shan plateau

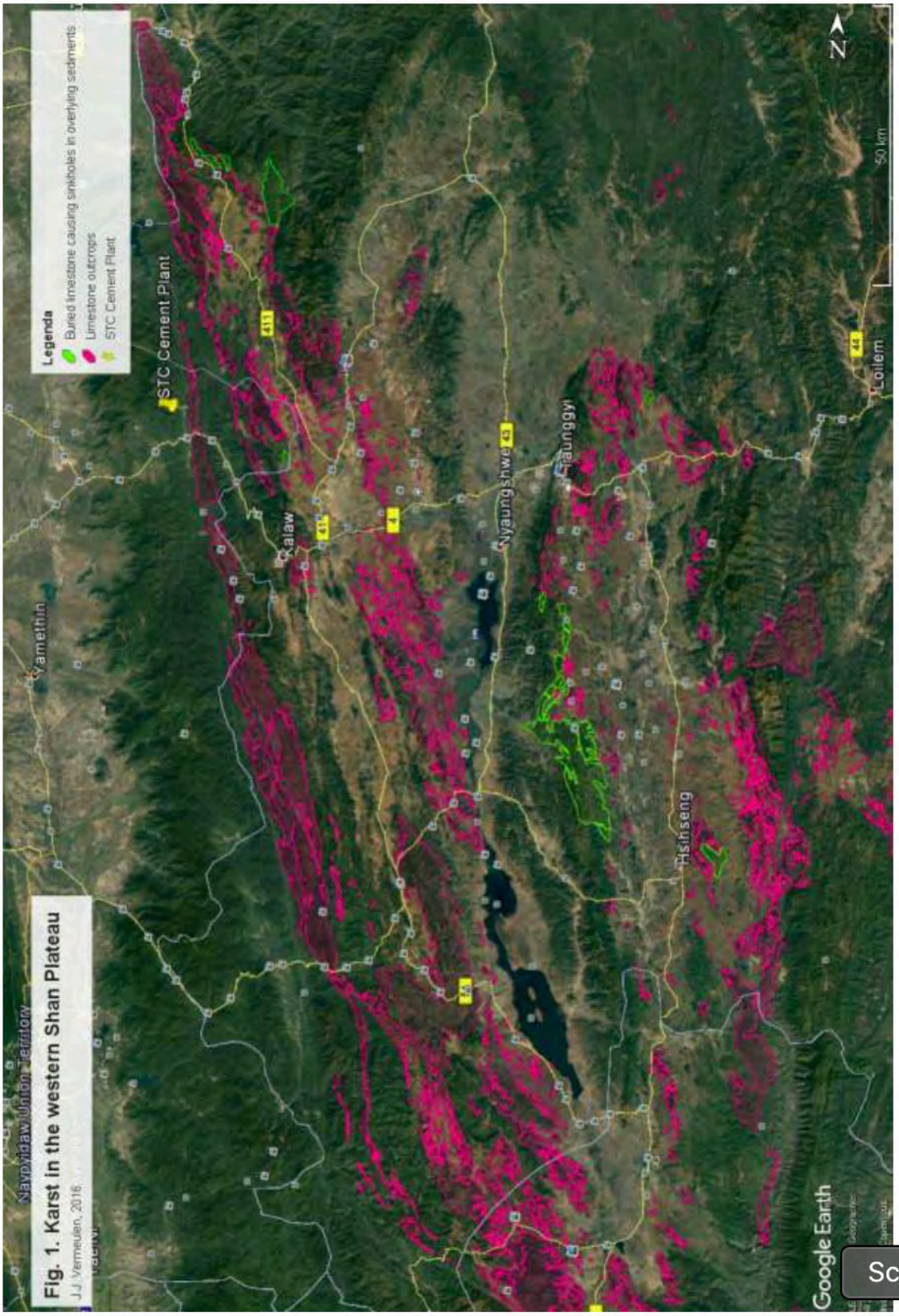
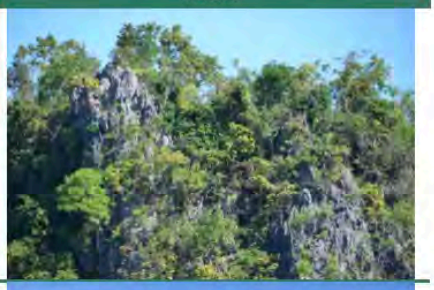
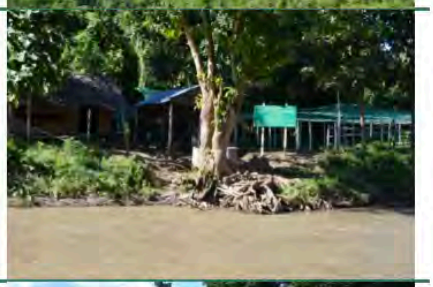
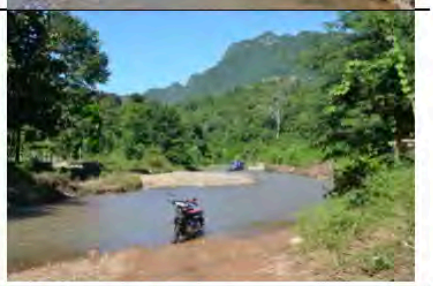


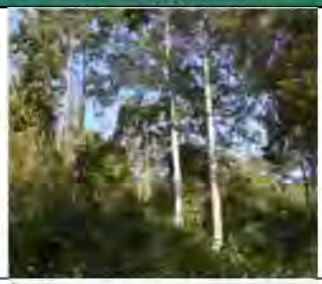
Table 6.25 Land Classes within the AoI, Project Concession and Project Area

Land Class	Description	Photo
Karst	This refers to the limestone outcrop ranging from the north to south of the AOI; a section of the outcrop falls within the project limestone concession. The limestone outcrop is part of the Shan plateau series of limestone ranges.	
Agricultural land	This comprises the areas utilized for cultivation of crops such as rice, sesame, ground nut, plantation timber and sunflower etc.	
Scrubland	This refers to the vegetation covering the AOI, project concession and project area.	
Semi-rural/Urban	These are areas where human settlements have been established or land cleared for buildings. This includes the cement plant factory site and areas that have been cleared for the establishment of plant facilities.	
Marsh	This land class can be found surrounding the wetland and reservoirs established within the project area.	
Freshwater habitat	This habitat can be found within the wetland and reservoirs established within the project area. There are also rivers and creeks around the project area in Thazi township.	

Coal Mine

The following land class types within the coal mine have been identified and described in *Table 6.26*.

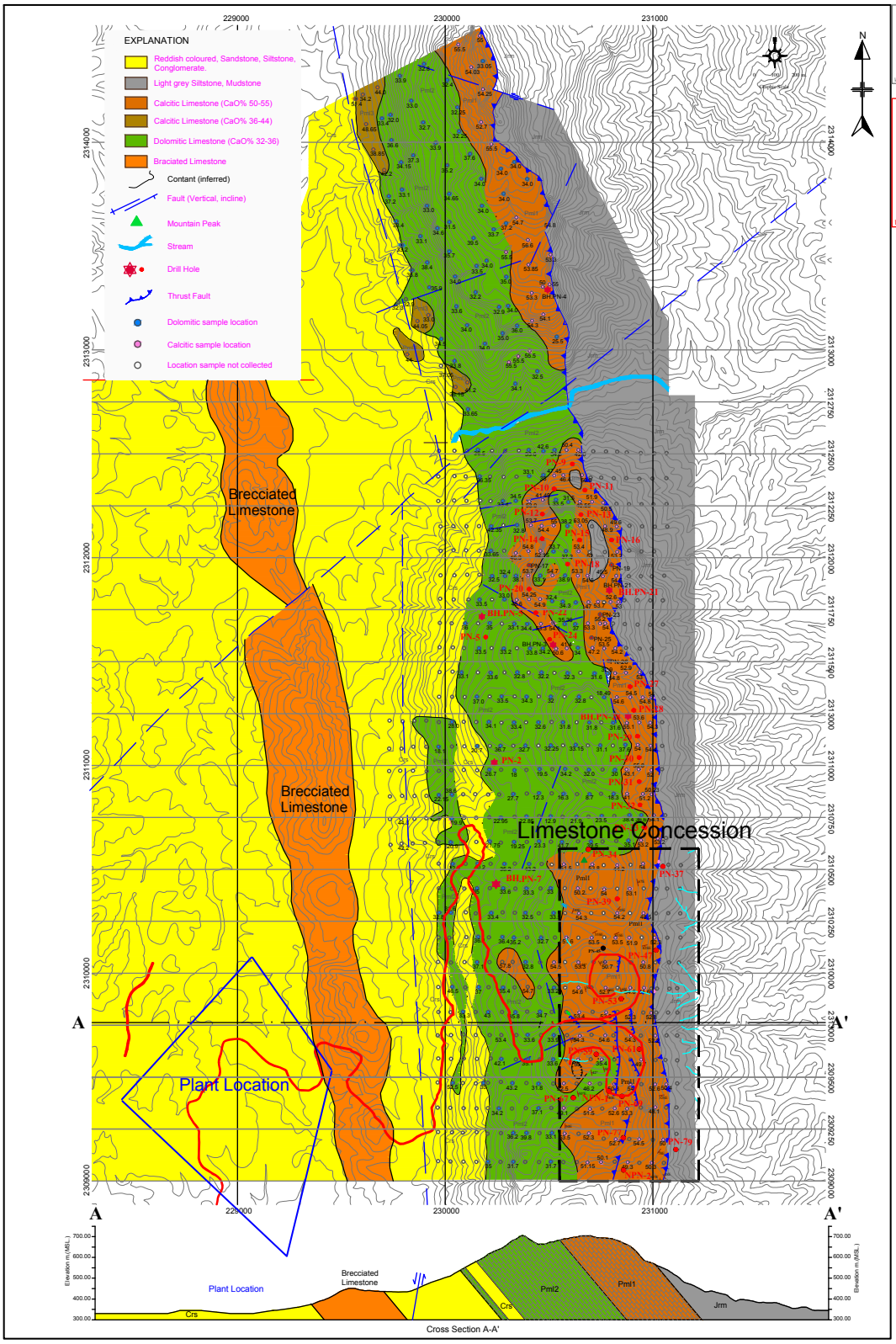
Table 6.26 Land Classes within the AoI, Project Concession and Project Area

Land Class	Description	Photo
Forest	There are several tracts of forest within the AOI that are noted to be of fairly good quality. These comprise largely of deciduous forest and mixed broad-leaved deciduous forest, interspersed with bamboo forests.	
Agricultural land	This comprises the areas utilized for cultivation of crops such as rice, sesame, ground nut, plantation timber and sunflower etc. Several sunflower fields were observed within the AOI.	
Semi-rural/Urban	These are areas where human settlements have been established or land cleared for buildings. This includes the workers' camps and villages within the AOI.	
Marsh	This land class can be found surrounding the wetland spot and reservoirs established within the project area.	No Photograph is available
Freshwater habitat	This habitat can be found within Paluzawa creek and tributaries within the AOI and project concession. There are also plans to establish wetlands within the project concession.	

6.3.9 Natural and Modified Habitats

Given an understanding of the species assemblages within each habitat/land class, and supplemented with field observations of the general quality of these habitats, natural-modified habitat classifications have been assigned as shown in *Table 6.27* and *6.28*. The distribution of Natural Habitat and Modified Habitat for each concession is shown in *Figures 6.32* and *6.33*.

THE CHEMICAL ASSAY RESULT AND GEOLOGICAL MAP OF KYAUKKET TAUNG & THAPYAY TAUNG, PYINYAUNG AREA.



World market for logs from teak plantations

Posted by Global New Light of Myanmar | Date: **July 04, 2019** | in: Articles

- ***By Mya Oo Maung***

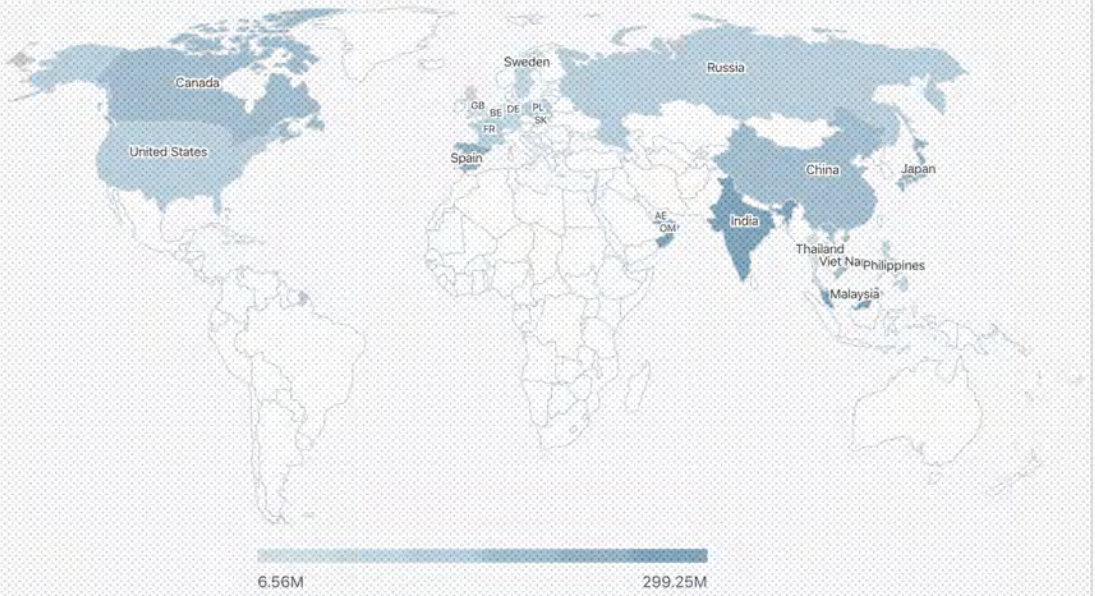
A teak plantation in Bago Region

Teak is a first-class wood that is highly valued and well accepted throughout the world. As a kind of wood produced in temperate zones and due to its properties, teak is popularly known as " Golden Teak" in the world. Its colour, sturdiness, stability, beautiful grains and appearance bear no comparison with other different woods. All the utensils made of teak have been highly expensive throughout history. Up until now, humanitarian views on teak have not changed. That is why trading in teak remains a highly beneficial business.

Higher purchasing power

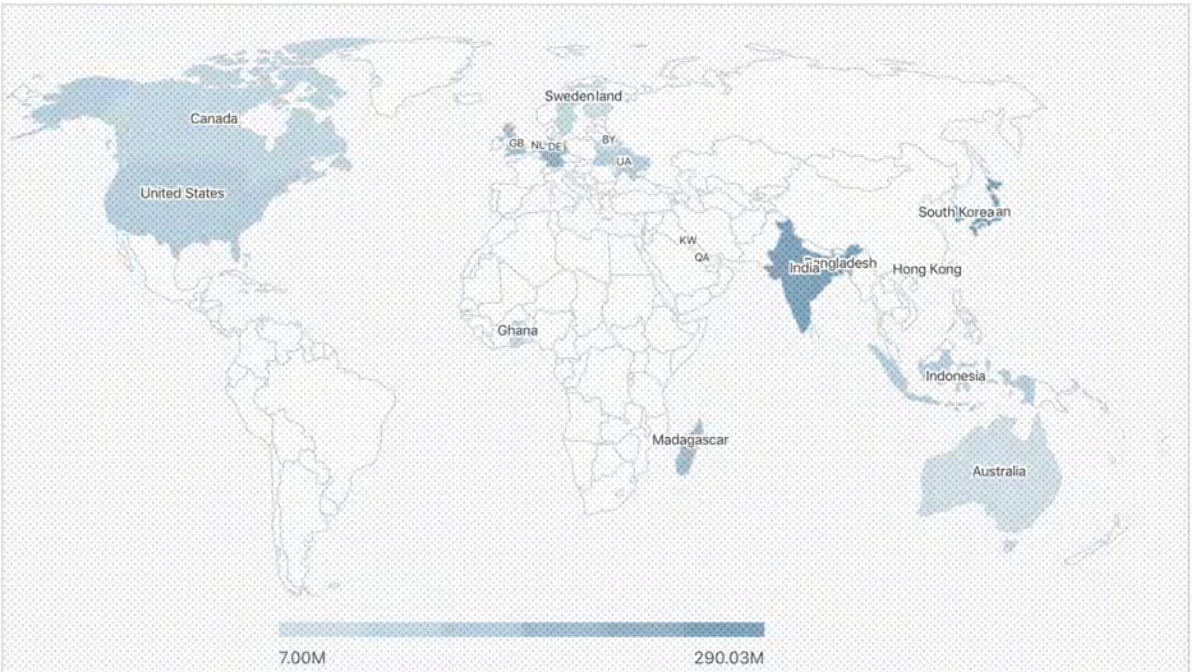
According to the statistics from 2005 to 2014, yearly world trading on logs of teak were over one million cubic meters worth $487 million. Main teak-importing countries in the world are India, Thailand and China. During the above-mentioned period, India had mostly imported teak logs in the world, generating 74% of the world 's trading amounts. Thailand stood second with 16% and China with 10%. Total trading amounts of these three countries have doubled from cubic meters 5.57 lakhs to1.2 cubic meters with quadruple amounts of $ 166 million to $ 696 million. That was mainly due to higher purchasing powers from India and China.

Myanmar is termed as a teak heavyweight in the world trading sector. It has possessed a half of natural areas of 29 million hectares in the world. Myanmar has produced a lot as it owns a large portion of teak plantations. Myanmar's natural plantations have produced 25% of the world's teak trading amounts. Teak trees naturally thrive in India, Myanmar, Thailand, and Laos. Felling of teak trees is now prohibited in India and Thailand. Extraction of natural teak trees is still allowed in Myanmar; reduction of production and export of teak logs are being prohibited.



Rank	Country	Export Value in 2016 USD	Shares in Export USD	1-Year Growth in Value %	3-Year Growth in Value %	Export Quantity Metric Ton	1-Year Growth in Quantity %
1	United Ar...	$299.25M	37.0%	+5.8%	+18.9%	-	+0.0%
2	Malaysia	$75.13M	9.3%	+5.7%	+28.8%	1.44M	-0.9%
3	India	$62.81M	7.8%	-1.7%	+48.6%	3.57M	+19.5%
4	Oman	$43.14M	5.3%	-59.0%	-23.7%	2.22M	-25.3%
5	Japan	$43.12M	5.3%	+9.5%	+6.7%	-	+0.0%
6	Belgium	$30.67M	3.8%	+33.0%	+14.6%	-	+0.0%
7	Spain	$30.52M	3.8%	+40.1%	+908.3%	1.04M	+19.4%
8	Canada	$21.92M	2.7%	-20.9%	-11.6%	1.87M	-32.0%
9	Vietnam	$19.24M	2.4%	-64.0%	-53.8%	-	+0.0%
10	China	$18.61M	2.3%	-35.1%	-35.0%	-	+0.0%
77	Myanmar ...	$12.22K	0.0%	+147.3%	+106.7%	16.40	+23.6%

Limestone Economy (Export)



Rank	Country	Import Value in 2016 USD	Shares in Import USD	1-Year Growth in Value %	3-Year Growth in Value %	Import Quantity Metric Ton	1-Year Growth in Quantity %
1	India	$290.03M	35.9%	-0.3%	+5.3%	16.76M	+15.1%
2	Bangladesh	$51.25M	6.3%	-34.1%	+26.5%	-	+0.0%
3	Japan	$43.48M	5.4%	-23.9%	-13.2%	550.58K	-26.7%
4	South Kor...	$42.95M	5.3%	+8.5%	+8.7%	2.04M	+14.7%
5	Kuwait	$39.82M	4.9%	-54.6%	+35.2%	4.15M	-44.0%
104	Myanmar ...	$71.25K	0.0%	+26.5%	-15.5%	306.88	+95.6%

Limestone Economy (Import)

The Irrawaddy

Burma

Caves Are More than Sites for Buddhist Shrines: Expert

Ko Nyi Nyi Aung at the entrance of the Elephant Whirlpool River Cave in Kyauk Nget village, Ywangan, southern Shan State. / Nyi Nyi Aung / Supplied

YANGON—While caves themselves have not generally been the subject of environmental conservation efforts in Myanmar, the widespread custom among the country's Buddhist majority of placing Buddha images or building stupas and shrines o mountains and hills, as well as inside caves, has helped to protect them from total destruction.

Buddhist religious sites are considered places of worship for adult pilgrims and a wonderland in which to play for children. One of the few people who turned this childhood wonder into an adult effort to preserve such sites is climber and cave researcher Ko Nyi Nyi Aung. He has been a mountaineer for 14 years and participated in the Myanmar Everest Expedition in 2016, in which two of his colleagues became the first climbers from Myanmar to reach the summit of the world's highest peak.

THE IRRAWADDY

Cement Factory Accused of Destroying Antiquities

By LAWI WENG/ SANKHLABURI Monday, February 25, 2008

Gaps in the walls of Kawgun cave, near Hpa-an, show where Buddha statuettes and other ancient plaques have been dislodged. (Photo: HURFOM)

Mining work by a Burmese government-owned cement factory is destroying ancient Buddha images and votive tablets in a cave near Hpa-an, capital of Karen State, according to historians and local residents.

The Kawgun cave—a natural lime stone cavern, 200ft high and 300ft long—is located near a village of the same name, two miles from Hpa-an. It contains many images and artifacts that historians say date from the Pyu era, spanning the period from the first century to the ninth century AD.

Although the department of archeology of Burma's Ministry of Culture has prohibited mining and excavations near religious sites, residents say the government-owned Myaingkalay cement factory, situated on the west bank of the Salween River, routinely blasts the mountains of the Kawgun area to extract material.

Residents say the blasting dislodges the Kawgun cave's Buddha statuettes and other historical objects. "Buddha statues are broken day after day, and we feel very frustrated," a monk told *The Irrawaddy*. "We want to repair the damage, but it should be the responsibility of the department of archeology."

The Irrawaddy was unable to obtain any reaction from the Naypyidaw-based department.

https://www.mmtimes.com/national-news/nay-pyi-taw/20291-limestone-mountains-need-protection.html

Frontier
MYANMAR

Kayin residents struggle against cement plant expansion

Wednesday, October 26, 2016

In rural Kayin State, residents are uniting against a military-owned corporation's plan to expand cement production using coal power.

By SU MYAT MON | FRONTIER
Photos THEINT MON SOE aka J

COMMUNITY OPPOSITION is mounting to cement production in Hpa-an Township, Kayin State. For the past three years, residents of 10 villages have banded together as the Thanlwin Network to counter the proposed expansion of the cement industry in the Myaing Kalay area, about two hours' drive east of Hpa-an.

A factory run by the military has been in operation at Myaing Kalay for more than three decades, but in recent years private investors have also shown interest in the area.

The mountain range is home to pagodas and sacred caves, some of which are inhabited by monks.

"If [Lay Htee Taung] is destroyed due to economic projects, we will lose our livelihoods and our culture. We will be responsible [for its destruction] to our descendants," he told a recent meeting on September 27 in Mayan Kone village that was attended by 400 people.

When the plant was built, villages were forced to relocate without any compensation. The factory creates air pollution during both hot and cool season.

She said the companies came to survey at Lay Htee Taung during rainy season, when much of the land in the area is flooded. Residents fear that the companies want to show that the land is vacant, rather than being used.

"It is not as they said – we grow rice annually in those areas once the water has subsided, and we also use it for fishing," she said.

The Irrawaddy

Burma

Revived Cement Factory Draws Protestors in Hpa-an

Hundreds of locals in Karen State's Hpa-an gather to voice objections to a recently revived proposal there to develop a limestone quarry and cement factory.

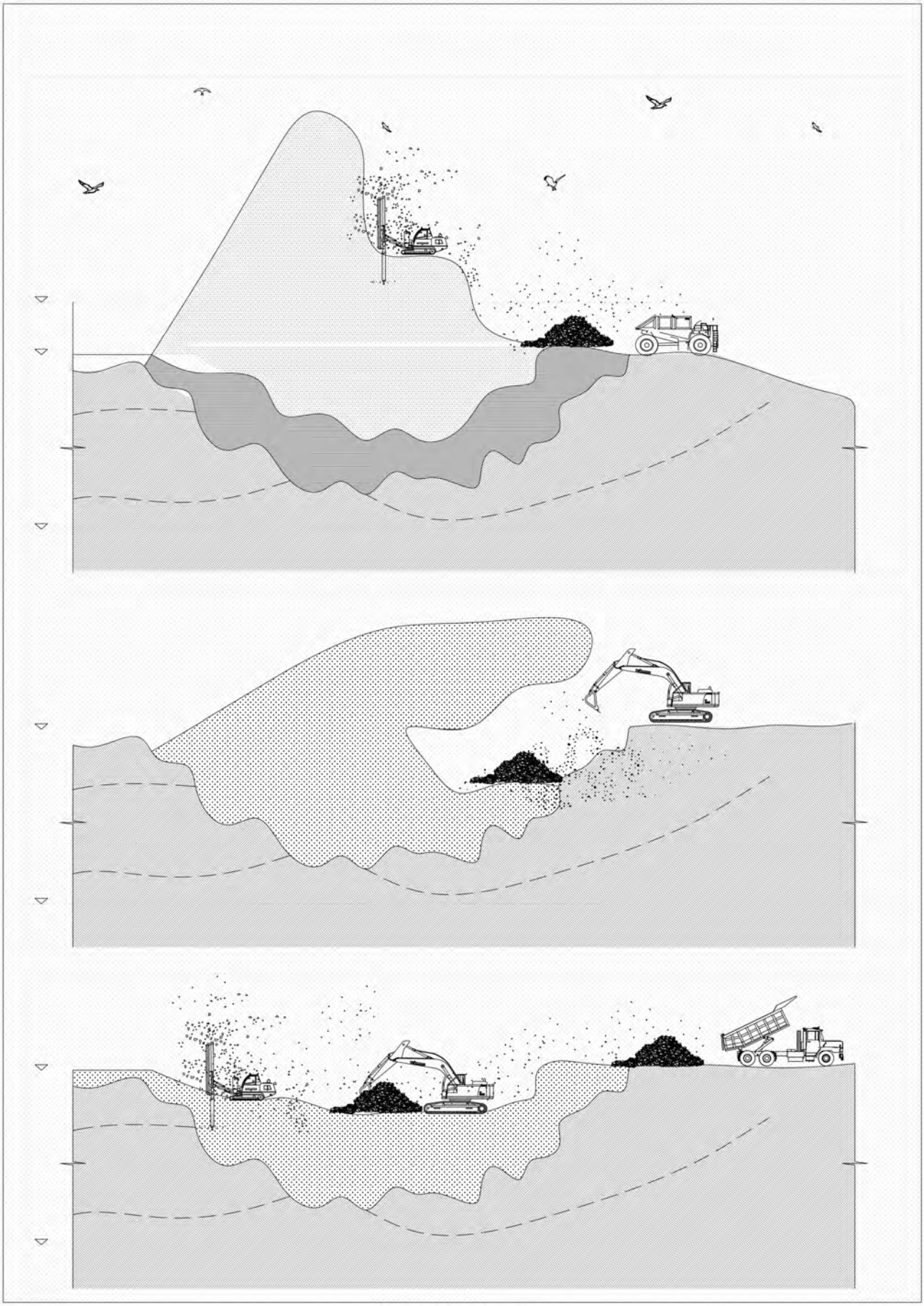
By **NYEIN NYEIN** 29 March 2016

RANGOON — Hundreds of locals in the Karen State capital Hpa-an gathered on Tuesday to voice objections to a recently revived proposal there to develop a limestone quarry and cement factory, which was put on hold two years ago pending public consultation.

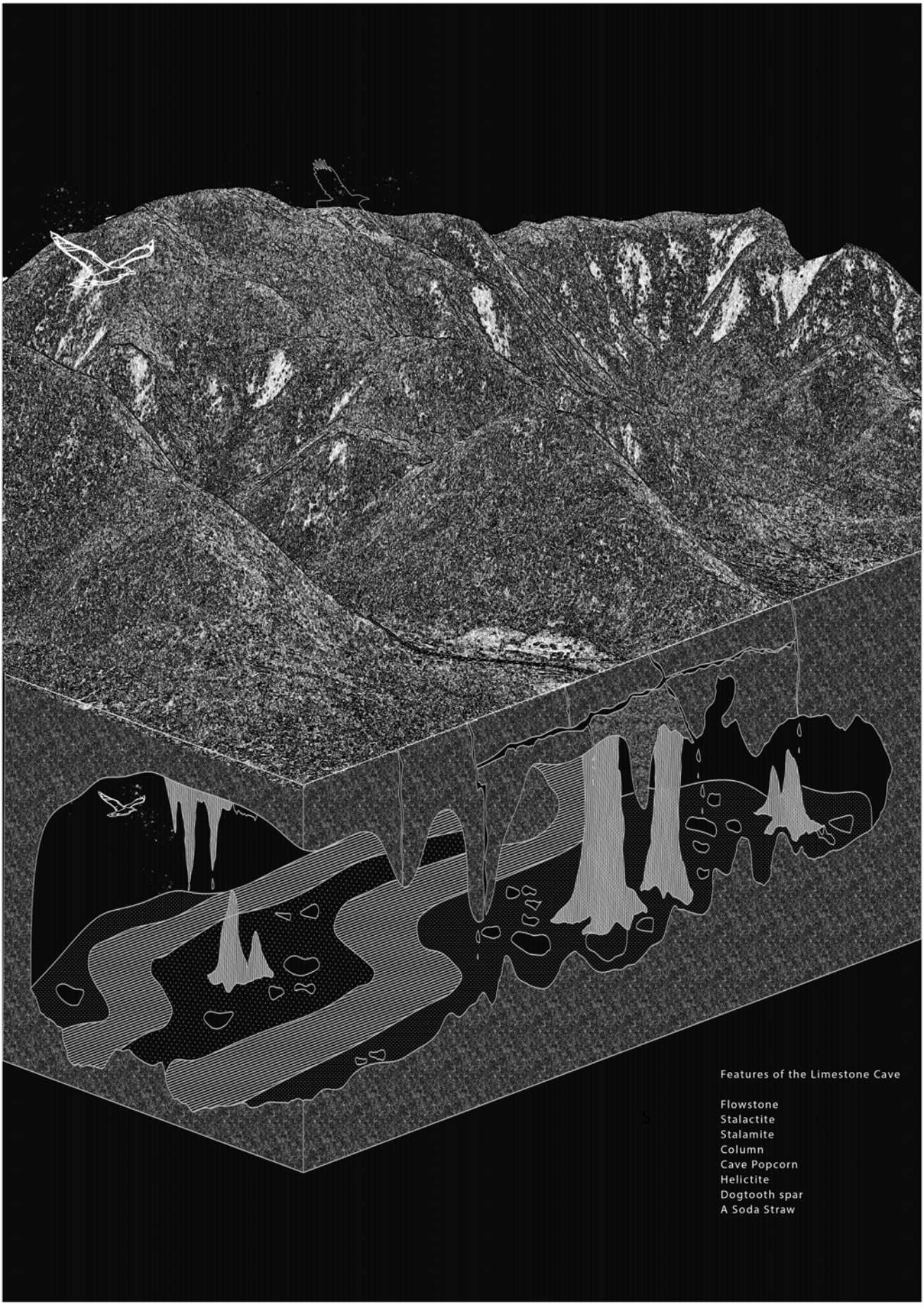
At a "No Cement" prayer vigil, protestors demanded a scrapping of the project, slated to produce 5,000 tons of cement per day in Mi Karen village, part of Hpa-an Township.

There are already two cement factories in Hpa-an run by the government and the military's Union of Myanmar Economic Holdings Limited (UMEHL), which have a combined production capacity of 4,900 tons per day. Both factories are located in Myaingkalay town, with the new project just a few miles away from the current operations, according to the Karen Environmental and Social Action Network (KESAN).

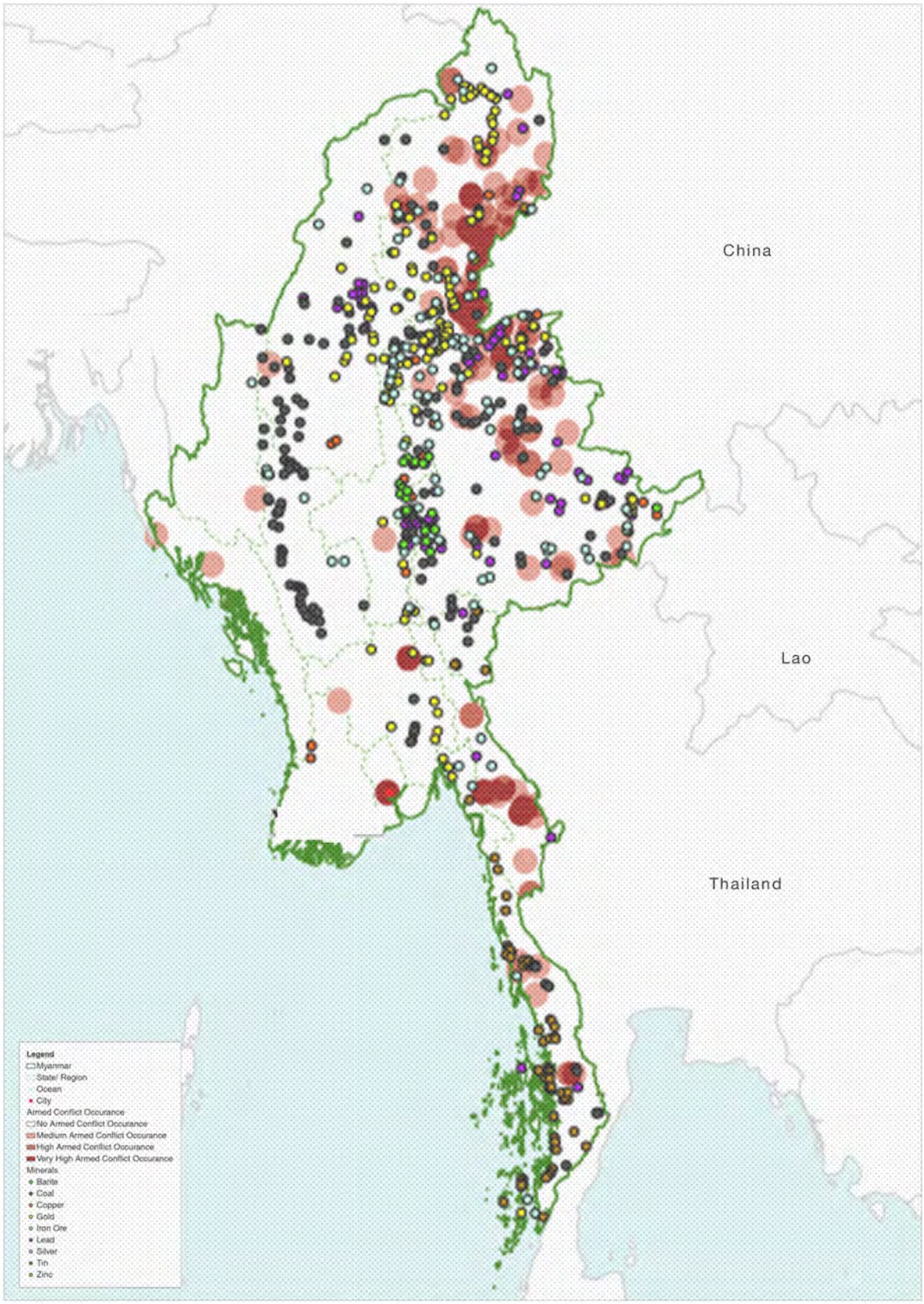
Saw Tha Phoe, an ethnic Karen environmentalist from KESAN, told The Irrawaddy that locals were facing enough health problems from the existing factories, which he linked to both air and noise pollution. Mining related to the operations had produced vibrations that also caused damage to an ancient pagoda, he said, adding that with the factories drawing migrants from elsewhere, both drug use and sexual abuse of women were social ills increasingly facing the community.



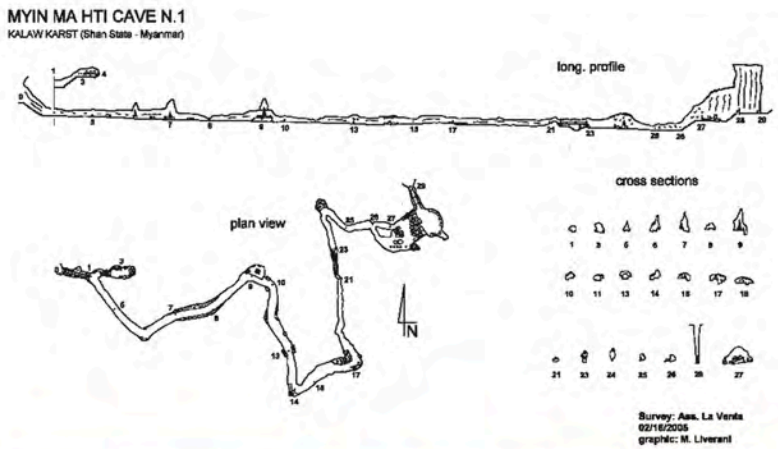
Limestone Quarry Extraction

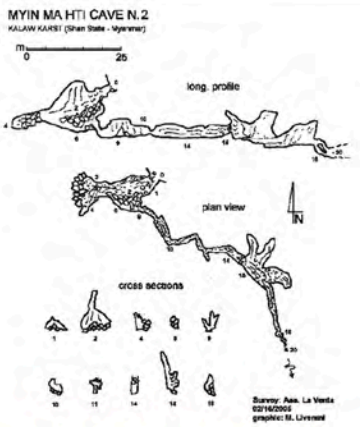


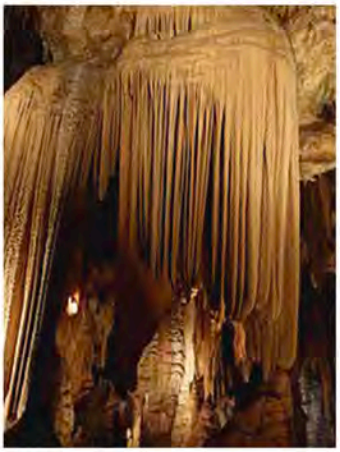
Karst Landsacpe & Limestone Cave Formation



Limestone & Political Conflict







Flowstone

Flowstones are speleothems (deposits of calcium carbonate) on the walls or floor of a cave formed from a gradual flow of water over a relatively broad area.

Stalactite

Formations "drip" from the roofs of limestone caves. Water reacts with carbon-dioxide to form carbonic acid which seeps slowly through the roof of the cave, depositing calcium carbonate, which hardens and builds up over time.

Stalagmite

Stalagmites rise from the floor in a build-up of calcium carbonate over time, from mineral-bearing water dropped from the roof of the cave. "drop".

Column

Sometimes, stalactites and stalagmites meet, forming a pillar or column of rock-hard calcium carbonate.

Cave Popcorn

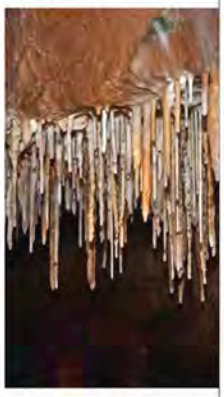
Cave popcorn, or coralloids, are secondary deposits of minerals, small nodes of calcite, aragonite or gypsum that form on surfaces in caves, especially limestone caves.

Helictite

A formation of calcium carbonate in a cave that grows in a twisted, curled fashion, like a helix (hence the name), seemingly defying the laws of gravity.

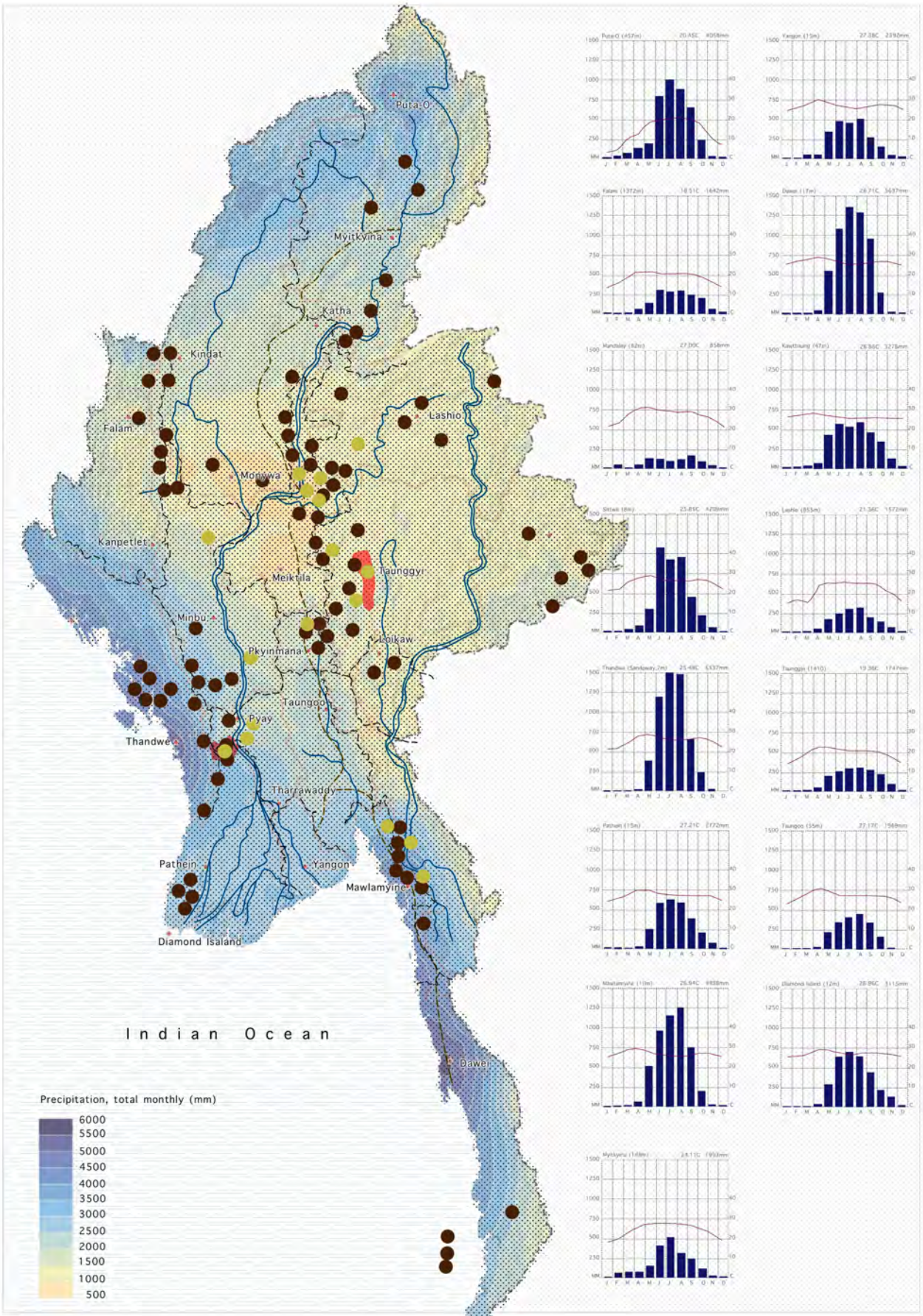
Dogtooth spar

It is a speleothem found in limestone caves that consists of very large calcite crystals resembling dogs' teeth (hence the name). They form through mineral precipitation of water-borne calcite.



A soda straw

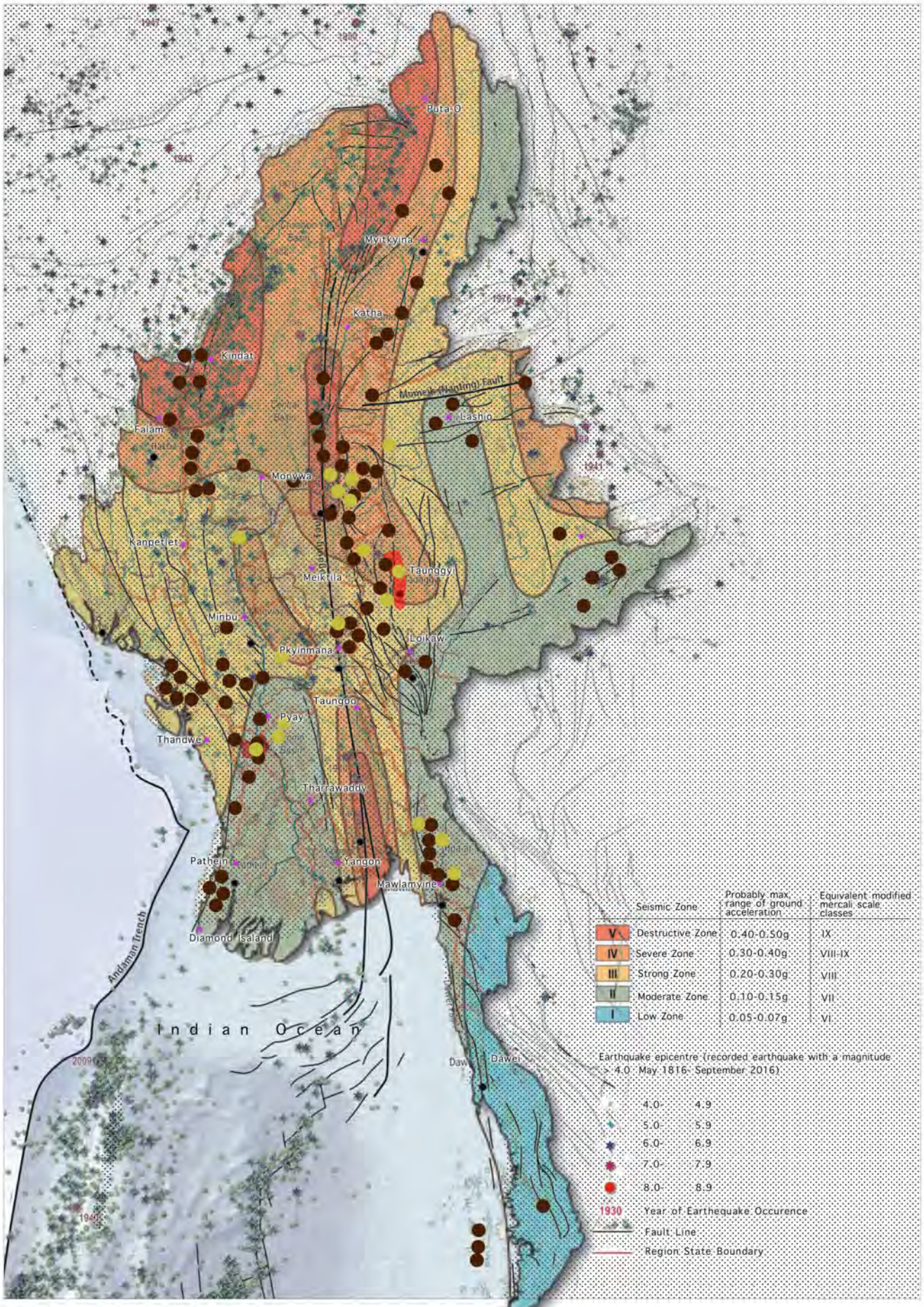
It is a speleothem in the form of a hollow mineral cylindrical tube. They are also known as tubular stalactites. Soda straws grow in places where water leaches slowly through cracks in rock, such as on the roofs of caves.



Rainfall Distribution Myanmar

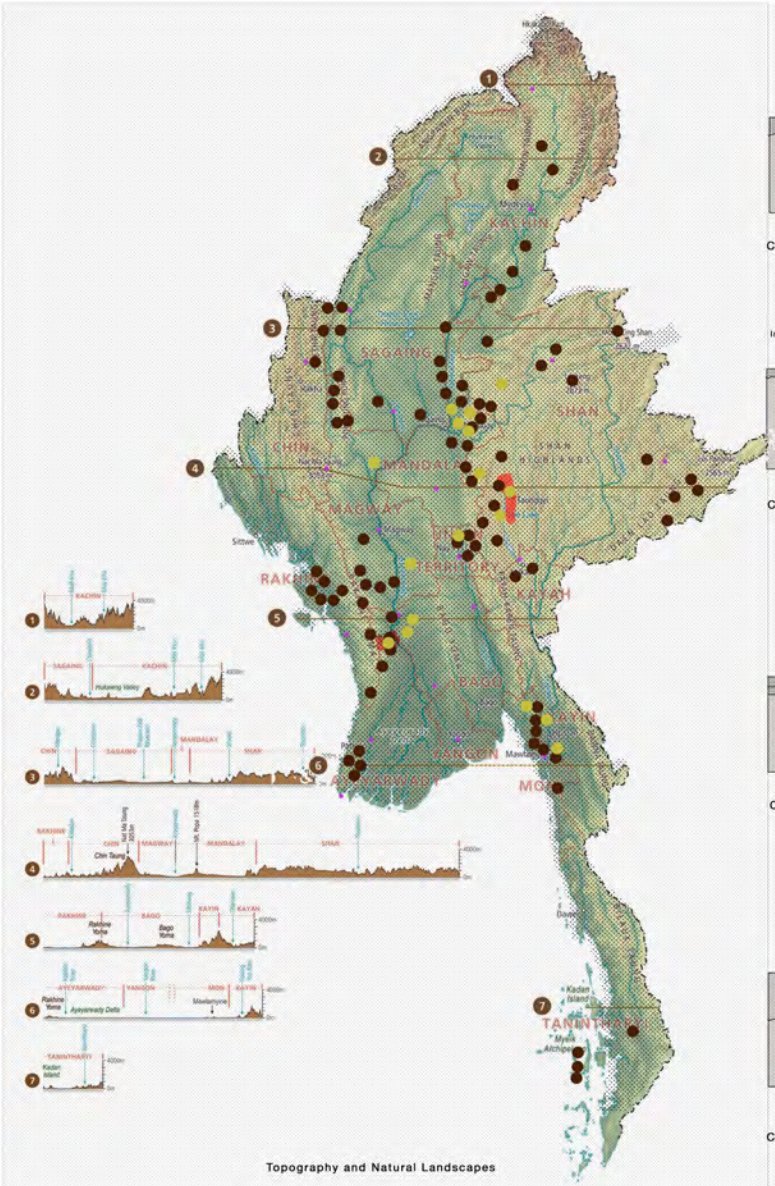
While the area weighted average rainfall (period of 1947-1979) ranges from 1,561 mm (1956) to 2,240 mm (1961), the average is 1,790 mm (Roy/Kaur 2000: 915). **August and July are the months with most rainfall**. Almost 90% of the rain falls during the summer monsoon period. **Mountain and hilly regions** such as in Chin and Kachin States and the Shan Highlands also **experience high rainfall values due to the orographic effect**, e.g. Taunggyi (1,747 mm).

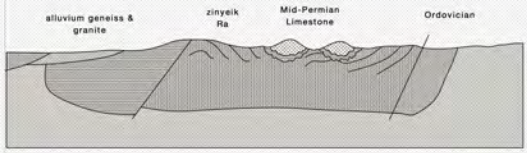
Myanmar: the **pre-monsoon season (mid- April to mid-May), the monsoon or rainy season (mid-May to mid-October), the post-monsoon season (mid-October to end-November), the dry and cool season (end-November to mid-March) and the hot season (mid-March to mid-April).**



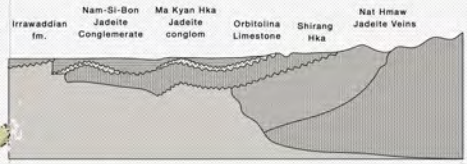
Natural Hazards : Earthquakes And Fault Lines, Seimic Zones

Myanmar,mainly in the seismically active areas along the major fault lines. Along the coast, in the Ayeyarwady Delta and in adjacent regions, tropical cyclones frequently make landfall, bringing heavy rain and causing fl ash flooding on a wide scale. In mountain regions, especially on steep slopes, landslides pose a threat to infrastructures, settlements and farmland.

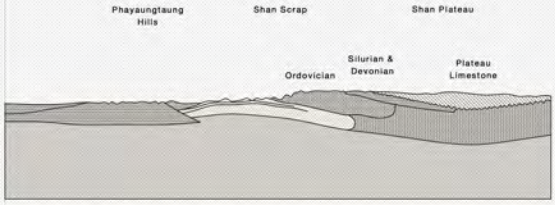




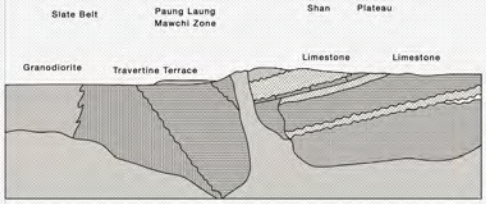
Cross Section Showing Kyaikto- Moulmein Scale: 1: 4000000



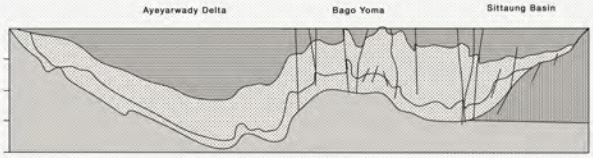
Cross Section Showing South Mandalay - Scale: 1:2500000



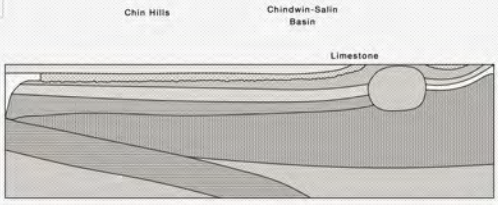
Cross Section Showing Shan Plateau Scale 1: 10000000



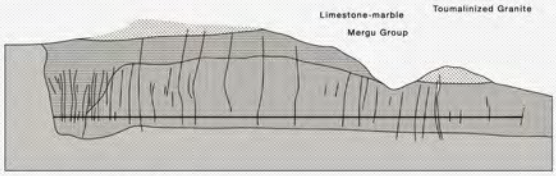
Cross Section Showing Paung Laung-Mawchi Scale: 1500000



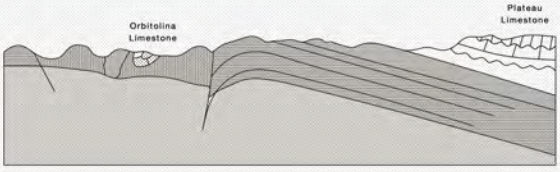
Ayeyarwady Delta - Scale 1: 20000000



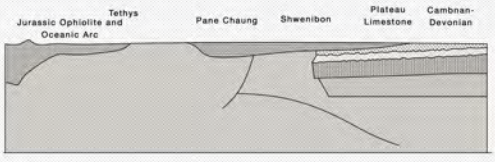
Cross Section Showing Chindwin Basin Scale 1 : 10000000

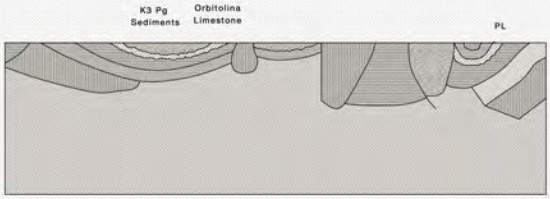


Mawchil Town - Scale 1:70000



Cross Section Showing Katha- Gangaw Range Scale 1:20000000





Topography and Natural Landscape & Limestone Deposits