The Dark Ecology of Magnitogorsk

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MAGNITOGORSK, SOUTH URALS, RUSSIA. Rich in various ores, the South Urals region of the Russian Federation has been exploited through mining and industrialization over the past century. Magnitogorsk represents the promise of social transformation ushered in by the October Revolution that this rich iron ore would spark a new powerful industry and create a new city. It was euphoria of possibilities. The urban vision embodied the dream that science could develop a better model for society. By the end of the 1930's Magnitogorsk Works was producing 10% of the country's steel1 . Joseph Stalin's vision of the most technologically advanced steel plant in the world came at the heels of the Soviet Union's rapid transformation from an agrarian society to a modern, industrialized country. It was also the moment of the Soviet avant-garde, when Constructivists advocated for new radical principles in construction. El Lissitzky, Leonidov and the OSA team from the Soviet Union alongside an international group of architects like Ernst May participated in the competition for the urban planning of this new city2 .

Magnitogorsk lies beyond a giant lake that was created by damming the Ural River—the steel factory would be surrounded by forest. The new socialist city, or Sotsgorod, separated industrial zones from residential ones with greenbelts that purportedly kept toxins from intermingling with domestic life. But according to Vilii Bogun, the city's primary architect, "The garden city, about which the first settlers of Magnitaya dreamed, was, to put it mildly, never realized3." As history would show later, the forest proved inadequate to stop the colossal amount of pollution from seeping through the water, air and soil. As a new city though Magnitogorsk represented for architects and urbanists of the time the promise of a social and technological utopia.

DARK ECOLOGY

Mining and industrial production have degraded eleven percent of the earth's soil1. Dark Ecology explores an alternative landscape for the post-industrial wasteland. Wasteland is a territorial concept that typically conveys the unwanted, exhausted and useless. This project aims to rethink emerging ecologic strategies in remediation, the act of cleaning, and often the attempt (and anxiety) to erase the material traces of production. In his lecture titled "Ecology without Nature in Athens Slavoj Žižek defines the ecological problem of the concept of "nature", "The big Other doesn't exist."... Nature has already accepted our pollution." This project investigates the creative potential in the processes, topographies and material derivatives that constitute degraded terrains. Dark Ecology can be embraced as a design methodology; one that acknowledges that not all human damage is reversible. As a project it relies on the terrain of ambiguity; natural/man-made, clean/dirty, unwanted/desired are rejected polarities. This "messy whole" and its material, chemical and "natural" manifestations is embraced, revealing surprising architectural, urban and landscape potentials. Magnitogorsk - because of the extremity of its degradation juxtaposed with its architectural promise in the industrial age - becomes the testing ground for Dark Ecology.

THE DARK ECOLOGY
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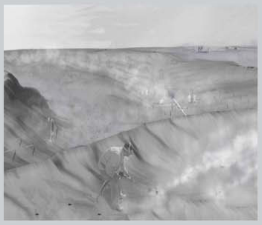
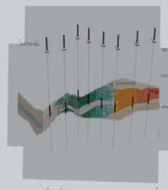


STEAMING THE SOIL

A soft approach, soil vapor extraction, requires steaming the soil to purge contaminants. Steam is injected into the soil via thin, 10cm wide tubes and reaches the contaminant located deeper in the vadose zone[1]. Vapors are the gases that form when chemicals evaporate. Soil vapor extraction (SVE) extracts these vapors from the soil above the water table by vacuuming the vapors out.
In *Dark Ecology*, steam is pumped through tubes into the land surrounding the mine. Over the course of years the steamed terrain becomes clean enough to farm. Punctures in the soil remain as indices of the cleansing operation.

S



S, SULFUR, ARCHITECTURAL DERIVATIVES

This dual capacity of the element, destructive and healing is explored in *Dark Ecology*. Sulfur baths are built in the crater of the former mine. Sulfur dioxides are turned into pure sulfur and are released into a water basin. Other structures are built by sulfur concrete allowing for strength and protection from toxic substances in the soil.

MINING THE MINE

In Magnitogorsk, the mine had for years provided the city and the entire Soviet Union with steel. Hyperaccumulators are planted in the exhausted mine transform the terraces of the open pit mine into an inverted garden. During the annual harvest farmers take the plants into the distillery.

Fe

Fe, IRON

One of the byproducts of iron ore mining is iron oxide, (FeO). Mixed with water, iron oxide run-off through mine tailings contaminates soil and groundwater. But in some cases the concentration of iron hydroxides in the soil is so high that the pre cipitate can be recovered for commercial use in pigments.

MATERIAL EXPERIMENTS/ CHEMICAL IMMERSIONS

Magnitogorsk sits on a bed of limestone. Its composition consists of calcium carbonate (CaCo3). Lime (Calcium containing materials) has the capacity to neutralize acid. At the same time, the stone's natural porosity can absorb oxides from the ground and can react to acids by degrading while neutralizing them. The phenomenon of degradation of limestone due to acidity in the air is typical for most monuments.

MINING HARVEST

A second step in the phytoremediation process is that of Phytomining. In Phytomining the shoots are cut in order to remove the accumulated metals from inside the plant. The plant regrows its shoots, which can continue absorbing additional metals from the soil.

After the harvest, the flowers are distilled though glass tubing, metals are extracted, and the collected resources will be utilized to construct Magnitogorsk's new buildings.

PHYTOREMEDIATION

Research in the removal of heavy metals from contaminated soil has developed a third remediation method, phytoremediation, developed over the last two decades, deploys metal-absorbing plants to clean the soil. Indian mustard, kale, ragweed, hemp and are among plant species known as hyperaccumulators, as they accumulate metals in their shoots. The term "hyperaccumulator" describes a number of plants that belong to distantly related families, but share the ability to grow on metal containing soils and to accumulate high amounts of heavy metals in their organs, far in excess of the levels found in the majority of species, without suffering from poisoning.

CHEMICAL ELEMENTS BUILT ENVIRONMENTS

Dark Ecology engages various landscapes in the environs of Magnitogorsk. The proposed implementations range from sulfur baths, city archives and dormitories to a distillery, and a mining garden. The various programs are interconnected. They can be experienced in different routes that one can take across and through the mountain. Both exterior and subterranean structures are built from limestone and sulfur concrete, which combines construction technology and programmatic content through the identity of the element. *Dark ecology* thus embraces the elements iron oxide, sulfur and the calcium in the limestone programmatically, physically and spatially in distinct architectural components in the city.

MINING TERRAIN: NEW LANDSCAPE

Dark Ecology reconciles the clean with the dirty, the unwanted with the desired. It partly remediates the existing conditions and partly accepts them. The mining landscape becomes reorganized based on zones of remaining contamination and partial remediation or ambiguity between the two: Steaming, capping, planting, fertilizing, draining and acid neutralization detoxify soil and water in various degrees.