Material Ecologies: Defining Alternative Grounds

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Materials, in essence, do not arrive to us as neutral entities – without baggage, cost, or meaning. Materials have had previous lives. They have been extracted, amassed, and compiled from previous forms and valued as lucrative economic and cultural commodities. They have been involved in previous relationships, as part of other masses that once occupied prior territories, and they have taken part in various industrial and domestic chronicles.

Materials have histories. These are histories that have engaged other materials, people, objects, systems, and environments. These are histories that can be explored, deconstructed, and mapped. These are histories that help us understand the implications of their many uses, and how the choices we make as architects and designers affect the distant and seemingly unrelated. **Materials also have futures.** While a material's past can be revealed, its future must be speculated upon, designed for, and enacted.

Students in a research seminar at Cornell University participated in a two-part investigation, examining the latent histories of architectural applications in order to understand the implications of generating and fabricating alternative definitions for material ecologies. The class engaged in descriptions of terra firma as both its site and program of design inquiry and production. We studied materials beyond a single episode in time and space and integrating research from multiple timescales and multiple physical scales. Embedding information regarding a material's socioeconomic and environmental past provided students with a better understanding to the scope of design specification for future placemaking, material circularity, and design sustainability.

The work presented here showcases material-based, material-scaled experimentations, mappings, and prototyping. Students re-defined what we commonly refer to as ground – designing and constructing physical profiles for its subsurface, surface, and super-surface. This stratigraphic methodology acknowledged the countless ways in which material systems are interconnected and entangled.

During the first phase of the seminar, we focused on existing ground materials – asphalt, cement, clay, gravel, lime, peat, sand – along with their interrelated ecologies and the ways in which they are currently utilized to construct our built environments. The products of this materials research were expressed through ontographies that included timelines and visualizations. Following this collaborative group research, each individual student was then asked to design their own material aggregate, informed by the logic and parameters of the previous ground materials. Students experimented with material structure and quality as a means to formulating, deducting, and/or abstracting concepts of modularity, multi-dimensionality, density, and porosity; thereby, exploring new spatial profiles that simulated ground processes and architectural applications. This later phase provided students opportunities for a hands-on material exploration beyond data visualization and digital simulation; one that offered not just territorial or global-scaled insights, but also biological and chemical experimentations within physical and digital prototyping.

Largely, student projects examined materials from human, non-human, and multi-species points of view, as parts and as wholes, and as systems and as composites. Students questioned the implications of emergent and future technologies, historical and contemporary environmental issues and infrastructural developments, and cultural practices and innovations that contributed to the depletion of some construction materials and the surplus of others.

The overall aim of the seminar was for students to understand that to design for material futures, first began with holistically understanding a material's past. And through the lens of an aggregate – we can examine how material ecologies directly engage the complexities of environmental and urban systems. Understanding the fundamentals of material flows and exchanges as it pertains to evolving supply chains is vital for developing sustainable practices and efficient manufacturing and fabrication work flows in architecture and design.

Figure. Material Aggregates. *The proposed prototype provides an eco-friendly alternative for stabilizing shorelines and restoring intertidal zones that are threatened by urban pollution, frequent flooding, and sea level rise.* Image credit: Grace Lam & Sirui Qiu.

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