THE NEW CERAMICS

sustainable ceramics

Robert Harrison

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Ceramics is dirty: debunking the myth

> *Premise:* Ceramics with all its inherent needs of making, materials, firing fuels and working space is certainly not a *clean/green* medium.
>
> *(Robert Harrison)*

Contrary to this premise, held by numerous members of our community, ceramics can be one of the sustainable and eco-friendly mediums for creativity. It really depends how conscientious you are about your practice. Great advances in research and technology have enabled us to become much more conscious of our carbon footprints as ceramic practitioners.

As we all know the practice of making with clay has been around since the beginnings of modern human existence. Small fertility (Venus) objects are dated to 26,000 years ago, and Japanese Jolmon vessels date to 16,500 years old. The earliest days of modern humans is traced in part to the shards of the earliest cultures that created and fired clay objects and vessels.

LEFT: *Salt-glazed Articulated Jug*, Walter Keeler, 2012. Ht: 30.5 cm (12 in). *Photo: courtesy of the artist.*

RIGHT: *Ancient Shards*, Robert Harrison. Granitewood Collection, Helena, Montana. *Photo: Robert Harrison.*

Twenty-first Century Shards, Robert Harrison, 2013. Granitewood Studio, Helena, Montana. *Photo: Robert Harrison.*

Makers today are in fact extending the lineage of ceramic practitioners that dates back through those thousands of years. For the majority of that time, some would argue up until the past few hundred years, ceramic practice was in harmony with the Earth. The Industrial Revolution of the 18th century changed the world. It brought with it great advances and innovation, but also had negative impacts on the environment.

With advances in research, understanding and technologies, we have the ability today to have a zero impact on the environment. One does not have to feel it is a hopeless situation and there is no point in even thinking about it. Ceramic practitioners, like every individual, play a role in this equation.

Any small step is a forward step.

Carbon footprint

What is a *carbon footprint*? The concept originates from the ecological footprint discussion, developed by Rees and Wackernagel in the early 1990s. The carbon footprint is a subset of the ecological footprint and of the more comprehensive Life Cycle Assessment (LCA). The mitigation of carbon footprints through the development of alternative projects, such as solar or wind energy or reforestation, is often known as carbon offsetting.

Inevitably, in going about our daily lives – commuting, sheltering our families, eating – each of us contributes to the greenhouse gas emissions that are causing climate change. Yet, there are many things each of us, as individuals, can do to reduce our carbon emissions. My research has not turned up specific data to the average individual potters/ceramic artists' carbon footprint, perhaps because our individual work is unique and so varied.

Blue QR Bowl, Aaron Nelson, 2011. Ht: 6.3 cm (2½ in) x 11.4 cm (4½ in), soft paste porcelain. *Photo: courtesy of the artist.*

How much energy does it take to fire a ceramic cup?

Aaron Nelson is the Artistic Director of the Medalta Artist-in-Residence programme in Medicine Hat, Alberta, Canada. Aaron was previously the Clay Business Manager of the Archie Bray Foundation. His extensive knowledge of ceramics materials and his commitment to sustainable issues continue to impress. Aaron writes:

> How much energy does it take to fire one cup? Is the act of turning clay into ceramic a sustainable practice? Are we really using fossil fuels in a responsible way? Where do the raw materials come from? What is the exact relationship between ceramics and glass? These are all questions that I have come to ask myself as my interest in the production of objects (I spent many years as a potter) has expanded to a more conceptual understanding of how these objects are produced and how they fit into contemporary dialogues around consumption. These questions have directed my research towards the formulation of an energy efficient material, which is more glass than clay.
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> Having worked with porcelain for a number of years I was interested in the aesthetics of translucency. Combined with my interests in energy conservation I have been developing a material loosely based upon the Renaissance prototypical porcelains known as the Medici porcelains. The material that I am currently working with matures at 1045°C [1913°F], is extremely translucent, and has many qualities associated with glass. It fires to temperature in just over three hours. Currently my research has been directed at fluxing the body with over 50% post-consumer material in the form of various types of recycled glass.

Below is a very simple breakdown of the energy required to once fire this small porcelain cup to 1045°C (1913°F).

Energy Audit: 19.98 kWh to fire 30 cups
0.66 kWh to fire one cup = 666 watts

How much energy is 666 watts?

- The energy consumed by an average-size plasma screen television while watching a Super Bowl (North American football) game
- The equivalent to the nutritional energy in three and a half doughnuts, roughly 190.2 calories
- The energy it takes to boil one liter of water.

So if you are watching the big game, drinking a pot of tea and eating doughnuts you are consuming about 2,000 watts of energy, enough to fire three cups!

If you amortise the energy required to fire the cup over the average lifespan of its useful life of an average of 50 years it takes about 13 watts per year, about what a standard compact fluorescent bulb consumes in one hour. Aaron's research has convinced him that the act of turning clay into ceramics can be incredibly efficient and consumes relatively little energy.

Red QR Bowl, Aaron Nelson, 2011. Ht: 6.3 cm (2½ in) x 11.4 cm (4½ in), soft paste porcelain. *Photo: courtesy of the artist.*

The bicycle kiln

When I heard about Aaron's idea for a human-powered kiln, I needed to learn more! Aaron writes:

> The Idea for a bicycle-powered kiln came out of a trip to the science centre coupled with an energy audit I conducted on my firing cycles. Having determined that I only needed to generate enough electricity to produce about 0.66 kWh, to fire one very small cup I postulated that it would be possible to generate the required electrical energy needed to build a small 27 cubic inch electric kiln with a bicycle-powered generator.
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> Using a belt-driven permanent magnet motor as a generator the system will be able to produce about 100 watts of energy with one bicycle pedaling at an average speed. This energy then flows into four deep cycle storage batteries and then into an inverter that converts the current to AC to power the kiln. Keeping in mind that while pedalling a bike a human body runs at about 25% efficiency so for every 1 watt produced it takes 4 watts of pedal power. I have determined with the loss of efficiency in various parts of the system I will need to pedal for about 12 hours. If four bicycles were hooked up in series it would only take three hours to generate the required energy.

Obviously a kiln of this sort has little practical applications. The purpose is more conceptual in nature in that it illustrates how little energy it really takes to transform clay into ceramic material.

Leach/Cardew and their sustainable legacy?

Walter Keeler is one of the UK's leading ceramic artists with an international reputation, and some say he is now the pre-eminent British potter. He studied at Harrow School of Art, noted for training production potters, and established his first studio in 1965 where he produced domestic stoneware. In 1976 he and his family moved to Monmouthshire in Wales and created an innovative range of salt-glazed stoneware for which he quickly developed an international reputation.

The following is an interview between the author (RH) and Walter Keeler (WK).

> **WK:** Both Madoline and I came from working-class backgrounds. Madoline's family worked in the coal mines, and struggled; in fact her father left home so there was one less mouth to feed. My father repaired shoes, and my grandfather grew vegetables to feed the family. We repaired, made and mended things to manage economically. Recycling started for practical and economic rather than ecological reasons. I recycled crankcase/engine oil scrounged from local automobile repair shops to fire my kiln instead of allowing them to 'spread the oil on the nettles'. I rationalised that OK, you are burning carbon but preventing other types of pollution; it's a mixed blessing. It was not uncommon to look into

dumpsters or skips for re-useable things; I still have a stool in the workshop I recovered from a skip. It is a post-Depression era thing, like buying second-hand items from junk shops, etc. Most of us go through our day-to-day lives and recycle newspaper, etc. without thinking too much about the ecological aspect. I have never looked at the ecology aspect in my studio practice.

Cardew went to places without a ceramic infrastructure, they had to find and make clay for low fire pots. He prospected, thinking, how can I use the local material? He had some labour, but the prospecting and collecting Cardew did in Africa to find and use local material can be used by anyone, anywhere if you had a mind to. How feasible is that? It depends on your initiative and your locale.

Materials didn't travel a great distance. China clay, feldspar, Cornish Stone were the useful materials in the south-west of England, perhaps that's why there is a concentration of potters there. The reality is that ecology and finance are tied up. If it's cheaper to use, people will use it. On the other hand, there are times you have to invest for the long run, for example low energy bulbs cost more upfront, but in the long run save you money and reduce your carbon footprint.

RH: My research leads me to believe that many processes that were utilised by Leach and then Cardew were early innovations in sustainable practices. Perhaps many of these practices came out of tradition or necessity, but then laid the groundwork for our current efforts to develop healthy sustainable practices for the individual as well as workshops and schools.

WK: Leach had that philosophical attitude that you should use raw materials that you could relate to and that would sustain some sort of integrity in the work. He probably wasn't thinking ecologically at that time but by coincidence it makes sense ecologically. Cardew stressed the idea that you could source materials that are close at hand and process them yourself, which reduces the industrial impact of producing refined materials at a distance and importing them.

I also think of Harry Davis and the Crowan Pottery. He used the old mill as a pottery and generated his own electricity from the water mill. There's a great story about David Leach who was quite thrifty and was visiting. David would go around switching off the lights at night in the mill. Then Harry would get up and storm around putting them back on. The early technologies required using the electricity as it was being produced. The system there was pretty 'Heath Robinson'.

This leads on to the Harrow Studio Pottery course, which was set up by Victor Margrie and Michael Casson in the late 1960s. Students were very good about using materials at hand and would often find the timber for building their own wheels.

There existed a mentality of not buying what you could find, so that recycling was not for ecology reasons but for economic reasons. A lot of potters are infected with that sort of thrifty nature, with most not having a lot of money; you find a way of doing it with materials at hand.

LEFT: Walter Keeler making an *Articulated Jug*, 2012. *Photo: courtesy of the artist.*

RIGHT: Walter Keeler's making shop/studio in Monmouthshire, Wales, 2012. *Photo: courtesy of the artist.*

Pioneer Pottery was a key and a very important publication of the time (60s) and the students were very serious about that. Potters still used materials that were available locally. That cut down on refinement (of the materials) at the time. Some people made that their way of life. We were using fireplace (wood) ash, using clay from underfoot and adding feldspar to make glazes. That practice eliminated buying refined materials. It does mean you have to grind and ball mill your materials and that could be more or less ecological. [Harry Davis wrote *The Potters Alternative*, advancing these types of ecological practices.]

A new generation seems ready to carry on and implement many of the ecological ideas that were discussed years ago but now have the advanced technologies to assist. A lot of people are using ground source heat pumps for their heating, etc. Ground source heat pumps (GHSP) draw heat from the ground or groundwater which is at a relatively constant temperature all year round. The cost of oil is going up all the time. Carbon fuels are expensive and growing more and more expensive. That in itself is enough to look for alternatives. It makes me think back to the days of the Harrow School in the 70s when the students talked about progressive ideas in wind generation and methane use. There was an oil crisis, and people were passionate about it. Ray Finch tore down his oil kiln and went to wood fire. Decisions were primarily made for financial reasons, but now amongst a new generation of young people, these decisions are being made for ecological reasons. The technology has caught up with the dream now.