WASTE GLAZE

Katrine Køster Holst

Oslo National Academy of the Arts 2015. Hanna[1] is a student at the Academy and is working on a project involving a number of glaze tests. I have noticed the way she weighs, blends, sieves and cleans, and I ask her if I can film one day when she is working in the glaze laboratory.

We meet in the laboratory; she is going to mix three different glazes. She has a notebook in which her recipes are hand-written. It is like a cookbook; the ingredients are written on lines one below the other. First in percent, then converted to proportional weights. I find a tall stool that I can stand on while I film the work process from above with a handheld camcorder. I focus on the bowl that is on the scales. Hanna begins her work. First, the main ingredients are weighed: nepheline syenite, kaolin, quartz, and chalk. Gradually the container is filled with off-white powder. When she comes to the recipe's small numbers, the coloured metals and pigments, the container is replaced with a piece of torn newspaper that is put on the scales. 0.5 grams of copper is a small amount. With her finger, she gently taps the teaspoon to sprinkle the dark metal powder onto the newspaper. When all the ingredients have been measured, she puts a lid on the container and shakes it vigorously to mix the powdered chemicals. Then she goes off screen, over to the sink to add water.

For me, there has always been something special about the moment when you mix the coloured metal oxides together with the other ingredients[2]. With only a few oxides, you can get a wide range of colours, shades, depths and structures. The colours not only depend on the individual oxides, but also on all the other constituents of the glaze. Many ceramicists also use pre-mixed pigments[3] to get more nuances in the shades of colour, and to achieve more powerful, more saturated colours.

I am mostly attracted to the metal oxides because they are materials that are used for far more purposes than just creating a colour. In the names of the metals themselves, such as cobalt, copper, iron and titanium, there are so many references to stories about traditions, economics, politics, past, future, environment, events and myths. When I work with the materials, relationships, ideas and associations appear. It can start at a completely arbitrary place in the small insignificant things, depending on what was just played on the radio, what I read in the newspaper or the internet, or was just registered in passing while on a train or bus. Detached associations are incorporated into the things that I do whilst I do them.

P3403 Cobalt Oxide
Harmful to health. Dangerous for the environment.

Contains tricobalt tetroxide (93-100%) cobalt oxide (0-5%) sodium carbonate (0-2%)

Harmful if swallowed. May cause irritation with contact to the skin. Toxic to aquatic organisms; may cause long-term adverse effects in the aquatic environment.

Keep out of reach of children. Avoid skin contact. Wear suitable gloves. This chemical and its packaging must be treated as hazardous waste. Avoid release into the environment. See the health, environmental and safety data sheet for further information.[4]

For a long time, cobalt was a mineral few people were interested in. Some might just associate it with the intense blue colour. [...] However, the mineral has now experienced a tremendous upturn and created a profit feast in the financial industry in the past year. The cause: the mineral is a key ingredient in the rechargeable batteries used in electric cars (as well as being used in PCs and phones). A typical electric car battery contains about 20 kilos (!) of cobalt. The reason why the metal is desirable to use in these lithium ion batteries is that cobalt increases its range. [...] So what is the problem? In two years, market analysts expect that nearly 20 percent of the cobalt on the market will be used in electric car batteries. [...] and why not just excavate more cobalt? The problem is that over 60 percent of the world's cobalt reserves are found in Congo, a country ravaged by civil war up until 2003, and a country which has the dubious honour of

> being the world's 20th most corrupt country, according to Transparency International's Corruption Index (2016). Although one of Congo's giant mines, Katanga, recently announced that it is resuming production again after two years of refurbishment work, experts believe that the world's cobalt producers are unable to cope with the demand in the long term. Wood Mackenzie, an energy market analyst firm, fear that the market could simply run out of cobalt.[5]

I finish filming in the glaze laboratory and look more closely at a ten-litre bucket that is standing on the floor. It is labelled «Waste Glaze» with large, quickly written letters. The bottom is covered with clumps of indistinguishable ingredients that are swimming around in a multi-coloured porridge-like mass. In the laboratory, the contrast between the waste and the clean ingredients; i.e., powder in steel drawers, becomes so significant. When pure ingredients are mixed, they are usually transformed into something with added value. In the case of the ceramicist, they become glaze, but once the ingredients are mixed, the process cannot be reversed. Incorrectly mixed or unsuccessful glazes end up as waste.

> In some workshops, it is possible to see containers or buckets with terms such as «remnants» or «mixed» labelled on them. It is usually a greyish fluid and the workshop owner would be able to inform you that it is a glass residue or tried-and-tested glaze (unsuccessful?) that ends up here. Let it be said very

> simply: it does not work!! [it doesn't work as glaze][6]

The opposite of to mix must be to separate. That got me thinking of the processes that a raw material goes through to get from the mine to the workshop and also what the mining industry does to gain control over the raw material. After the materials have been subject to the industry's processes, they can be re-assembled, and to put them together, one needs to know almost precisely what they consist of; for example, chemical formulas, ratios and the level of purity. The purer the raw material, the greater the predictability and knowledge of the material's properties and possibilities there is. Conversely, if we lose control of the information, the raw material loses its value, at least as far as an industrial mindset is concerned.

I started to take an interest in the buckets. As with all other types of waste, one can read and interpret a lot from the contents. In the bucket lay the ceramic department's incorrectly mixed glazes and residual products, but therein, there were also many other questions that could be interesting to investigate. I asked the ceramic department's workshop technician if, instead of sending the glaze waste away, he could put the buckets in my office.

The glaze waste accumulated in dozens of buckets. Gradually, I had amassed a stock of waste, and I made sure that it didn't dry out. I wanted to maintain the consistency between plastic and liquid so that I could dig into the substance with a spoon without destroying the waste's history. The first trials with the glaze waste were simply about emptying a bucket and looking at the marbled layers and recording the associations.

With the glaze waste, I had found a point of departure that represented the complete opposite of that which usually characterizes glaze chemistry. I had no information, no pure raw materials and no measures of predictability. What was left? How could I use these limitations to identify other methods? I decided that one bucket of glaze waste was a project, and for each bucket I had to change my methods.[7]

An example of one of the bucket projects:

- *32 kilos of waste is divided into 32 new portions, each one kilogram in weight.*
- *Each portion is stirred into a liquid mass (corresponding to a regular glaze).*
- *The liquid mass is sieved and further divided into new portions, so I have 6 versions of the same mixture.*
- *The 6 mixtures are fired at 6 different temperatures.*

On a small island[8] in Oslo fjord there was once a large limestone quarry. Work, i.e. extraction of the limestone, started in 1899 and was one of Norway's largest operators until it was shut down in 1985. Then, the island of Langøya was hollowed out for limestone and abandoned, leaving two deep craters that descended 80 metres below sea level. The craters were open for several years, and because the seawater did not penetrate through the crater walls, after many geotechnical investigations, it was established that they were suitable as a landfill for the disposal of environmentally hazardous and inorganic industrial waste.[9]

In 2015, I was tipped off that Langøya could be relevant for my project[10]. The future of the island was discussed extensively in the media. An aerial photograph from 2002 that I found online caught my interest. In the picture the hollowed-out island in the open fjord was visible. Part of the crater was dry, part of it was half full of an iron red liquid, and at the furthest point, one could see a basin that had almost been filled to sea level. A dirt road formed a rim that curved around the elongated island. In 2015 the landfill in one crater was almost full, and the Norwegian Geotechnical Institute (NGI) was investigating how the landfill should be sealed with a top cap. The question that preoccupied both scientists, politicians and the general public was whether it was possible to restore the island gradually so that it could be used for recreation purposes.

> When the landfill has been filled and the terrain landscaping completed, a top cap is added. The top cap should prevent water from precipitation from infiltrating into the landfill. Three layers of large amounts of clay are removed before limestone from the island's own reserves is laid on top at a depth of nearly two metres. On top of it all, a layer of growth is added that will ensure regeneration of the biodiversity typical of Langøya. Today, top capping and rehabilitation of the northernmost part of the landfill is ongoing.[11]

According to the workshop technician, the glaze waste from the Academy had previously been sent to Langøya's waste disposal site for heavy metals. But precisely who it is who receives the waste today and how it is deposited, he did not know. I called the department responsible for technical support and operations of the Academy. They did not know either, but they could put me in touch with their contact person for waste management. The following morning, I received an email:

> Hi both of you! […] I'm putting Katrine, one of our fellows, in contact with you, since she has some exciting questions regarding hazardous waste. :) Katrine works with ceramics and is investigating and working on the properties, origin and degradation of the raw materials she uses in her practice, such as clay, glazes, minerals etc. […]
>
> Jan Arve is the manager of hazardous waste at Franzefoss and is used to dealing with everything we send. If there is anyone who can answer your questions, then it is most probably him. His telephone number is[...][12]

Some days later, the manager[13] explains to me what happens to the glaze waste after it leaves the Academy and goes out into the community and what the process thereafter is. He explains that the waste is categorized with waste material numbers. The ceramic glaze waste belongs to the main group «Hazardous waste» and is assigned with the waste code 7000 and subgroup 7091 "Inorganic salts and other solids - which is hazardous due to the content of inorganic substances, heavy metals etc.» This waste group is sent on to the cement producer Norcem´s plant in Porsgrunn. Since 2002, they have had a department for the treatment of organic special waste in Brevik. There, the glaze waste is first burned at high temperatures, then it is crushed into a fine powder and thereafter mixed in the production of cement.[14]

While collecting information from emails, phone calls, homepages and encyclopaedias, there is one company that crops up again and again: the cement company Norcem. The company in Brevik, which today receives the glaze waste from the art college, is the same company that, from 1899–1985, ran the limestone quarry on Langøya, which later became a waste landfill.

When I think of Langøya, I see a container. A container that has been filled with glaze and sealed with clay. It gives a ceramist something to think about - for the most common way of thinking in ceramics is that the clay is the body and the glaze, the surface - and in a receptacle, it is usual that the glaze is the material that seals the clay.

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[1] Hanna Björkdahl (1985), was a student at the Oslo National Academy of the Arts from 2015–2017.

[2] Colouring metal oxides are, for example, iron, cobalt, copper, manganese, nickel. The oxides have different colour strengths and cobalt is among the strongest, where 0.2-0.5% is enough to give blue tones to a transparent glaze.

[3] Stains are blending colours for glazes and clays that are pre-burned and powdered. It makes them more predictable.

[4] Cobalt oxide, supplier: Waldemar Ellefsen AS, Rosenholmveien 48, 1252 Oslo (2016).

[5] Lind Berg, Tora (2018). 3 graphs which show why cobalt is creating a headache for the electric car manufacturers. Published 15 January. https://filternyheter.no/3-grafer-som-viser-hvorfor-kobolt-skaperhodepine-for-elbil-produsentene/ (read 10 November 2018).

[6] Lynggaard, Finn (1976). *Keramisk håndbog. [Ceramic Handbook]*. Oslo: Aschehoug. 2nd. edition, Copenhagen: J. Fr. Clausens Forlag. p. 189.

[7] I started by collecting the glaze waste in the spring of 2015 and since then have worked with it throughout the entire PhD. project.

[8] Langøya is located to the west of Holmestrand in Oslo fjord; it is three kilometres long and at its widest, 500 metres. The island is uninhabited. The limestone quarry on the island belonged to the cement company Norcem, and the stone was used as a raw material for cement.

[9] Waste management is run by NOAH AS. The company's facilities at Langøya have been developed for the reception and efficient and environmentally responsible treatment of all current types of inorganic hazardous waste. All the hazardous waste received is utilized; this is done by converting the waste into stable and environmentally safe substances.

[10] Hilde Herming and Linda Thu.

[11] The text is a transcription of a clip from the film NOAH, Langøya (05:04 minutes) https://www.noah.no/forkunder/treatment centre / langoya / film / (seen 11 November 2018). "NOAH AS (Norwegian Waste Management) was established in 1991. NOAH runs the national reception centre for the treatment of inorganic hazardous waste on Langøya (opened in 1995), and also provides guidance on hazardous waste to companies. NOAH was originally owned by the state and large Norwegian companies (including Norsk Hydro, Equinor and Elkem), but was acquired by Bjørn Rune Gjelsten's investment company Gjelsten Holding in 2003. From 1999, NOAH also operated a treatment plant for organic hazardous waste in Brevik, which was sold to Norcem in 2002."

[12] Email from Annika Isaksson Pirtti, employed by the Operations department at the Oslo National Academy of the Arts. (8 November 2018).

[13] Telephone conversation with Jan Arve Granli, Franzefoss Gjenvinning AS (9 November 2018).

[14] Sources: *Store Norske leksikon [Great Norwegian encyclopaedia],* NOAH and NG

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