Exploring Art+Science Projects

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Abstract

The author describes his recent projects in collaboration with scientists from the Ecole des Mines (MINES ParisTech—Centre des Matériaux). *Lava Coins* (2007–2009) develops a dialogue between the material and the immaterial, the natural and the industrial, external aspects and internal structure. *Glass Microskeletons* (2010–2012) explores the creative process through the optics of glass. Unicellular algae (diatoms) build their exoskeletons in silica through a process of biomineralization. The result is a recording of microscopic architectures in optical glass, making visible their invisible forms and documenting in objects a voyage through the intimacies of silica.

The poetics of minerals is the matter of my work. By revealing the intimacies of a hidden world, I create objects that awake curiosity. Transforming matter involves both physics and metaphysics in such a way that I perceive no distinction. A substance cannot be separated from its force, nor can a material be separated from its metaphors. This may explain why we use chemical processes to name psychological ones: crystallization, dissolution, condensation, sublimation.

By conceiving minerals, plants and animals as all belonging to the same realm, we can explore transversal relationships. I understand construction and art to be natural forces.

Lava Coins: Revealing Depth with Surface Techniques

While in Paris in 2007, I met Michel Jeandin, a research professor at MINES ParisTech (formerly Ecole des Mines de Paris). We immediately realized that we shared a common fascination for materials and their poetry. We have collaborated on two different projects: *Lava Coins* and *Glass Microskeletons*.

When I first visited the Competence Center for Spray Processing (C2P) [1] at the Materials Research Center, I was intrigued by the plasma spray facility, a big capsule like a bank safe containing a robot that sprays powdered metal (Fig. 1). Sophisticated machine pieces were coated there. I thought it would be interesting to use this technique for a different purpose: I proposed to spray metal on volcanic lava rock, which is both material and nonmaterial, being highly porous.

Fig. 1. Plasma spray facilities at the Competence Center for Spray Processing. (© MINES ParisTech, Evry, France)

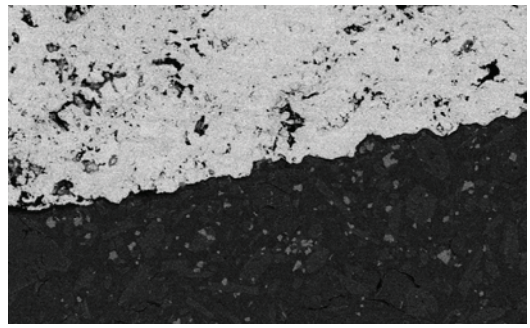

Fig. 2. Copper on lava; photo H: 400-µm scanning electron micrograph (SEM), C2P, 2007. (© MINES ParisTech/C2P, Evry, France)

Researchers showed interest in the idea because this had not yet been tried, and they wondered what would result from it. This unusual meeting of metal and stone stimulated further scientific research at C2P. The association of such dissimilar materials is a major concern in the science of materials, especially as it relates to the study of prominent issues such as bonding mechanisms and interface phenomena and properties (Fig. 2)

After a year of tests, we were able to achieve simple lens-like, lava-coated forms that I call lava coins. The metal powder melts as it is sprayed onto the porous lava. We then slightly polished it to enhance, by contrast, the structure of the stone (Figs 3, 4).

Fig. 3. *Lava Coin*; copper on lava, 9 cm diameter, 2008. (© Ariel Kupfer. Photo: Tan Kadam.)

Fig. 4. *Lava Coins*; titanium, copper and aluminum on lava, 3.4 cm diameter, 2008. (© Ariel Kupfer. Photo: Tan Kadam.)

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My intention was to go beyond the conventional use of this plasma technique. I used it to accentuate the inner structure of a natural material (which, in lava stone, is already perceived on the outside) rather than just coating a mechanical part. What is the value of these lava coins where surface meets depth?

Glass Microskeletons: Optics of the Invisible through Silica

Diatoms [2] have been haunting my imagination since I discovered their existence in 2000. They are unicellular algae that synthesize silica in water and build sophisticated glass exoskeletons, which appear to the naked eye as white dust.

I began carving their forms in silver, and a few years later I engraved them on copper plates. The results were interesting but still too decorative. I then understood that diatoms need to be shown in their own material, glass.

I therefore took photos of their skeletons with an electron microscope (Fig. 5) and engraved them via laser in glass blocks (Fig. 6). In this way, all the techniques involved in the process were, like diatom shells, based on silica. These invisible architectures are revealed and documented in their preferred material and through procedures the material has inspired.

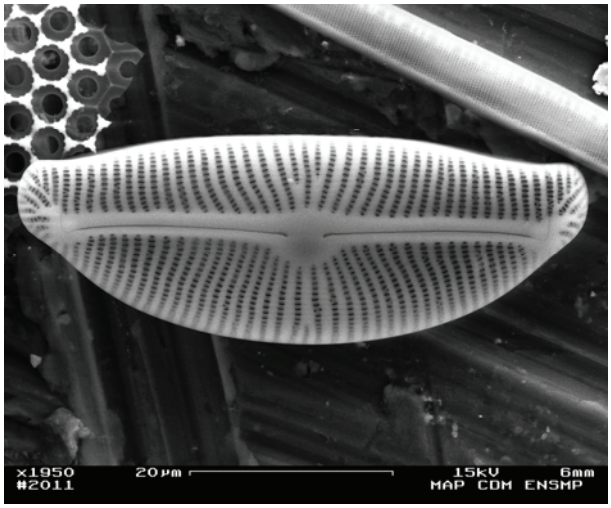

Fig. 5. ***Diatom Silica Exoskeleton*****, SEM photo, MINES ParisTech/C2P, Evry, France, 2011. (© Ariel Kupfer)**

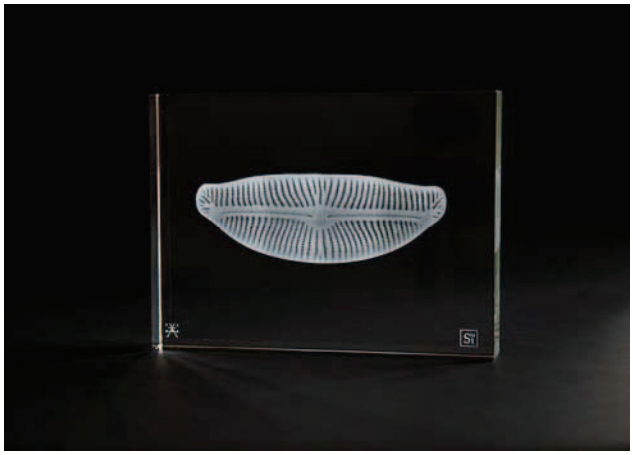

Fig. 6. ***Glass Microskeleton*****, optic glass, 18 × 24 × 3.5 cm, 2012. (© Ariel Kupfer. Photo: Diego Ferrari.)**

In this way, I hoped, physics and metaphysics entered into a zone of indistinction. There is a coherent continuity between idea, technics and matter.

It would not be possible to perceive the beauty of these tiny skeletons without fine optical instruments. At the same time, these forms, found in almost any water sample, have strongly stimulated the development of microscopy. From optical lenses to microskeletons, it is glass itself that is having a dialogue.

A new collaboration with the researchers of the Centre des Matériaux of MINES ParisTech made it possible to pursue the *Glass Microskeletons* project, the realization of an old dream: to look through an electron microscope and take photographs, to see what is normally invisible and document its traces.

My experience in working with the researchers at the Centre des Matériaux has always been smooth, friendly and, in a collaboration that benefits both science and art, mutually respectful. This exchange gave me the opportunity to develop the technological possibilities of my mineral research. It also allowed me to share a way of playing with materials and metaphors that has no other purpose than learning through creativity itself.

Working with diatoms drew me to the National Museum of Natural History in Paris, where I had the chance to meet Pascal Jean Lopez, CNRS researcher on diatom biomineralization and morphogenesis. This new collaboration fostered the development of my *Sand Books* project, a work in progress that involves bacterial biomineralization. Here, too, I intend to follow the material's own preferences, both technical and metaphorical, in the hope of reconciling idea and matter.

References and Notes

1. Centre de Compétence en Procédés de Projection (C2P), Centre des Matériaux de MINES ParisTech, Evry, France <www.mat.ensmp.fr/C2P>.

2. Diatoms are extremely abundant both in plankton and in sediments in marine and freshwater ecosystems, and because they are photosynthetic they are an important food source for marine organisms. Diatoms have an extensive fossil record going back to the Cretaceous era; some rocks are formed almost entirely of fossil diatoms and are known as diatomite or diatomaceous earth. These deposits are mined commercially as abrasives and filtering aids. Analysis of fossil diatom assemblages may also provide important information on past environmental conditions.