



Illustration: Underwater funeral of a companion of Captain Nemo burying within Coral Realm

20,000 Leagues Under the Sea (Jules Verne, 1870)

In the literature, Jules Verne (1870) described the coral reef as a fantastic architectural structure in the sea, which has organic shaped solid branches creating magical structures like arches and columns so that, the coral reef shares a similarity with architectural characteristics.

“Actual Petrified thickets and long alcoves from some fantastic school of architecture kept opening up before our steps. Captain Nemo entered beneath a dark gallery whose gentle slope took us to a depth of one hundred metres. The light from our glass coils produced magical effects at times, lingering on the wrinkled roughness of some natural arch, or some overhang suspended like a chandelier, which our lamps flecked with fiery sparks.The hole grew longer, wider, and soon was deep enough to receive the body. Then the pallbearers approached. Wrapped in white fabric made from filaments of the fan mussel, the body was lowered into its watery grave. Captain Nemo, arms crossed over his chest, knelt in a posture of prayer, as did all the friends of him who had loved them.... My two companions and I bowed reverently.”

“There lies our peaceful cemetery, hundreds of feet beneath the surface of the waves!”



Burning Ghats in Varanasi in India

The Pyres of Varanasi: Breaking the Cycle of Death and Rebirth

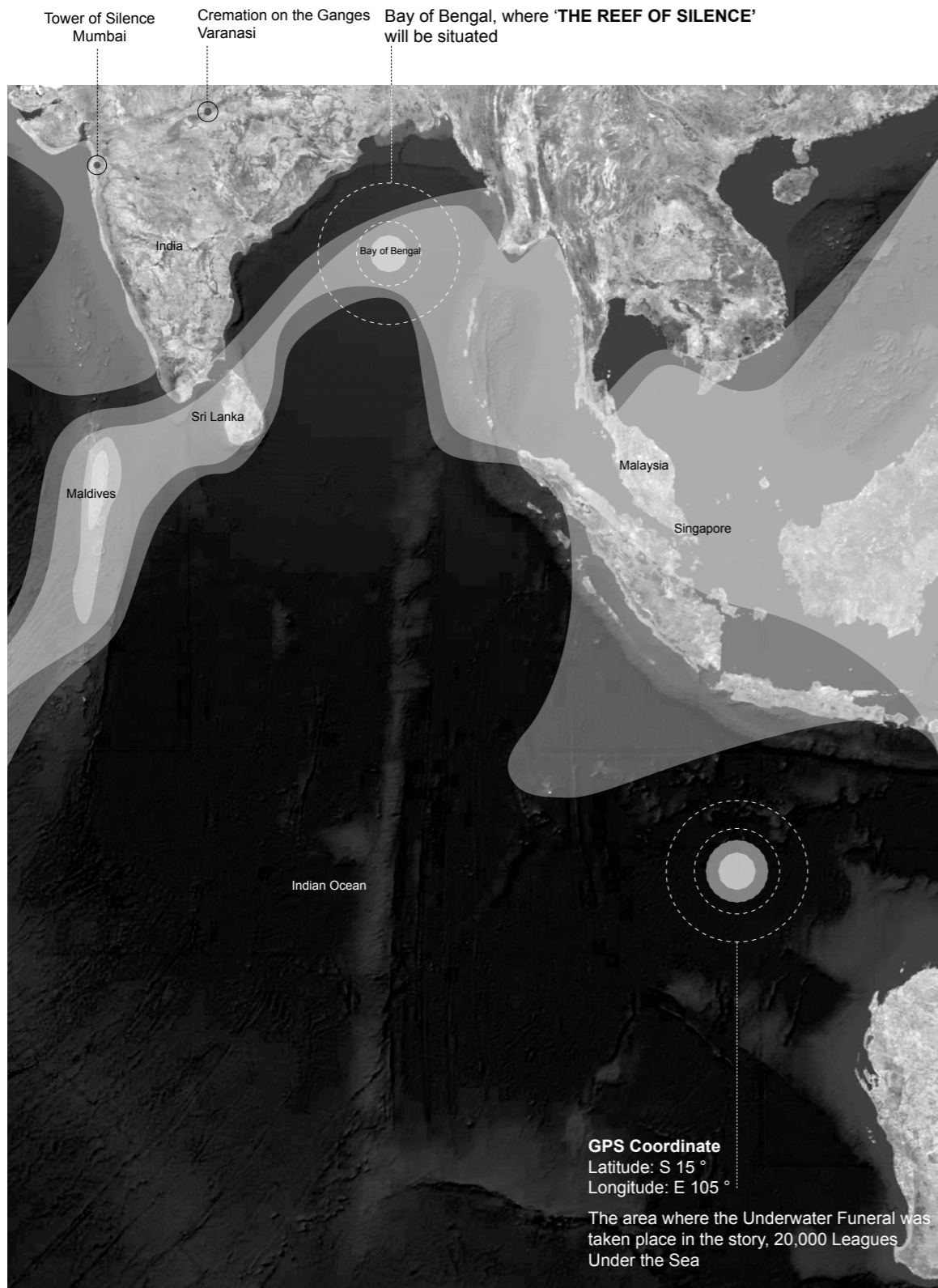
When I stepped on Varanasi's famous cremation ghat, which runs 24/7, burning hundreds of bodies a day in plain sight, it dawned on me how physically distant most of us are from the departed. Funeral practices vary worldwide. Of those I've witnessed, few are as transparent and raw as the Hindu ritual on the banks of the Ganges River. The Hindu believe that if the deceased's ashes are laid in the Ganges at Varanasi, their soul will be transported to heaven and escape the cycle of rebirth. Since many believe Varanasi has been inhabited for 5,000 years (which would make it one of the world's oldest cities), it is considered to be the most sacred of cities on the banks of the Ganges River. People come from all over to pray, collect sacred water, bathe, and yes, attend to their dead. Some even come to die. Pete McBride, National Geographic



Tower of Silence

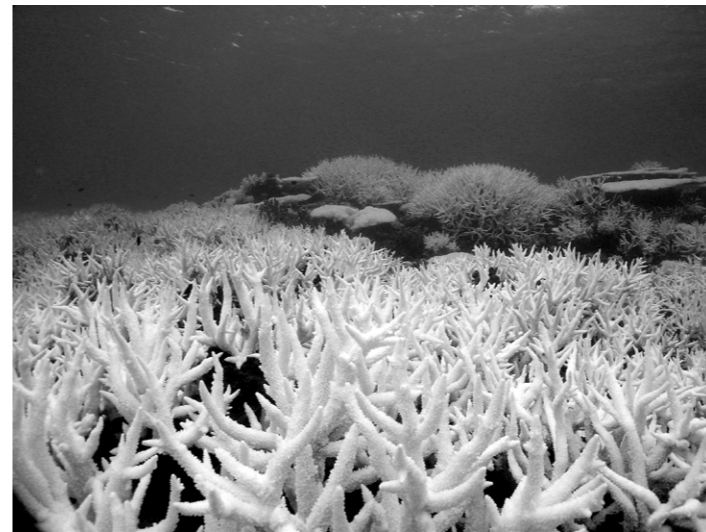
Sky Burial in Zoroastrianism in India

In India, the architectural project called 'Tower of Silence' in addition to its religious meaning has a purpose of revitalising endangered animal species by providing them with food. Less than 5% of the population of Indian vultures was left, because they scavenged dead farm animals, whose bodies were contaminated with stimulation drugs. Therefore, the religious leader of Indian Zoroastrianism pursued the government to revive the traditional method of burial. Feeding vultures with human bodies could save huge amount of money to supply their food. Tower of Silence is a 10-metre-tall roofless structure in a cylindrical shape to let vultures freely fly in and out and is 45 metres in diameter. It has only one access through a steel door, which is about 5.5 metres high. The structure was built on a high platform about 3 metres high. There are steps leading to the interior space to place dead bodies. The interior space has three rows of slab for different purposes. The external row is for males; the middle one is for females and children are placed in the most internal row. Dead bodies are exposed to and consumed by the birds within hours. The bones are moved into the central well after a few days to dry.



Mapping of the Fictional, the Real and the Visionary

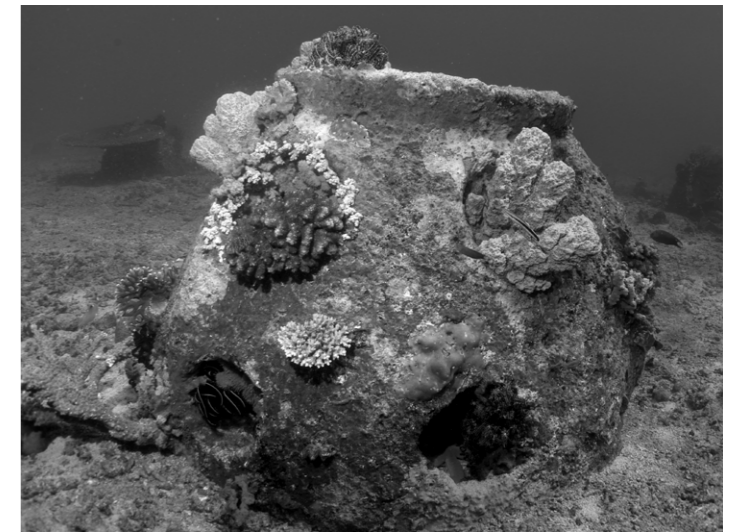
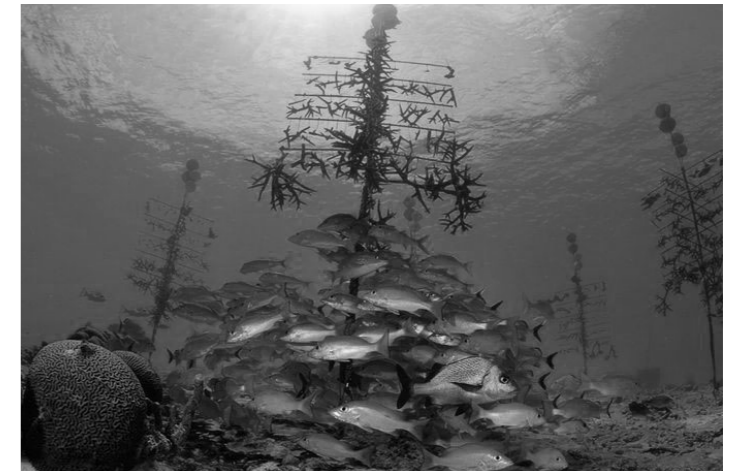
The Fiction: Underwater Funeral in 20,000 Leagues Under the Sea
 The Real: Tower of Silence, Mumbai and Burning Ghat, Varanasi
 The Vision: The Reef of Silence, Bay of Bengal



Coral Reef Destruction

Coral Damaging and Bleaching

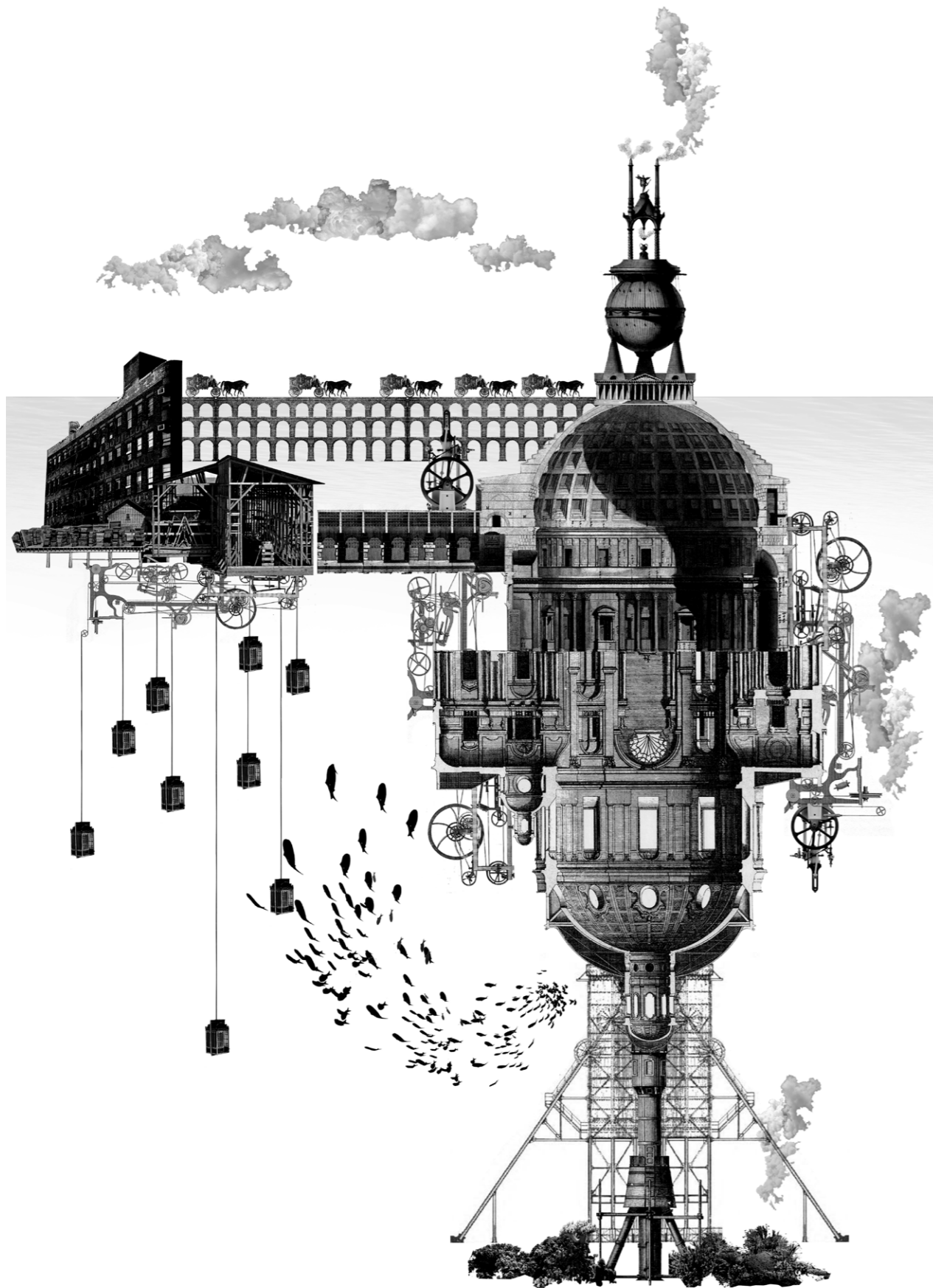
Coral reef is urban infrastructure of marine life. However, it is being constantly damaged by human like over fishing and climate change. Therefore, people will loose this significant marine basis.



Coral Reef Restoration

Coral Transplantation

It is not easy to slow down damaging coral reef so there is strong effort to make the coral reef survive. Coral transplantation is one of possible solutions being studied and applied. Firstly, fragment or small branch of coral could be grown in indoor aquarium or in-situ frame structure in wild seawater where condition of water and environment are controlled to accelerate rate of growth and survivor. A small piece of coral branch can be transplanted on artificial frame structure or wild reef and encouraged for it to spontaneously build its own structure of reef.



The last ritual and spiritual moment of mourners and the new habitable hall of the afterlives



The last ritual and spiritual moment of mourners and the new habitable hall of the afterlives

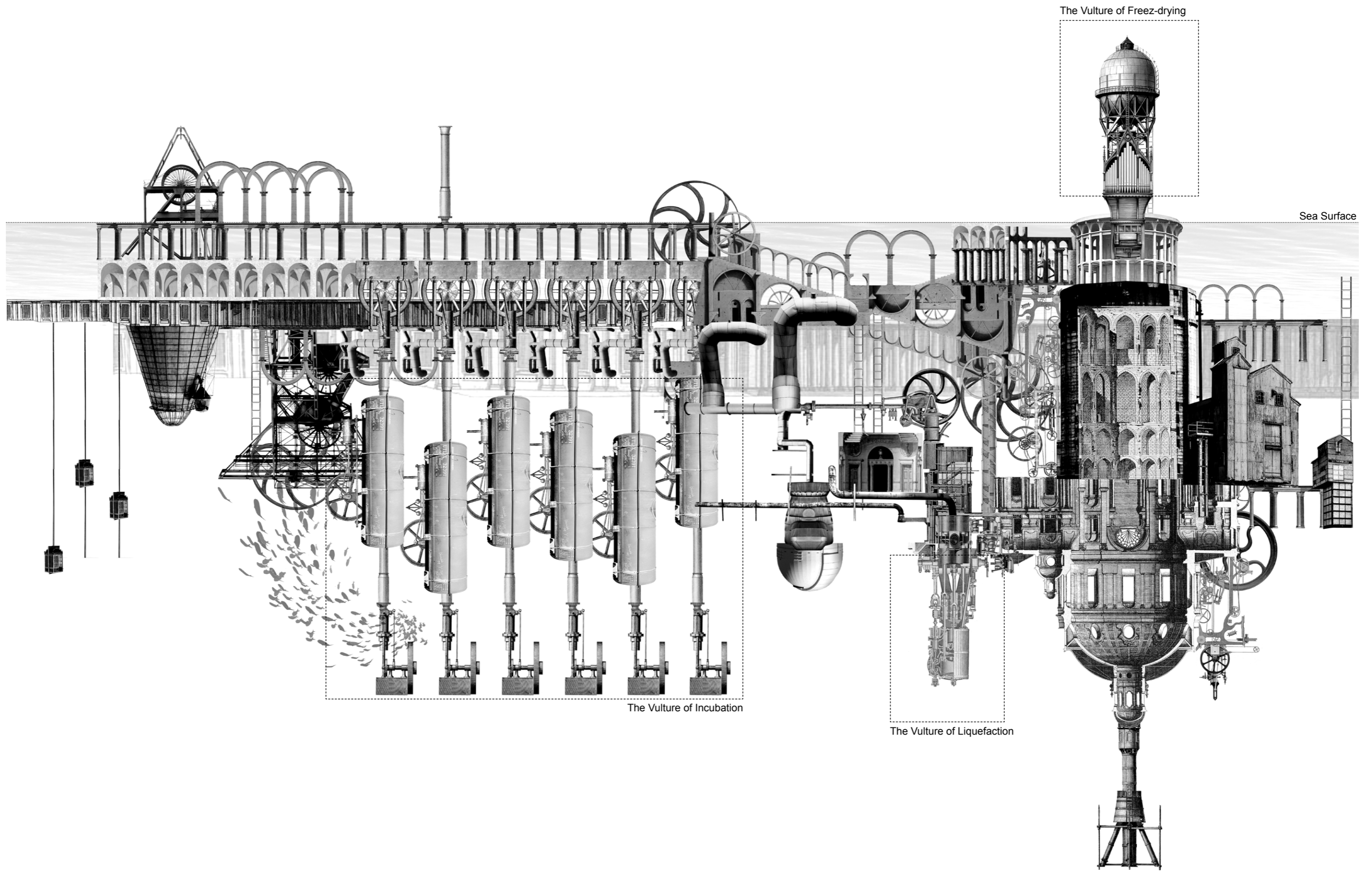
2016 JACQUES ROUGERIE FOUNDATION "INNOVATION AND ARCHITECTURE FOR THE SEA" AWARD

NAME OF THE PROJECT

The Reef of Silence

DESCRIPTION

Funeral Procession & Submerged Decompos[it]orium



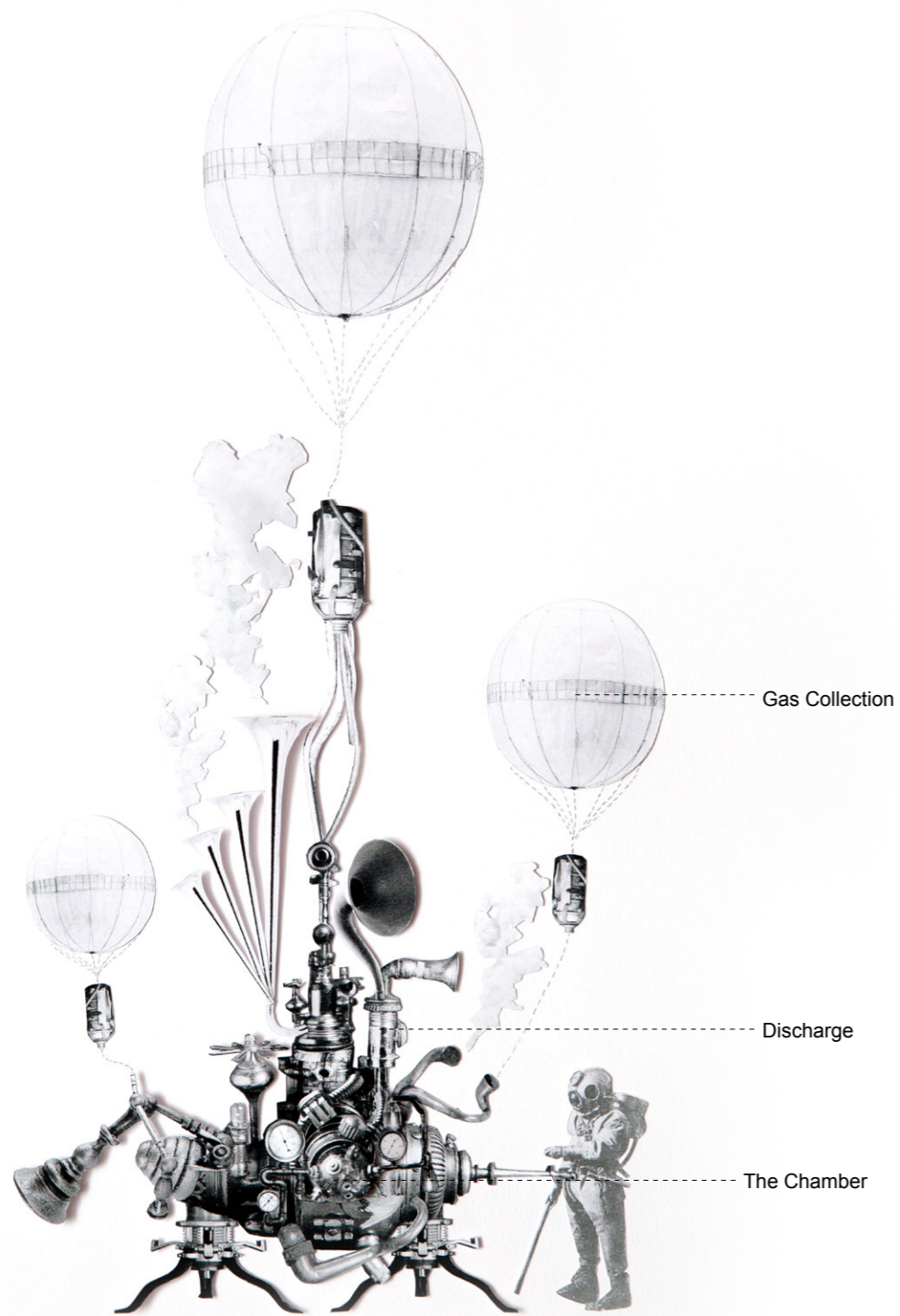
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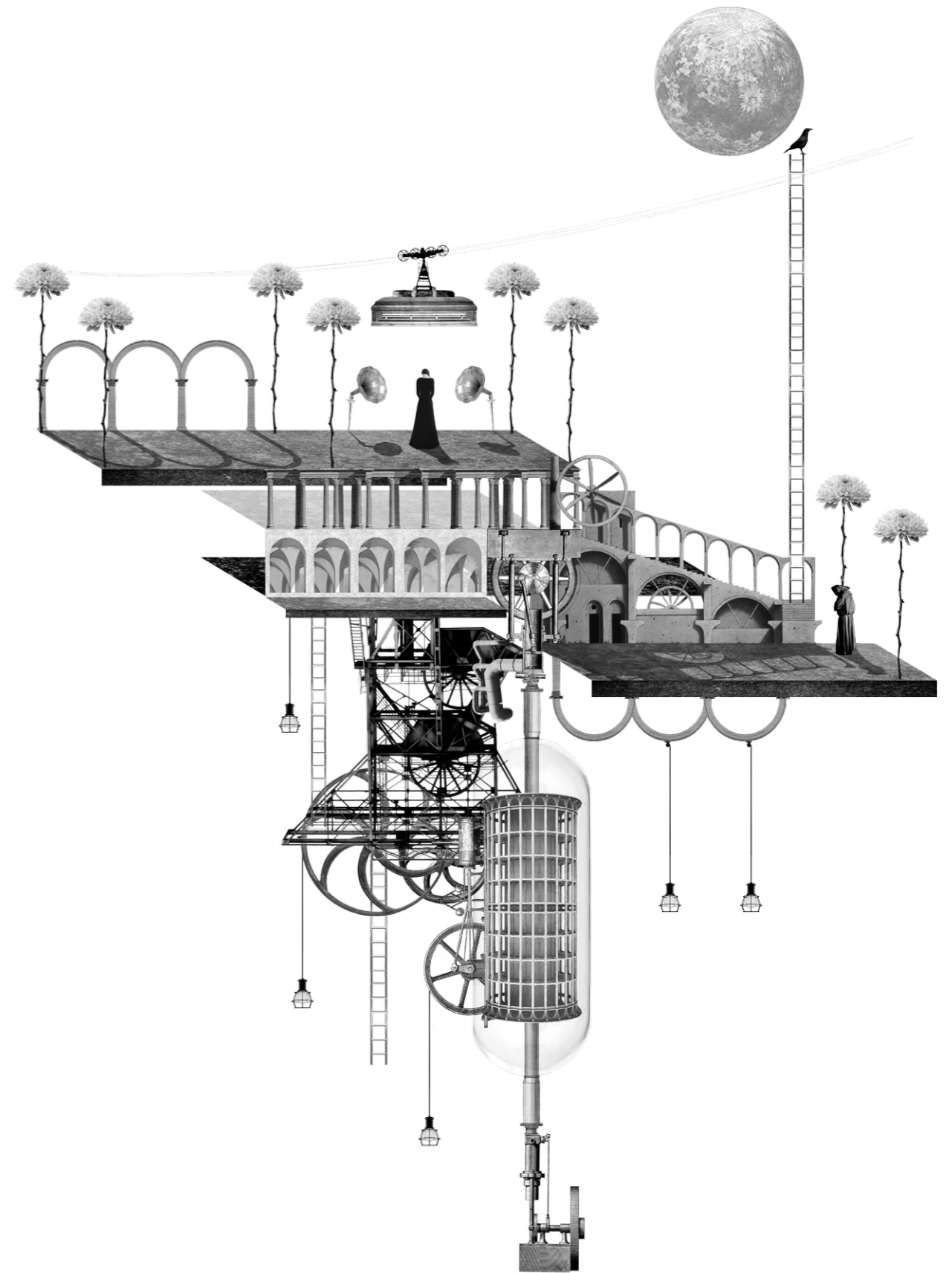
DESCRIPTION

The Tectonic Vultures within the general narrative



Underwater Decomposition Chamber

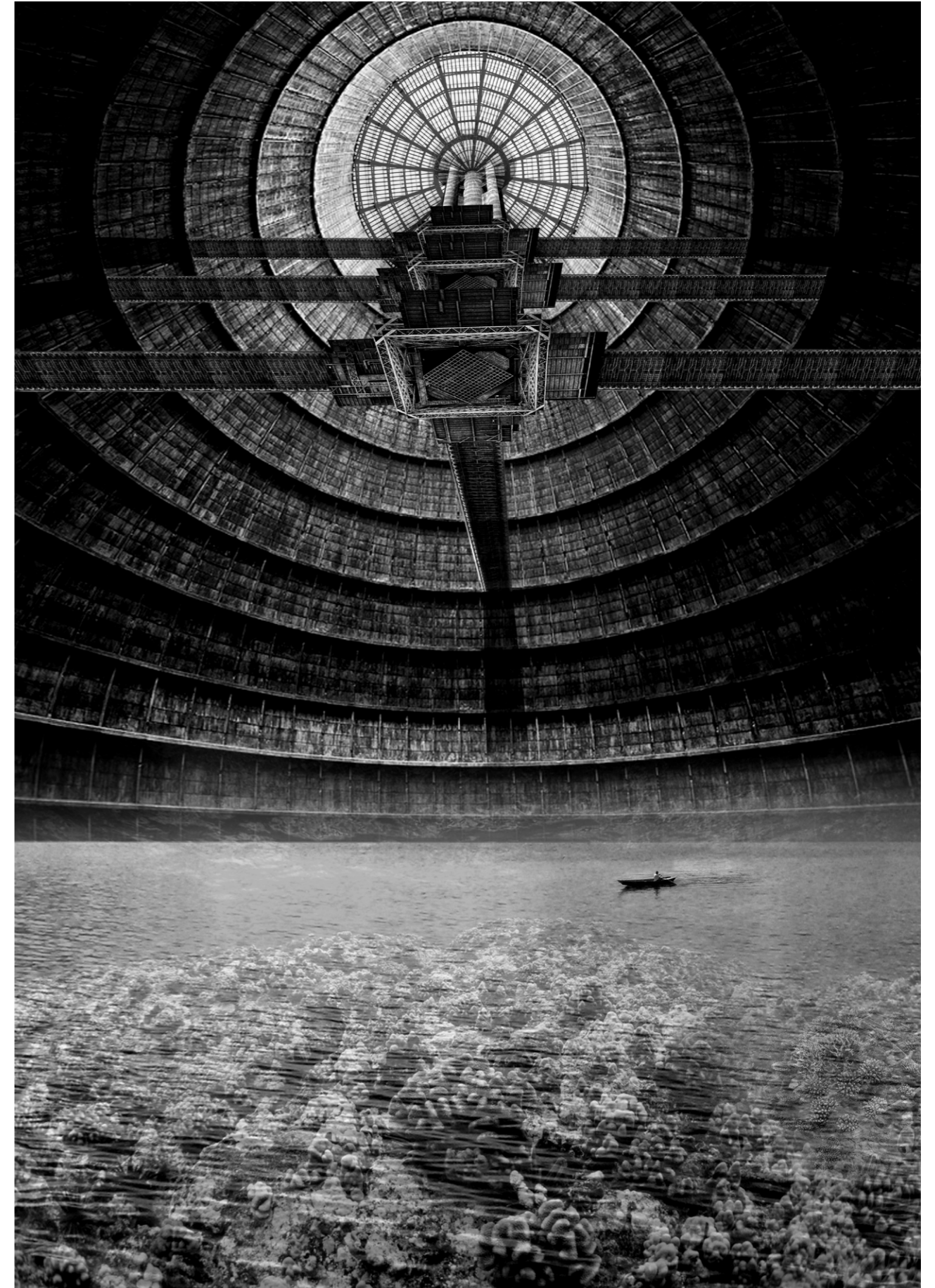
Although it would seem to be brutal in some culture, especially in western countries, natural burial has been a traditional way in which the deceased is not buried underground but is returned into the nature, sometimes, providing such benefits. For example, in Tibetan Buddhism, sky burial is the way of leaving a corpse on a mountain to feed vultures, which is sacred. In modern society, new ways of cremation could have positive influence not only on saving space and resources but also reducing harmful emissions. The underwater decomposition chamber is an innovative invention to prevent decaying and decompose a human dead body into eco-friendly substances such as bone ash, power or liquid.



Condolence & Mourning Bridge



The Glimpse of Underwater Structure



Coral Nursery & Cultivation

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DESCRIPTION

Photo Montages Exploring Contextual and Spatial Qualities



Architectural Skin & Growing Coral



Architectural Skin covered by Coral

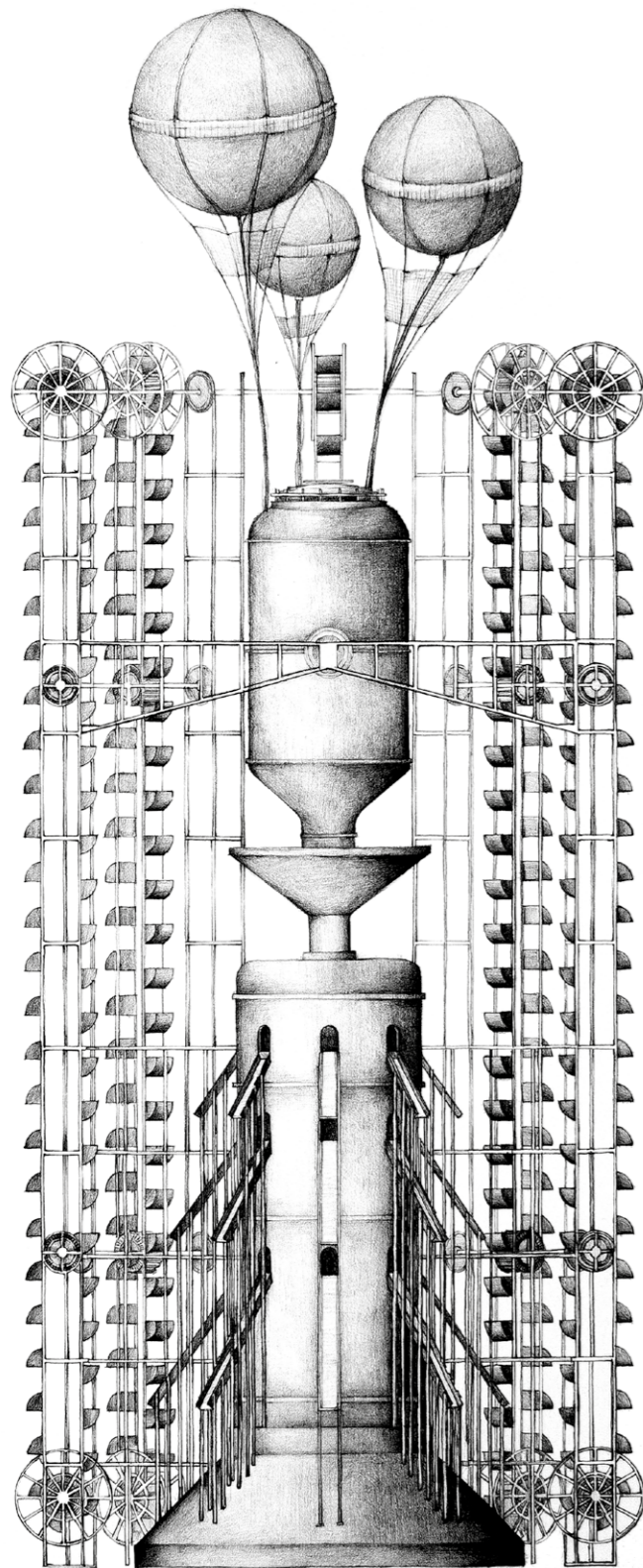
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The Reef of Silence

DESCRIPTION

Creating Natural Reef Structure on Artificial Structure



Liquid Nitrogen Supply and Collection

Liquid nitrogen was utilised as a refrigerant for instant freezing preventing a corpse from decay. After vibrating, the balloons recollects the evaporated nitrogen and steamed water in the chamber to turn the frozen body into fine powder.

Freeze Drying Chamber with Ultrasonic Vibration

After the freezing process, ultrasonic waves vibrated the body to break it down into grains. Moreover, the magnetic structure in the collector would remove metallic components in the powder, because harmful metallic components like mercury should not be contained in nutrients.

1. FREEZING: Initial pre-frozen process to zero degrees for 24 up to 48 hours.
2. METAMORPHOSIS: The sealed frozen body is placed within about 83 litres of liquid nitrogen. The temperature drops to -196°C in order to make the body crystallised. After two hours of freezing, the liquid nitrogen evaporates into the atmosphere.
3. VIBRATION: Ultrasonic vibration breaks down the remains into powder in 60 seconds. Metal or any other substances are separated.

Body Powder Mill

A large cylindrical tank is the body powder mill that stores the powder and filters it into particles of different sizes. The finest powder was delivered to the youngest and smallest corals in the incubators while the powder with bigger particles was supplied to relatively mature ones.

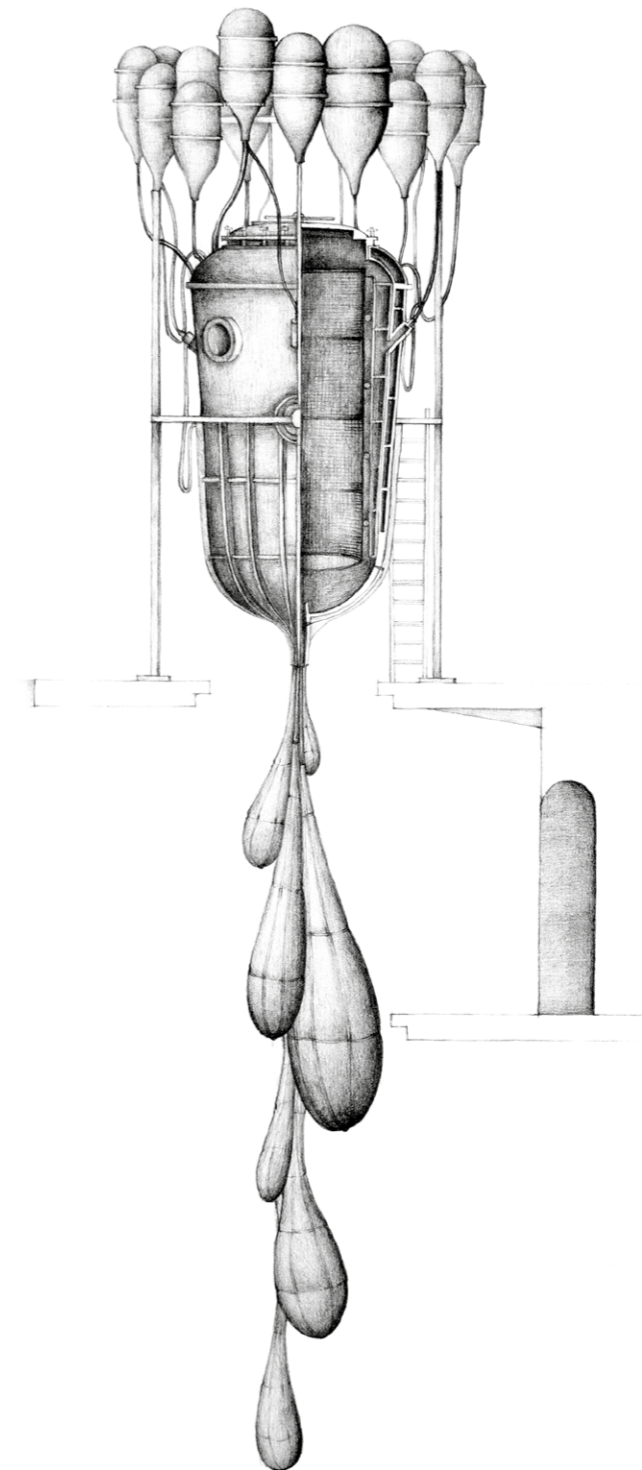
Powder Distribution

Stored powder was distributed to bucket elevators. The top row was for larger particles. Going through the filtration process the finest particles of the powder were supplied at the lowest row.

Bucket Elevator

It delivers the powder to the incubators.

The Vulture of Freeze-drying



Alkaline Water

The containers above the chamber stored alkaline water that encouraged the liquefaction preventing the dead bodies got boiled in the water in extremely high temperature.

The Chamber with High Pressure and Temperature

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1. PREPARATION: A dead body will be placed in a hydrolysis vessel covered with a silk back. Then, it will be filled with potassium hydroxide alkali, which will decompose the body into underlying matters.
2. HEAT AND PRESSURE: To control boiling, it will be heated to a temperature about 160 Celsius with high pressure.
3. LIQUEFACTION: The body will be transformed into liquid and left pieces of its bone.
4. REMAINS: DNA and Genetically-free liquid including amino acids, peptides, sugar, salts, and soft bone remains, which can be environmentally disposed.

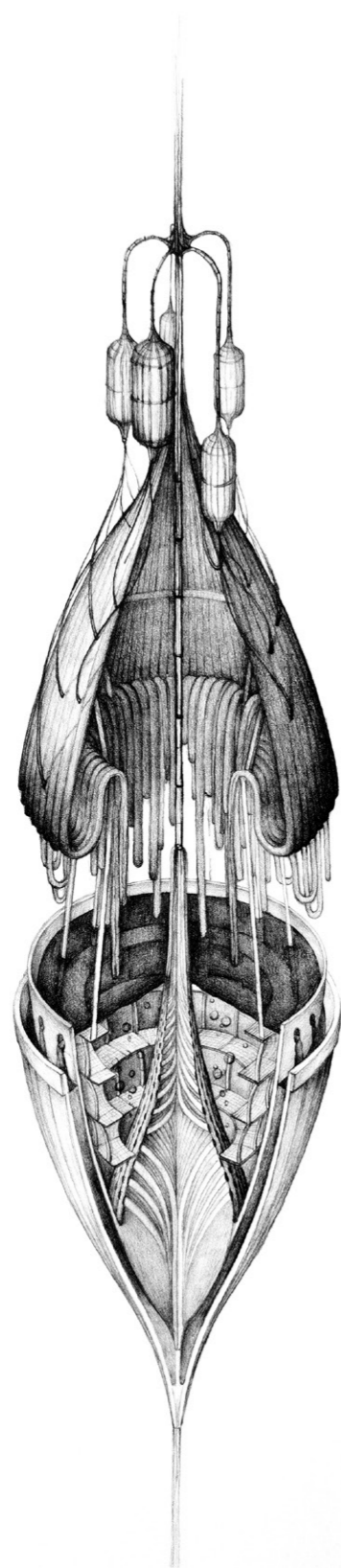
Separation of Bones and Metal

A mesh cage, additional layer inside the chamber, filtered fragments of bones and metals but drained the liquefied body.

Containers for the Liquid

The filtered liquid held plentiful amino acid, which is one of the most essential nutrients, and was stored below the chamber. Then, it could be exploited as additional nutrition for the coral incubators.

The Vulture of Liquefaction



The Vulture of Incubation

Additive substances

Each small tank controls different conditions such as calcium, UV light, salinity, alkalinity and additional feeding.

CALCIUM REACTOR: Calcium is an essential chemical component for corals to build limestone structures (Sheppard, 2015). The bone, that delivered as a result of the liquefaction process could be turned into fine powder and dissolved into the water. The supplier contains saturated water with calcium and provides it to the incubator to maintain its density.

UV STERILISER: Ultraviolet rays have a significant advantage in eliminating harmful microbes while light is essential for photosynthesis. However, purification by ultraviolet is intermittently operated since it scavenges all kind of microbes irrespective of species.

HYDROMETER (Salinity): Salinity should be maintained from 1.022 to 1.026 and the optimised value is 1.025, which is 3.5%. Due to the environmental sensitiveness of the juvenile coral in the incubator, salinity of water must be kept at the constant value as long as possible while it could constantly vary because a variety of substances are being supplied into the incubator.

ALKALINITY CONTROL: Acidification is one of the negative effects on corals' growth (calcification) because high acidity causes the lack of dissolved calcium in the water (Sheppard, 2014). Hence, alkaline liquid of decomposed bodies produced by the liquefaction process could be supplied to maintain the alkalinity.

Water Circulation

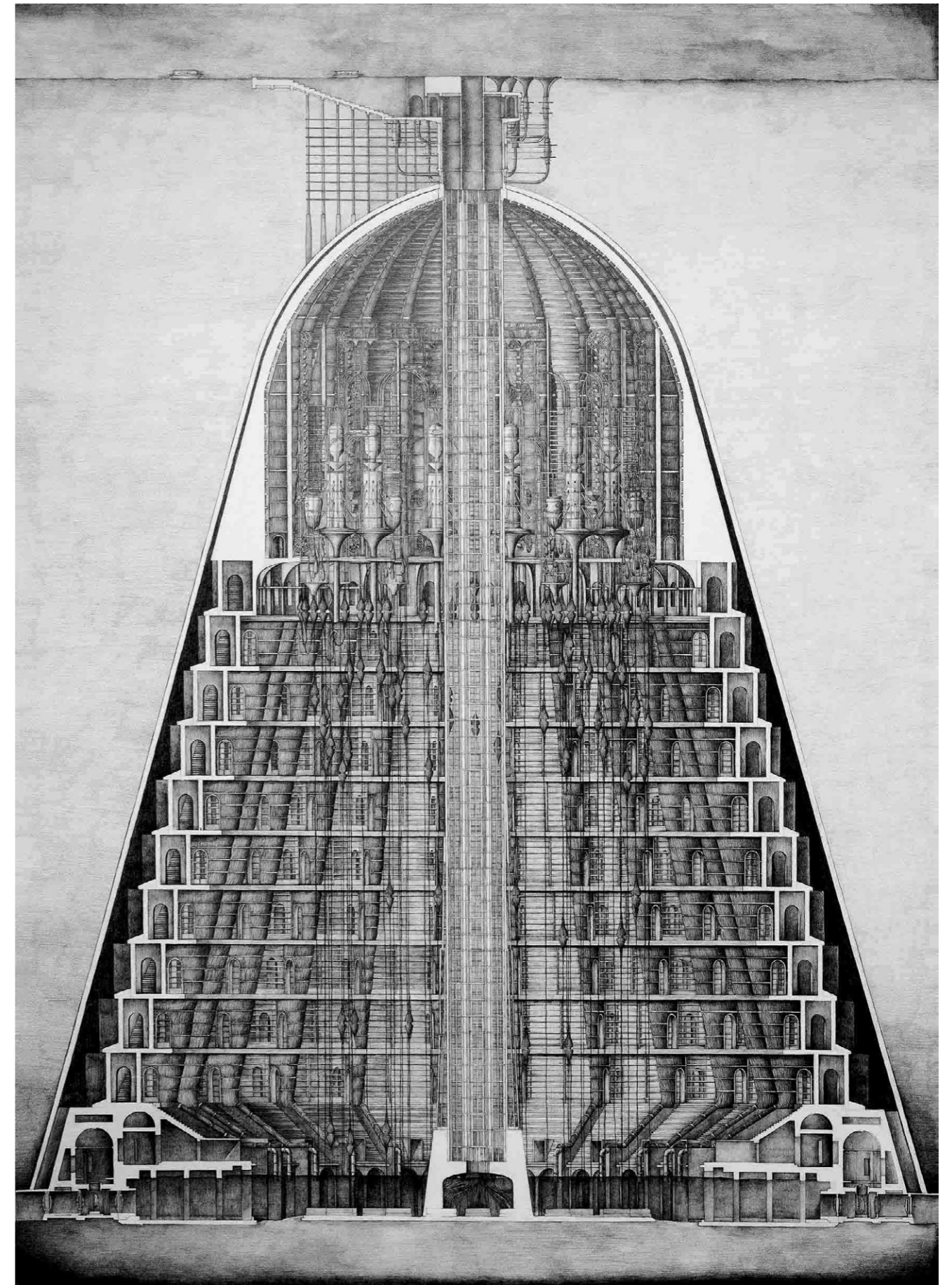
Water supply and return could make the water keep flowing. It is significant that the coral needs the flow of the water to capture the suspended nutrients.

Lighting

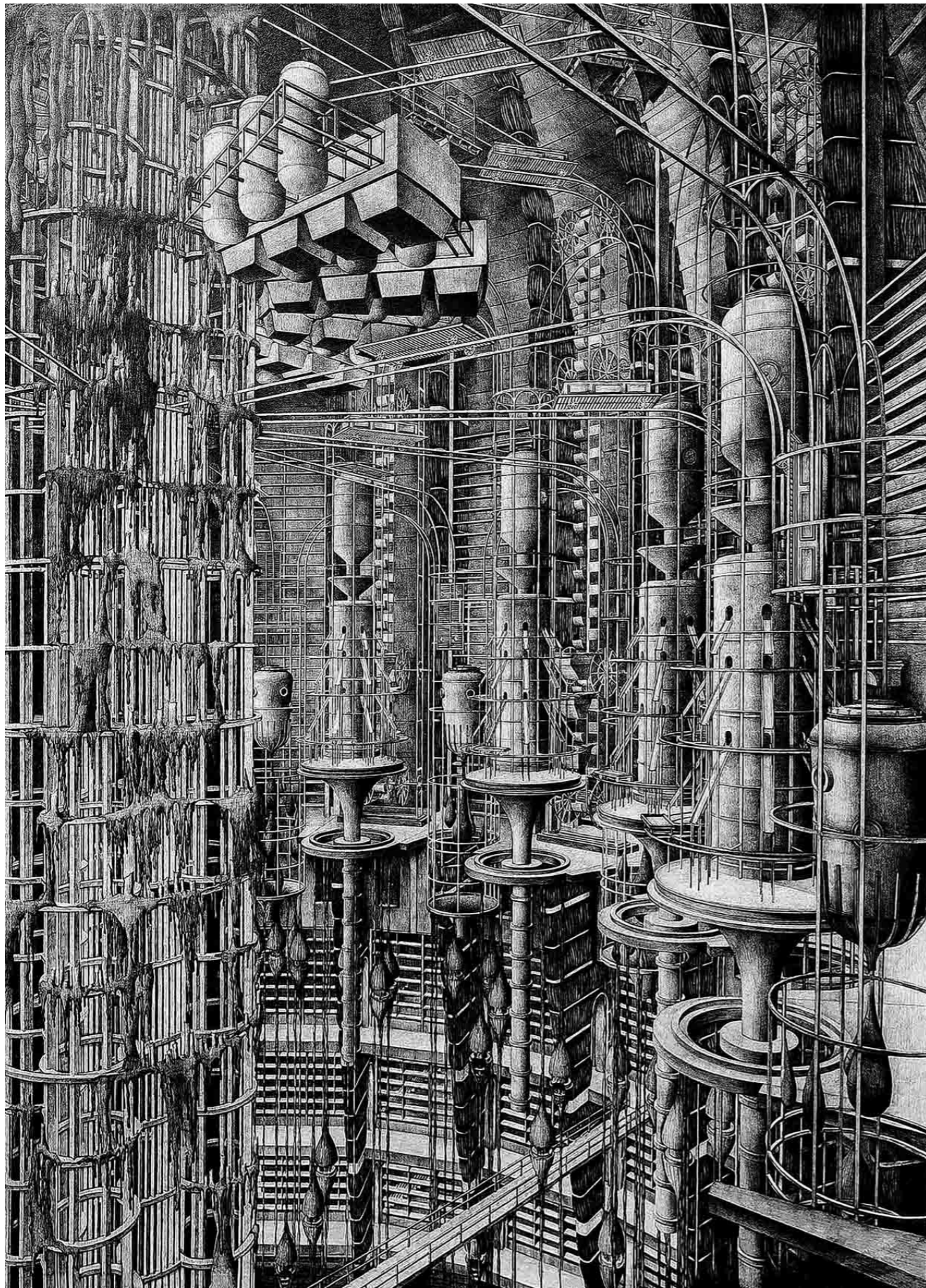
Light is inevitable for photosynthesis and temperature. Although artificial light can provide adequate circumstance, due to enriching effect of the natural sunlight, fibre optic cable will bring the sunlight from sea surface down to the incubators. Because of corals' sensitiveness on intensity of light, if it is too low, the amount of nutrients corals can capture is significantly decrease while, if too high, corals release symbiotic planktons within increasing temperature.

Skimmer

A method to get rid of unnecessary and harmful component in water called skimmer is equipment of generating air bubbles that can attract tiny suspended matters in the water with their surface tension then bring them to the top of the skimmer. On the other hand, discharging carbon dioxide will help calcium to be dissolved into water in lower acidity encouraging calcification of corals. So that, both process in relation to utilising air bubbles could be integrated to enhance the quality of water.



Section Drawing (1140 x 820 mm, Pencil)



Interior Perspective Drawing (1140 x 820 mm, Pencil)



Elevation & Section Drawing (1140 x 820 mm, Pencil)

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The Reef of Silence

DESCRIPTION

Final Drawings of the Interior Perspective and Elevation