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Crawling Glazes on Mid-Century Modern Maritime Canadian Studio Pottery: Shared or Re-Created?

Studio pottery can be defined as unique ceramic wares hand-produced in small quantities by individuals or small groups who are involved in all aspects of its production. As such, it is distinguished from mass-produced pottery made on an industrial scale by factories. Excluding aboriginal pottery (e.g., Owen et al. 2014, 76; 2016, 231), which has been produced by indigenous peoples (Eastern Woodlands cultures) in central and eastern Canada for millennia, the production of studio pottery in this country dates to the early 20th century. Some of the earliest studio potters worked in the Canadian Maritime provinces (New Brunswick, Nova Scotia, and Prince Edward Island), an area largely blanketed by clay deposited in glacial lakes (e.g., Lake Shubenacadie; Stea et al. 2004, 14) following the last ice age. These deposits no doubt attracted the attention of those working with this medium, and indeed some of these clays are suitable for throwing on a potter's wheel directly from the ground. Others, however, had to be processed and/or mixed with other clays before being thrown or moulded into pottery and then successfully fired (Home 1944, 74; Owen and Boudreau 2008, 27).

Erica and Kjeld Deichmann, immigrants of Danish extraction, are commonly considered to be among the first producers of studio pottery in Canada to have made their living from their craft (Inglis, 1991, 11). The Deichmanns moved to Moss Glen, on the north shore of the Kennebecasis River east of Saint John, New Brunswick, with the hope of establishing a hobby farm, but the discovery of red clay on their property inspired them to make pottery. Funded by an inheritance, in 1933 the couple spent a year in Europe indulging their Bohemian interests. While in Denmark, Kjeld learned how to build a kiln from a former classmate (Inglis 1991, 12). The Deichmanns returned to Moss Glen in the spring of 1934 to set up their own studio, building a large, wood-fired kiln, and initially used local clay to make pottery. Although they lived in an isolated, rural hamlet, by no means did the Deichmanns work in a vacuum. Over time, they networked with other potters both in the Maritimes (e.g., Eleanor and Foster Beveridge and Nita des Barres; Crawford 2005, 37) and abroad, eagerly seeking out expertise from giants in the field such as Bernard Leach, the renowned pioneering British studio potter.

The Diechmanns were active from Aug. 1935 until Kjeld's death in 1963. They produced utilitarian wares and figures, the most well-known of which was a camel-like creature they called a "goofus" (figure 1), whose image often appeared on their plates, bowls, and pin dishes. Other figures included female busts and birds (see Owen and Boudreau 2008, 8), but goofus figures are by far the most common. Notwithstanding initial setbacks related to overfiring in their home-made kiln, they soon met with success and by 1937 were exhibiting their wares nationally and internationally. With this, their fame grew to the point that their studio in Moss Glen – the Dykelands Pottery – became a mecca for visitors. In 1956, they moved to nearby Sussex to escape the throngs.ⁱ Erica Deichmann decorated and glazed pots thrown by Kjeld. She is said to have experimented with over 5000 glaze recipes over the years.ⁱⁱ The most prominent of these was arguably her "Snow on the Mountain" (SOTM) glaze, a type of crawling glaze (see below) with ameboid "islands" of thick, snow-white glaze separated by patches of the ceramic substrateⁱⁱⁱ (red-firing earthenware, pale tan stoneware or a thin layer of slip^{iv}). Its appearance has led some admirers to refer to it simply as a "pebble glaze."

Other potters were already active in the Maritimes by the mid-1930s (see Crawford, 2005, 21-25). For example, Alice Hagen (1872-1972) set up her own pottery at age 60 in Mahone Bay, Nova Scotia in 1931, where she trained others in pot-making. Like many other women in the late 18th/early 19th century, including noted Nova Scotian artist Edith Smith



Figure 1
Deichmann goofus figure in red-firing clay (13.3 cm tall; signed *Erica/cojoined KD/NB*).



Figure 2
Porcelain blank decorated by artist Edith Smith (27cm tall; signed *Edith A Smith 1921*; factory-stamped *B&Co/France* [L. Bernardaud & Co/Limoges]).

(1867-1954), Hagen honed her painting skills by decorating porcelain blanks. An elaborate contemporary example by Edith Smith can be seen in Figure 2. Although Hagen created a wide variety of ceramic wares which often had florid colours, her signature work involved throwing bowls made from clays she tinted different colours (figure 3). She marketed these as “Scotian Pebble.” The earliest dated piece of apparent studio pottery from the Maritimes of which we are aware is a small, unglazed redware creamer incised on its base “Acadian Pottery/Enfield,” with the phrase “Souvenir of Halifax, NS 1911” written in now-faded ink on its side (figure 3). High-quality red clay from the Enfield area is still used today by local potters and in the brick-making industry. The longest operating (c. 1880-1925) commercial potworks in Nova Scotia was established by James Prescott in Enfield. He produced all manner of utilitarian wares, from milk pans to chamber pots and drainpipes, but also decorative terra cotta plaques. One such plaque is signed with a cojoined “HP,” evidently referring James’ son Henry, and “Acadian Pottery/ Enfield N.S.” and stamped “W.S. & C/H.” This likely denotes the Halifax distributor Webster, Smith & Co. (Maclaren 1972, 16-22). It seems that Acadian Pottery produced these decorative wares on behalf of James Prescott & Son, so it may not have met the criterion for studio pottery *sensu stricto*.



Figure 3
 Early pieces of Nova Scotian studio pottery. A “Scotian Pebble” bowl (*left*; 13 cm diameter) by Alice Hagen (unsigned, but similar bowls are marked *A. Hagen/M-NS*; the “M” signifies Mahone Bay), and (*right*) an unglazed, hand-thrown redware creamer (12 cm tall; incised on the base *Acadian Pottery/Enfield*; “*Souvenir of Halifax, NS 1911*” is written in faded black ink on side).

Some historical potters produced wares simply for their own gratification, but others sold their pottery. Among the latter, many participated in regional craft shows. This not only allowed them to market their wares to the public, but to interact directly with other craftspeople. This made historical potters both colleagues and competitors. It also begs the question as to whether knowledge about how striking features, such as the SOTM glaze, were produced was shared by competing colleagues, who then created their own versions of it, or whether potters simply copied one another without direct technical knowledge of their competitors’ method. Certainly, many Maritime potters were influenced by the pottery forms produced by others. For example, influential Nova Scotia potters Eleanor

(“Sandy”) and Foster Beveridge of Mader’s Cove (near Mahone Bay) produced figures in porcelain, but rather than “goofus” tetrapod creatures, they made models of birds and stylized human figures quite different than those fashioned by Erica Deichmann.^v The Beveridges commonly decorated their porcelain tableware and figures with cobalt blue sprigs (figure 4), a motif unique to them. Their thinly potted and sgraffito decorated porcelain bowls (figure 5) resemble some of the pottery made by renowned Austrian/British potter Lucie Rie (1902-1995). After initially producing small stoneware pots, the Beveridges later produced substantial stoneware and redware pieces of very high quality, with few if any visible flaws. Starting in 1967, they worked exclusively with porcelain bodies (Holtz 1999, 2). Sandy Beveridge is known to have discarded many of her early pieces (Holtz 1999, 3) and is anecdotally quoted to have said that “a hammer is a potter’s best friend.” Evidently, Foster Beveridge’s employment as a naval engineer allowed them the luxury of maintaining this high standard of production.

Alma and Ernst Lorenzen began making pottery as hobbyists in the mid-1940s in Dieppe, NB. Ernst was employed at the Moncton airport at the time. The Lorenzens’ work soon attracted the attention of Lloyd Shaw, owner of Shaw Brick, a multi-generational family business now centered at Lantz, NS.^{vi} Shaw sent the Lorenzens some red-firing local clay and was so impressed with their work that he encouraged them to move to Lantz. With his financial backing, they moved there around 1950 and their hobby became a full-time vocation. Today, the Lorenzens are best-known for sculpting in clay

detailed models of native mushrooms, although they also produced tableware (Owen et al. 2012, 93-107). Carrie Mackenzie, a less known but highly competent potter from Saint John, NB, made, among other forms, knobbed dishes that closely resemble the “Kish” bowls produced by the Deichmanns (figure 6). On occasion, the Beveridges, Lorenzens, and Mackenzie made use of crawling glazes, with one of the Beveridges’ versions being, at least visually, a close replica of the Deichmanns’ SOTM glaze (cf. figures 7 and 8).



Figure 4
Cobalt-blue sprigged decoration on porcelain humanoid figure made by the Beveridges (22 cm tall; stamped with an encircled “*B*” and signed *Beveridge/NS*).

It is hardly surprising that some of these potters produced similar forms of wares and glazes – imitation is, after all, the

highest form of flattery. But one wonders just how much specific technical information potters shared about the production of their ceramic bodies and glazes, including details such as ingredients and their proportions or firing conditions and duration. This issue is addressed here using compositional data for crawling glazes produced by four the Maritime potters/potting couples described above.

Crawling glazes

A glaze is a glassy coating on a ceramic substrate, whether earthenware, stoneware, or porcelain. With some exceptions, glazes are water-based mixtures of quartz (the main glass former), a flux (e.g., alkali compounds, boron, or lead), and a stiffening agent such as alumina to increase the molten glaze's viscosity during firing. In some instances, colourants such as base metal oxides and carbonate minerals, as well as opacifiers with very high melting temperatures (e.g., tin and zirconium oxides), are added to the glaze mixture. Ceramic objects to be glazed generally are either dried at room temperature or, in the case of soft-paste porcelain,^{viii} kiln-fired at high temperature (e.g., ~1200°C, depending on its composition) before being glazed and refired at lower temperature (e.g., ~1000°C; e.g., Owen and Hanley 2017, 92). The glaze mixture melts during kiln firing and quenches to form a glass when heat is dumped from the kiln. Objects to be glazed can be dipped in the glaze mixture or sprayed. Stoneware traditionally had a salt glaze, produced by tossing rock salt into the kiln as stoneware objects are being fired at very high temperature, but silica-based glazes can be used instead (as is the case in Deichmann samples D3 and D4).



Figure 5
Two Beveridge porcelain incised and pinched bowls. They are thinly potted and decorated with vertical sgraffito lines, suggesting the influence of famed Austrian/British potter Lucie Rie. Diameter of each bowl ~13 cm.



Figure 6
Knobbed “Kish” bowls (shown inverted) produced by (left to right) the Deichmanns (9 cm diameter and 6 cm diameter, respectively; both are stoneware and signed *Deichmann/co-joined KD/NB*), and Carrie Mackenzie (13 cm diameter; redware; signed *Carrie Mackenzie*).



Figure 7
Analysed Deichmann pottery. Left to right: Deichmann creamers/pourers D1, D2, D3, and D4 (all signed *Deichmann* and “*DK*” except D4 [cypher only]). Largest creamer is 9 cm tall.

Glazes that separate into discrete beads or blebs (“islands”) during kiln firing are referred to as crawling glazes. The glaze blebs are separated by irregularly shaped patches of the substrate. Glaze crawling is generally considered to be a flaw, but in some instances this effect is produced deliberately. The intentional creation of crawling glazes dates back to late 16th century Japanese Shino wares.^{viii} Glazes that are viscous and have a high surface tension when molten are prone to crawling (Hamer and Hamer 1997, 87). Molten glazes with a high alumina (Al_2O_3) content are relatively viscous and the presence of opacifiers tends to increase surface tension (Ibid). Carbonate minerals break down (dissociate^{ix}) over a range of temperatures as they are heated.^x Thus, provided this process overlaps partial melting of the glaze mixture, their use in glazes can lead to an increase in viscosity as CO_2 bubbles^{xi} form and impede flow of the molten glaze. Enriched in these and other ingredients, such glazes can have unusual compositions. However,

the crawling of glazes with less radical compositions likely occurred due to conditions prior to firing, especially poor adhesion between the dried glaze and its clay substrate. This can happen because of greasy or dusty areas on a pot’s surface; incomplete drying of a pot after being sprayed or dipped into the glaze mixture; applying the glaze thickly; or overgrinding of glaze materials.^{xiii} Potters seeking to produce crawling glazes can ensure poor adhesion by coating their pots with a slip or an initial glaze (“underglaze”) prior to glazing (e.g., Hopper 2013; see for example Deichmann sample D3, figures 7) with the mixture they intend to crawl.

Crawling can be initiated along pre-firing cracks formed in the dried glaze. This can result from a surfeit of clay or other material in the glaze mixture, causing it to absorb water and allowing excessive shrinkage and cracking in the glaze as it dries (Berneburg 2015). Alternatively, insufficient clay or other very fine-grained material to ensure good contact, and therefore a strong bond with the substrate, facilitates crawling of the glaze during firing. Used in excess, however, very fine-grained material promotes excessive shrinking of the glaze during drying, which can result in crawling during firing.^{xiii}

Sample Description

Eight pottery samples with crawling glazes were analysed: four Deichmann creamers/pourers with SOTM glazes^{xiv}; one Beveridge mug with a crawling glaze that resembles Deichmanns’ SOTM glaze; one of the Beveridges’ flower frogs, on which the glaze failed to retract into separate “islands”^{xv}; one Lorenzen mug with a pale grey glaze that dripped and

separated over a black underglaze; and a Mackenzie bowl with a brown crawling glaze.

Two of the Deichmann samples (D1, D2) are redware, whereas the others (D3, D4) are stoneware (figures 7). The Deichmann redware samples have tiny (<1 mm) black glassy beads on the clayey^{xvi} surface, between the white glaze blobs and in bands of non-crawling glazes on the interior and exterior of these vessels. Two narrow (5-10 mm) bands on D2 – one in the top interior of this creamer, the other separating the crawled and uncrawled-glaze on its exterior – have a pinkish cast. There are pink patches in some of the crawled glaze “islands” immediately above the pinkish band on the exterior of this sample. Sample D4 has a pale tan body, whereas D3 has a paper-thin brown stoneware slip covering a very pale grey and glassy (i.e., well-vitrified) stoneware body. The crawling glaze on D3 is vesicular (i.e., contains bubbles), forming a 3 cm x 0.6 cm patch where it has dripped and thinned over part of the slip-covered top interior of this pourer.

The Beveridge mug (figure 8) is made of redware. Its crawling glaze is confined to vertical panels separated by dark brown glazed panels that extend into the interior of the mug. In contrast, crawling glazes encircle the Deichmann samples (figure 7). Smaller glaze “islands” on the mug have discrete brown speckles that form patches on larger “islands” in the centre of the crawling glaze panels. The crawling glaze has begun to drip over the upper edge of the mug, clearly coating the dark brown underglaze. The flower frog (figure 8) has a stoneware body. Its sides are coated with a thin layer of slip over which the glaze, confined to the top of the piece,

failed to drip. It has a mottled brown/greyish-white colour. The lower edge of the glaze is thick and intersects the underlying slip at a high angle, a testament to its viscosity during kiln firing.



Figure 8
Analysed Beveridge pottery. *Left:* mug (14 cm tall; signed with incised *E.&F./Beveridge/N.S.*); *right:* flower frog (9 cm tall; signed with incised *Beveridge*).

The body of the Lorenzen mug (figure 9) is cream-coloured, unvitrified, and slightly gritty to the touch. It is likely made of stoneware rather than porcelain, *sensu stricto*. The crawling glaze was applied to the interior and exterior of the mug but not its base. The mug has a black underglaze that was no doubt applied to ensure crawling of the overglaze and to add colour contrast. A lidded stoneware vase with the same glaze is shown in Crawford (2005, 40).^{xvii}

The MacKenzie bowl (figure 10) has a redware body. Its brown crawling glaze shows a variable degree of retraction (i.e., “beading”). The entire bowl except for the base is glazed. Crawling occurred mostly on the exterior surface. The glazed interior has crawled only within 5

mm of the rim and on one $\sim 5\text{cm}^2$ surface. Glaze crawling is extensive on the exterior but there are patches that remain smooth. Many of the glaze “islands” are hollow and have popped (figure 10). The exposed clay body between the crawled glaze is brown, whereas the bottom of the bowl is reddish-brown. Use of a 10x hand lens reveals the presence of white rectangular crystals up to about 1 mm in length in the glaze. The Beveridge mug bears their early mark (“E & F Beveridge” incised in script) rather than their later encircled “B” stamp, with “Beveridge,” so the mug is dated to approximately 1960.^{xviii} The flower frog has “Beveridge” inscribed on its base.

Results

Ceramic body and slip compositions are given in Table 1. Analytical methods are described in the Appendix. In addition to the samples described here, an analysis of the Acadia Pottery unglazed redware creamer (figure 3), along with the composition (from Owen and Boudreau 2008, 9) of unwashed clay from the Moss Glen clay pit used by Kjeld Deichmann, are also included in Table 1. The Beveridge and Lorenzen mugs were too tall to allow *in situ* analysis of their bodies, which are exposed only on the base. The body of Deichmann stoneware pourer (sample D3), exposed on a broken edge, was analysed by SEM/EDS; the slip coating the entire vessel was analysed by XRF (Table 1).

The compositional characterization of pottery and character of its raw materials need not rely on a plethora of components. The most abundant elements (commonly expressed as oxides) include silica (SiO_2), alumina (Al_2O_3), lime (CaO),



Figure 9
Analysed Lorenzen mug (10 cm tall; signed with an inscribed *Lorenzen*).



Figure 10
Analysed Mackenzie bowl. *Left*: Bowl (10.7 cm diameter; signed *71 B* [likely a glaze number]/*Carrie Mackenzie/ '54*); *right*: detailed photo shows popped glaze blebs (see text).

	Deichmann samples					Beveridge		Mackenzie	1911 Enfield	Moss Glen
	D1*	D2	D3 (slip)	SEM/EDS D3 (body)**	D4	Flower frog slip/engobe	body	bowl	creamer	clay***
SiO ₂ (wt%)	63.1	59.1	57.5	61.8	54.4	55.3	62.6	58.8	57.9	62.5
TiO ₂	0.9	1.3	1.4	1.1	1.1	4.3	1.8	1.2	1.0	1.1
Al ₂ O ₃	25.2	23.0	31.5	30.1	34.6	16.5	24.9	16.3	20.3	19.5
Fe ₂ O ₃ (t)****	3.5	4.9	2.6	1.8	2.3	10.5	3.8	8.3	8.3	8.2
MnO	<0.1	<0.1	<0.1	<0.1	<0.1	0.3	<0.1	0.1	0.2	0.1
MgO	0.9	0.9	0.9	<0.1	1.5	2.5	1.4	1.8	2.6	2.4
CaO	0.7	1.4	0.5	0.4	0.9	3.7	0.9	2.6	3.0	1.0
Na ₂ O	2.7	1.4	3.1	2.9	2.5	1.3	1.2	1.3	1.5	1.4
K ₂ O	1.7	1.8	1.8	2.0	1.8	2.3	1.9	3.2	4.3	3.7
P ₂ O ₅	0.4	0.8	0.1	<0.1	0.2	0.3	0.3	0.5	0.2	0.1
PbO	0.4	0.4	0.3	<0.1	0.3	0.7	0.7	4.8	<0.1	ns
ZnO	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	ns
SnO ₂	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	ns
SO ₃	<0.1	4.7	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	ns
BaO	<0.1	0.1	<0.1	<0.1	<0.1	2.0	0.1	0.1	0.5	ns
Cr ₂ O ₃	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	ns
ZrO ₂	<0.1	0.1	0.1	<0.1	<0.1	0.1	0.1	<0.1	<0.1	ns
Total	99.6	99.8	99.8	100.0	99.7	99.8	99.7	99.9	99.9	100.0
n=	15	1 (map)	42	12	16	27	25	20	20	1

*D1 - small creamer; D2 large creamer; D3 - 1955 pourer; D4 - tiny creamer (Fig. 7)

**analysed by SEM/EDS

***data from Owen and Boudreau (2008, 9), presented here volatile-free; ns-not sought

****Total iron as Fe₂O₃

ns - not sought

Table 1
Composition of ceramic bodies and slip (where present).

and alkalis such as soda (Na₂O) and potash (K₂O). Glazes can contain fluxes other than alkalis. These include lead oxide (PbO) and, in rare instances (including one of the pots described here), zinc oxide (ZnO), as well as opacifiers and/or colourants. In terms of raw materials, the body of many traditional ceramic wares is dominated by a mixture of pliable (“plastic”) clay and an aplastic component (“temper”) such as quartz sand (pure SiO₂). Clays comprise a diverse group of minerals, all of which contain silica and alumina. Depending on the type of clay and the proportion of quartz-rich sand mixed in with it, the silica/alumina ratio of pottery bodies can vary considerably.

The Deichmann stoneware bodies have lower silica/alumina (SiO₂/Al₂O₃ [wt.%]) ratios (sample D3 [slip]: 1.8, D3 [body]:

2.1; D4: 1.6) than their redware counterparts (D1: 2.5; D2: 2.6) (Table 1). The higher titania and iron oxide content of the slip on D3 accounts for its brown colour. Apart from that, the slip on D3 has a composition very similar to the pale grey, well vitrified body of this sample (Table 1). The body of D2 contains 4.7% SO₃ and has twice the lime content as D1, implying the use of a calcium sulphate mineral (anhydrite or its hydrous counterpart, gypsum) in its preparation.

Neither sample of Deichmann redware was made solely from local clay, which has an iron oxide content approximately twice that of D1 and D2 (Table 1). This could be lowered by mixing in a substantial amount of relatively iron-free clay, such as kaolin or iron-poor stoneware clay, but doing so would increase the alumina content of the vessels, which is already ~25 rel.% higher than Moss Glen clay (Table 1). Deichmann samples D1 and D2 are therefore interpreted to have

	Deichmann samples*										Beveridge			Lorenzen		Mackenzie
	SOTM1**		SOTM1		SOTM2		SEM/EDS		SEM/EDS		underglaze	mug	flower frog	underglaze	mug	bowl
	D1	D2	D3	σ	D3	σ	D4	σ	D4	σ						
SiO ₂ (wt%)	56.8	59.0	53.8	5.3	55.5	1.2	58.1	3.4	60.5	1.6	48.1	44.5	67.2	44.8	56.1	30.1
TiO ₂	0.1	<0.1	0.1	0.1	0.1	0.1	<0.1		<0.1		0.4	0.2	2.0	0.4	0.1	1.5
Al ₂ O ₃	21.6	21.2	22.2	4.0	21.7	0.6	22.1	2.1	21.3	0.9	8.0	13.3	11.1	12.9	16.0	3.7
Fe ₂ O ₃ (t)***	0.2	0.2	0.6	0.7	1.1	0.1	0.2	0.1	<0.1		5.1	2.7	3.6	3.6	0.5	1.4
MnO	<0.1	<0.1	<0.1		<0.1		<0.1		<0.1		1.2	0.4	0.1	16.8	0.9	0.0
MgO	7.0	6.2	11.6	4.4	11.5	1.6	6.1	3.0	5.2	3.0	1.3	0.5	4.0	3.1	2.3	0.1
CaO	1.3	1.5	1.4	0.3	1.4	0.1	0.9	0.2	1.1	0.2	1.9	4.5	4.0	3.9	4.1	1.2
Na ₂ O	8.5	8.1	6.7	1.4	6.0	0.3	8.5	0.8	7.4	0.9	0.4	6.1	2.2	0.7	1.8	3.5
K ₂ O	3.2	3.0	3.0	0.5	2.6	0.1	3.5	0.3	4.3	0.5	1.8	3.6	3.9	3.6	5.2	0.4
P ₂ O ₅	0.2	0.1	0.1	0.1	<0.1		<0.1		<0.1		0.1	0.2	0.2	0.1	<0.1	0.1
PbO	0.3	0.3	<0.1		<0.1		<0.1		<0.1		30.6	10.2	0.6	9.9	12.3	46.9
ZnO	<0.1	<0.1	<0.1		<0.1		<0.1		<0.1		0.8	13.5	<0.1	<0.1	<0.1	<0.1
SnO ₂	0.1	<0.1	<0.1		<0.1		<0.1		<0.1		<0.1	<0.1	<0.1	<0.1	0.2	10.8
SO ₃	<0.1	<0.1	0.2	0.2	<0.1		<0.1		<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BaO	0.4	0.1	0.2	0.1	<0.1		<0.1		<0.1		<0.1	<0.1	0.8	0.2	0.1	<0.1
Cr ₂ O ₃	0.2	<0.1	<0.1		<0.1		<0.1		<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
ZrO ₂	<0.1	<0.1	<0.1		<0.1		<0.1		<0.1		<0.1	<0.1	0.1	<0.1	<0.1	<0.1
Total	99.9	99.8	100.0		100.0		99.4		99.8		99.7	99.7	99.8	99.8	99.8	99.7
n=	23	12	13		6		39		15		15	15	25	23	21	22

*Deichmann samples: D1 - small creamer; D2 large creamer; D3 - 1955 pourer; D4 - tiny creamer (Fig. 7)

**SOTM1 and SOTM2 are compositional groupings of Deichmann glazes (see text)

***total iron as Fe₂O₃

Table 2
Composition of crawling glazes and underglazes (where present).

been made from an unidentified source of red-firing clay. It is known that, over time, the Deichmanns gradually abandoned exclusive use of Moss Glen clay, which they felt had a short firing range that contributed to high kiln losses.^{xix} To address this problem, they began to mix high-firing stoneware clay from Shubenacadie, NS – kaolin, quartz and/or nepheline syenite – with their local clay (see Crawford 2005, 36; Inglis 1991, 13). Owen and Boudreau (2008, 27) calculated that the composition of a dated (1939) Deichmann bird figure was consistent with a mixture containing 1 part (by weight) Moss Glen clay with 0.23 parts silica (quartz), 0.25 parts kaolin, and 0.03 parts nepheline syenite (a type of granite).

The stoneware body of the Beveridge flower frog has a composition more closely resembling the Deichmanns' redware (especially sulphate-free sample D1) rather than their stoneware (Table 1). However, it has a beige rather than brick-

red colour. It is also coarser grained, with mineral clasts up to 1 mm in diameter, than either the Beveridges' or the Deichmanns' redware. Clearly, the stoneware clays used by the Deichmanns and Beveridges came from different sources. The brown slip on the flower frog is also unusual because it is iron- and titania-rich (10.5% Fe₂O₃; 4% TiO₂) and alumina-poor (16.5% Al₂O₃). In this regard, it should more properly be referred to as an engobe.^{xx}

The composition of the body of the Mackenzie bowl resembles that of the 1911 Acadian Pottery creamer, suggesting that both were made using the same source of clay, perhaps Enfield. It also resembles the composition of Moss Glen clay, but the Mackenzie bowl contains 4.8% PbO. It is very unusual for significant concentrations of lead to occur naturally in clay deposits. For this reason, lead was likely added to the clay, although its intended purpose is unknown to us now. Lead is usually used as a flux in glazes rather than a constituent of earthenware bodies.

Glaze compositions are given in Table 2. There is reasonably good

correspondence between XRF and SEM/EDS data for the glazes on samples D3 and D4 (e.g., the results fall within one standard deviation [σ] of each other; Table 2). Based on the four samples described here, the Deichmanns used two variations of their SOTM glaze, one being more magnesian than the other by a factor of about two. Redware samples D1 and D2 and stoneware sample D4 (figure 7) have similar glaze compositions. They are dominated by silica (~56-60 wt.% SiO₂), alumina (~21% Al₂O₃), magnesia (~5-7% MgO) and alkali oxides (~7-8% soda (Na₂O), ~3-4% potash (K₂O)), with small amounts of lime (~1% CaO). In contrast, the glaze on stoneware sample D3 contains approximately twice the magnesia content (11.5% MgO) as the other Deichmann glazes, largely compensated by lower silica and alkalis. Given the huge amount of SOTM-glazed pottery they produced, analyses of other samples of the Deichmanns' SOTM glaze on different types of ceramic and underglaze/slip substrates are required to confirm that the data presented here is representative of a significant proportion of their production. It is noteworthy that we are unaware of any Deichmann porcelain with a SOTM glaze. We surmise that a white crawling glaze on a white-firing body would not have the visual impact that this glaze had on redware and stoneware vessels, which may be why the Deichmanns used other glazes on their porcelain. Evidently, they were not inspired by the Beveridges or Lorenzens to apply a dark underglaze on their porcelain wares to achieve a colour contrast with their SOTM glazes.

The black glassy beads seen in the exposed ceramic patches between the glaze "islands" on Deichmann samples D1 and

D2 are iron-rich, containing up to ~68% Fe₂O₃. Neither their identity nor origin is known. Similar black glassy beads also occur, though in smaller concentrations, on the unglazed base of both samples. This means they may have formed due to pre-glazing (i.e., surface preparation) treatment rather than glazing itself. Alternatively, the iron-rich composition of samples D1 and D2 evokes exsolution phenomena that have been described in some geological silicate melt systems (e.g., Charlier and Groves 2012, 37, among many others).

Notwithstanding differences in their compositions, the crawling glazes on Deichmann samples D1, D2 and D4 (henceforth SOTM1), D3 (SOTM2) are visually indistinguishable from one another. All are snow white and have a glassy luster. In contrast, the crawling glazes on the Beveridge mug and flower frog have a pale brownish cast and are speckled with or have dark brown patches. They are compositionally distinct from their Deichmann counterparts and from each other. For example, they have significantly lower alumina contents (mug: 13.3%, flower frog: 11.1% Al₂O₃) than either SOTM1 or SOTM2, and, unlike the crawling glaze on the flower frog, the glaze on the Beveridge mug contains high concentrations of lead (10.2% PbO) and zinc (13.5% ZnO). Zinc oxide can help trigger melting of glaze ingredients and, in large amounts (>25 wt.%), can promote crawling.^{xxi} The dark brown underglaze on the mug is even more lead-rich (30.6% PbO) but it contains only a trace of zinc. The tan cast of the Beveridges' crawling glazes is likely due to their iron content, which is highest (up to 7.5% Fe₂O₃) in the brown patches.

The Lorenzens' crawling glaze has an alumina content (16% Al_2O_3) intermediate between its Deichmann and Beveridge counterparts (Table 2). This was sufficient to ensure retraction of the glaze over its black underglaze. Like the crawling glaze on the Beveridge mug, the Lorenzen glaze is lead-rich (12.3% PbO), but it lacks zinc. Its underglaze also contains lead (9.9% PbO). It owes its black colour to its high manganese content (16.8% MnO). Although a decolourant used to remove the green tint imparted to glass by iron, a surfeit of manganese (in the form of pyrolusite, MnO_2) darkens glass – and therefore glazes containing it – to the point of becoming black unless strongly backlit.

The brown glaze on the Mackenzie bowl has little in common with the other crawling glazes described here. It has the lowest concentrations of silica (30.1% SiO_2), alumina, (3.7% Al_2O_3) and potash (0.4%) of all the glazes, and the highest lead content (46.9% PbO). It is also the only glaze to contain appreciable tin oxide (10.8% SnO_2), which is used in glazes as an opacifier. The white crystals in this glaze are too small to analyse non-destructively. The lead content of this glaze precludes using MELTS software (Gualda et al. 2012, 875) to reliably reconstruct the crystallization of a melt of this composition. However, the concentrations of lime, soda, and potash in the glaze, together with the colour and shape of this mineral, indicate that it is a sodic plagioclase feldspar (e.g., oligoclase).^{xxiii}

Interpretation

Erica Deichmann sometimes referred to her SOTM glaze as a “magnesium carbonate pebble glaze” (e.g., see photo

captions in Inglis, 1991, 60). Indeed, SOTM1 – and especially SOTM2 – have high concentrations of magnesia, a diagnostic component of the mineral. Both glazes contain just over 1% lime, the source of which might be calcite, a calcium carbonate mineral – CaCO_3 – that is known by ceramists as “whiting,” although the use of the common calcium-magnesian mineral dolomite ($\text{CaMg}(\text{CO}_3)_2$) cannot be excluded. However, dolomite cannot be the sole source of both components because the ratio between them, expressed in terms of their molecular proportions (MP)^{xxiii} is too high (i.e., MgO/CaO [MP] averages 7.5 in SOTM1 *versus* 1.0 in ideal, stoichiometric dolomite^{xxiv}). This ratio is even higher (11.4) in the SOTM2 glaze. Although dolomite does not always have an “ideal” composition, it is calcium rather than magnesium that can be in excess in natural dolomites (dos Santos et al. 2017, 164).^{xxv} Consequently, we infer that the source of magnesia and lime in the Deichmann's SOTM1 and SOTM2 glazes is either a mixture of magnesite and dolomite, or of magnesite and calcite. Regardless, magnesite is the main or exclusive source of magnesia.

The very low titanium ($\leq 0.1\%$ TiO_2) and iron (0.2% Fe_2O_3) contents of the SOTM1 glaze imply the use of rather pure (i.e., glass-grade) quartz sand and kaolin, likely the sole source of alumina. Higher iron (0.6% Fe_2O_3) in the SOTM2 glaze suggests the use of a less pure (or less well-washed) sand. The soda and potash likely originated as alkali carbonate minerals. Alkali carbonate minerals can be highly hygroscopic (i.e., can absorb water from air, turning them to “mud”), so Erica Deichmann would have stored them with a desiccant (e.g., silica

gel) in a sealed jar. Alkali carbonate minerals are readily available from potting-supply outlets, as are other carbonate minerals (e.g., magnesite, dolomite, and calcite).

Although compositionally distinct from the SOTM glazes used by the Deichmanns, the crawling glaze on the Beveridges' flower frog and the Lorenzens' mug are nevertheless the same general type (i.e., magnesian) of glaze. Their magnesia/lime (MP) ratios, however, differ, being higher ($\text{MgO}/\text{CaO} = 1.4$) in the flower frog than the Lorenzens' mug (0.8). This suggests that the Beveridges used a mixture of magnesite and subordinate calcite (or of dolomite and even less calcite) in their crawling glaze, whereas the Lorenzens combined dolomite with subordinate calcite (or magnesite with even more calcite) in theirs. The crawling glaze on the Beveridges' mug, in contrast, contains very little magnesia (0.5% MgO) and so has a very low magnesia/lime (MP) ratio ($\text{MgO}/\text{CaO} [\text{MP}] = 0.2$). Its underglaze has a magnesia/lime (MP) ratio of 1.0, so dolomite alone was very likely the source of both components.

Carrie Mackenzie's brown crawling glaze is the odd man out. Mackenzie was clearly not attempting to copy the SOTM-type glazes – the magnesia content of her crawling glaze is negligible (0.1% MgO) and contains a high proportion of lead (largely replacing potash) as a flux, with tin oxide to opacify the glaze. The presence of iron – and titania, if fired under oxidizing conditions – accounts for its brown colour. This effect is also seen in the Beveridges' glazes. MacKenzie's glaze crawled despite its low concentration of alumina. Some of the blebby glaze "islands" are hollow, suggesting that

crawling was caused by devolatilization of clay and/or small amounts of carbonate minerals during melting. Thick application of the glaze might also have contributed to the effectiveness of this process. No slip or underglaze was needed.

Discussion

It is challenging to infer an artisan's intent when investigating historical cultural artifacts, even those of relatively recent age. In the absence of documentation such as diaries, letters, or notebooks, analytical data can in some instances be used to evaluate diagnostic features that appear to have been shared or re-created by artisans working in media such as ceramics.^{xxvi} In this instance, the compositional and aesthetic dissimilarities between the Deichmann, Beveridge, Lorenzen, and MacKenzie crawling glazes indicate that specific details of their creation were not shared by these artisans.

Despite its markedly different composition, only the crawling glaze on the Beveridges' mug remotely resembles the Deichmanns' SOTM glaze. It is not known whether the SOTM-type glaze was invented by either couple, or if it had been published and was found by only one of our protagonists. It is also not known which couple made their glaze first. The prolonged use of this glaze by the Deichmanns suggests that it originated with them. As it stands, it appears that one couple, likely the Beveridges, attempted to re-create what the other had made knowing only the most rudimentary information about the glaze's ingredients, such as the fact that it contains a magnesium-bearing carbonate mineral. The elevated MgO/CaO (MP) ratio ($=1.4$) of the glaze on the Beveridges'

flower frog shows that they used magnesite as a source of magnesium instead of exclusively relying on dolomite. The alumina content of this glaze was insufficient to ensure effective crawling, despite being pre-treated with a slip. In this regard, the flower frog was a failed experiment, but the result was sufficiently pleasing to its creator that it was not discarded.

Alternatively, if the Deichmanns did share specific details of their recipe, then the Beveridges evidently attempted to refine it. This would account for compositional differences between the two glazes, as well as between the Beveridges' successfully and unsuccessfully crawled glazes (i.e., on their mug and flower frog, respectively). The former inference – that the Deichmanns kept details of their SOTM glaze preparation secret – is the more likely of the two, particularly since the crawling glaze on their mug is, compositionally, so diametrically different. The Beveridges did not make abundant use of their crawling glaze– the mug and flower frog described here are the only examples we have seen. Perhaps the difficulty they had in ensuring crawling of their glaze, as with their flower frog, and the development of dark brown patches and flecks in the glaze, as seen on both the mug and flower frog, discouraged them from making many more. Regardless, if the Beveridges had access to specific information about SOTM glaze recipes and their firing conditions, we see no reason that it would not have been as successfully used on their pots as it was on the Deichmanns'. Cream-firing (likely stoneware, but possibly porcelaneous) tableware with a pale grey crawling glaze was made in abundance by the Lorenzens. Although mildly magnesian

(2.3% MgO) in the case of the mug described here, its liberal use of lead as a flux clearly distinguishes it from *bona fide* SOTM glazes.

The inference that the Deichmanns kept secret details of their SOTM glazes is consistent with the competitive nature of artisanal trades, even in the early days of studio potting in Canada. After all, the abundance of wares with this glaze that are still extant shows that it was a best seller. The Deichmanns earned their living solely from their pottery and produced a very wide range of forms, from very small creamers to larger and more imposing pitchers, bowls, platters, and sculptural pieces. This meant their work was available to clients from various economic backgrounds. Contemporary price labels preserved on some pieces as well as exhibition catalogues show that the Deichmanns sold their wares for a range of prices, from approximately fifty cents to tens of dollars apiece, the latter being a considerable amount in the mid-20th century. In contrast, the Beveridges only made and taught pottery to supplement their income from Foster's employment by the Canadian Navy until 1965.^{xxvii} The Deichmanns thus led a relatively impecunious lifestyle that at times could be stressful. For example, Elisabeth Deichmann Harvor describes "tension and money worry" in her recollections of family life at Moss Glen.^{xxviii} She also contrasts the idyllic setting at Moss Glen and Erica mixing bare-handed a witch's brew of glaze ingredients on the dining room table (Canadian Poetry Online 1998, 4-6). Consequently, we surmise that the Deichmanns could hardly afford to share details of one of their most popular glazes with competing potters. In a market with a finite demand for studio pottery, the

financial reliance of the Deichmanns on their craft thus influenced both their relationship with other potters and the scope of the wares they produced. Thus, an element of entrepreneurship emerged early in the history of studio pottery in this country, with the Deichmanns' formula for their SOTM glaze remaining a "trade secret."

It is unclear why the Deichmanns varied the amount of magnesia in their SOTM glaze, but it is likely that the SOTM1 glaze failed to retract properly on some of their stoneware bodies. This could be why they coated stoneware sample D3 with a brown slip. This specimen certainly is not unique in this regard. Many Deichmann stoneware pieces with a SOTM glaze have a brown slip. In the case of D3, it was only by the removal of a small piece for analysis by SEM/EDS that its grey, glassy (well vitrified) stoneware body was discovered because the entire sample, including the base, had a slip coating.

Carrie Mackenzie exhibited her wares with the Deichmanns and other artisans in craft fairs in the 1950s.^{xxxix} In addition to creating "Kish"-type knobby bowls (figure 6), she might have been inspired to experiment with crawling glazes herself after seeing their wares. However, Mackenzie was certainly not trying to emulate the white, SOTM-type glaze when she made the bowl shown in Figure 10. Her glaze has a very low alumina content (3.7% Al_2O_3), so it is unclear what triggered such effective crawling during firing. No slip or underglaze is present. The moderate titania content indicates the use of rutile, which likely caused the brown colour of Mackenzie's glaze if it was fired under oxidizing conditions. The bubbly character of this glaze (figure 10) suggests

that devolatilization of glaze ingredients overlapped rather than preceded melting,^{xxx} consistent with its very high concentration (46.9% PbO) of lead – a potent flux.

The Maritime potters discussed here all made crawling glazes as part of their production lines. Moreover, contemporary catalogues show that they exhibited together, so they were well aware of each others' work. It is likely that the SOTM glaze originated with the Deichmanns, as it was one of their most successful creations. That said, only the Beveridges created a close facsimile it. Ironically, this glaze, which is featured on the redware mug described here, diverges furthest from the SOTM glaze compositionally. The success of the Deichmanns' SOTM line of wares might have prompted Mackenzie and the Lorenzens to make their own crawling glazes. However, based on the examples described here, they certainly did not attempt to re-create the Deichmanns' achievement. Moreover, given the differences between their own wares, it appears that they didn't share their own knowledge of crawling glazes with each other or with the Beveridges.

Conclusions

Non-destructive chemical analysis of crawling glazes produced by four mid-century Maritime potters (Erica and Kjeld Deichmann, Eleanor and Foster Beveridge, Alma and Ernst Lorenzen, and Carrie Mackenzie) was undertaken to evaluate the extent to which they resembled one another. The Deichmanns are famous for their "Snow on the Mountain" glaze. The glazes on all four Deichmann samples analysed here have magnesian compositions, but one (SOTM2, on

stoneware pourer D3) contains approximately twice the concentration of this component as the others (SOTM1). Perhaps not coincidentally, D3 is the sole Deichmann sample to have been coated with a slip prior to glazing, a common surface treatment strategy used by potters to promote crawling. Despite the compositional variations between SOTM1 and SOTM2 glazes, all are snow-white and have a glassy luster.

Both examples of the Beveridges' crawling glazes are compositionally dissimilar to one another and to the SOTM glazes. In this regard, the essentially non-magnesian, lead- and zinc-rich glaze used on the redware mug described here is particularly distinct. Although it has a mottled brown tint, the glaze on this mug more closely resembles the SOTM glazes in appearance than any of the other glazes described here. Crawling was ensured by the presence of a dark brown, lead-rich underglaze made from a recipe that included dolomite as the likely sole source of magnesium and calcium. The glaze on one of the Beveridges' stoneware flower frogs is mildly magnesian- and lead-poor. The glaze's relatively low alumina content, approximately half that of the SOTM glazes, precluded effective crawling despite pre-treatment with a slip. A stoneware mug made by the Lorenzens was pre-treated with a lead-fluxed black underglaze. This colour is required to provide colour contrast with a pale grey crawling glaze that itself is lead-rich. The most lead-rich glaze is on a bowl by MacKenzie. This crawled, brown glaze was opacified by the addition of tin oxide. Many of its "islands" are hollow, indicating that devolatilization of glaze ingredients overlapped melting.

None of these crawling glazes are as aluminous or magnesian as the SOTM glazes and all but one is lead-fluxed. Only the Beveridges created a close facsimile to the SOTM glaze and they well may have been the only ones to try. However, its composition bears little resemblance to the SOTM glaze. If re-creating the Deichmanns' SOTM glaze was indeed the Beveridges' intent, then they did it without their help. The Deichmanns no doubt were collegial artisans, but they were also competitors.

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Appendix: Analytical Methods

Samples were analysed non-destructively under vacuum (2 mbar) using a Bruker M4 Tornado^{PLUS} benchtop micro-X-ray Fluorescence (μ XRF) spectrometer at the Mineral Imaging and Analysis Laboratory in the Department of Geology, Saint Mary's University, Halifax, NS, Canada. Both single spots and areas were measured using a 20 μ m X-ray beam from a Rh source operated at an accelerating voltage of 50 kV and a beam current of 600 μ A. Counting times were 180 sec for single spots and 30 ms/pixel for areas, where emitted X-rays were captured by two silicon drift detectors. The spectra

were evaluated using the M4 software and elements were identified by their characteristic X-rays peaks (e.g., K-alpha, L-alpha). The XMethod software was used to create a polynomial calibration method with several certified [USGS (United States Geological Survey; SCO-1, SDC-1, STM-1), CNRS-CRPG (Centre national de la recherche scientifique-Centre de Recherches Pétrographiques et Géochimiques; IF-G), SARM (South African Reference Materials; NIM-S Syenite, NIM-P Pyroxenite) and in-house (HFL-1, galena) standards to quantify the spectra within the compositional range of the pottery. We lack a cobalt standard, so this component, if present, was undetected.

To evaluate reproducibility of the XRF data, the glazes on two Deichmann samples (D3, D4) were also analysed using a LEO 1450VP SEM equipped with an Oxford Instrument INCA X-max 80 mm² SDD EDS detector. Sample D3 was prepared as a polished grain mount; sample D4 was small enough to fit into the chamber. Count time was 60s. Replicate analyses show that the SDD EDS detector can yield analytical results comparable to a microprobe equipped with a WDS detector (Owen 2012, 1257; Ritchie et al. 2012, 892).

References

- Berneburg, P. 2015. Technofile: “Why do glazes crawl?” *Ceramics Monthly* (March, 2015). [Technofile: Why Do Glazes Crawl? \(ceramicartsnetwork.org\)](http://ceramicartsnetwork.org)
- Charlier, B. and Grove, T.L. 2012. “Experiments on liquid immiscibility along tholeiitic liquid lines of descent.”

Contributions to Mineralogy and Petrology 164: 27-44.

Crawford, Gail 2005. *Studio Pottery in Canada*. Goose Lane.

dos Santos, H.N., Neumann, R., and Avila, C.A. 2017. “Mineral quantification with simultaneous refinement of Ca-Mg carbonates with non-stoichiometry by X-ray diffraction, Rietveld method.” *Minerals* 7: 164-178.

Fabbri, B., Gualtieri, S., and Shoal, S. 2014. “The presence of calcite in archeological ceramics.” *Journal of the European Ceramic Society* 34: 1899-1911.

Gualda G.A.R., Ghiorso M.S., Lemons R.V. and Carley T.L. 2012. “Rhyolite-MELTS: A modified calibration of MELTS optimized for silica-rich, fluid-bearing magmatic systems.” *Journal of Petrology* 53: 875-890.

Hamer, Frank and Hamer, Janet 1997. *The Potter's Dictionary of Materials and Techniques*. London: A & C Black. 4th edition.

Holtz, F. 1999. *Eleanor Beveridge - Foster Beveridge a retrospective. Studio Ceramics: 1957-1985*. Exhibition catalogue (5 pp), Anna Leonowens Gallery (2-13 Nov. 1999), Halifax, NS.

Home, R.M. 1944. “Pottery in Canada.” *Canadian Geographical Journal* XXVIII: 64-77.

Hopper, R. 2013. Lichens and lizards and leopards, oh my! Reticulated glaze recipes for wild ceramic surfaces. Glaze crawling, on purpose. *Ceramic Arts Network Daily*. [Lichens and Lizards and Leopards, Oh My! Reticulated Glaze](http://ceramicartsnetwork.org)

[Recipes For Wild Ceramic Surfaces \(ceramicartsnetwork.org\)](http://ceramicartsnetwork.org)

Inglis, Stephen. 1991. *The Turning Point: The Deichmann Pottery 1935-1963*. Canadian Museum of Civilization. 71.

Khaled, Z., Mohsen, A., Soltan, AM, and Kohail, M. 2023. "Optimization of kaolin into metakaolin: Calcination conditions, mix design and curing temperature to develop alkali activated binder." *Ain Shams Engineering Journal* 14(6), 1-14.

Maclaren, G. 1972. *Antique Potteries of Nova Scotia*. Petheric Press Ltd.

Maynard, M.H. 2015. *Passion and persistence. An inaugural history of the New Brunswick College of Crafts and Design*. PhD dissertation: University of New Brunswick.

Owen, J.V. 2012. "Double corona structures in 18th century porcelain (1st patent Bow, London, mid-1740s): a record of partial melting and subsolidus reactions." *Canadian Mineralogist* 50, 1255-1264.

Owen, J.V. and Boudreau, J. 2008. "A new look at Deichmann pottery, Moss Glen, New Brunswick (1935-1963)." *Fusion* 32(1): 8-9,27.

Owen, J.V. and Day, T.E. 1998. "Assessing and correcting the effects of the chemical weathering of potsherds: a case study using soft-paste porcelain wasters from the Longton Hall (Staffordshire) factory site." *Geoarchaeology* 13: 265-286.

Owen, J.V., Forfa, D. and Greenough, J.D. 2014. "Geochemical and

mineralogical constraints on the provenance of L'sitkuk pottery from the Annapolis Basin, Nova Scotia." *Canadian Journal of Archaeology* 38: 76-105.

Owen, J.V., Greenough, J.D., Himmelman, M. and Powell, S. 2016. "Geochemistry of pre-contact potsherds from southern mainland Nova Scotia: constraints on pottery pathways." *Canadian Journal of Archaeology* 40: 231-267.

Owen, J.V. and Hanley, J.J. 2017. "Bartlam porcelain re-created." *American Ceramic Circle Journal* XIX: 67-95.

Owen, J.V., Lorenzen, D. and Saulnier, T. 2012. "Lorenzen pottery: 50 years in the making." *Material Culture Review* 76: 93-107.

Owen, E.M., Owen, J.V., Hanley, J.J. and Kennedy, N. 2018. "Development of an integrated body-glaze layer on an 18th century lead-glazed true porcelain teapot from Philadelphia: insights from kiln firing experiments on compositional analogues." *Historical Archaeology* 52: 617-626.

Ritchie, N.W.M., Newbury, D.E. and Davis, J.M. 2012. "EDS measurements of X-ray intensity at WDS precision and accuracy using a silicon drift detector." *Microscopy and Microanalysis* 18: 892-904.

Stea, R., Demont, G. and Lake, C. 2004. "Glacial lakes in Nova Scotia and their economic legacy of clay!" *Nature's Resources*, 14-16.

ⁱ An alternate version of what prompted the move to Sussex suggests that the provincial government helped the Deichmanns purchase a house there so they would be closer to potential customers, given the many tourists travelling on the new Trans-Canada Highway (Maynard 2015, 74-75).

ⁱⁱ See [Canadian Women Artists History Initiative : Artist Database : Artists : DEICHMANN, Erica \(concordia.ca\)](https://www.concordia.ca/canadian-women-artists-history-initiative-artist-database-artists-deichmann-erica)

ⁱⁱⁱ The patches, however, can have a glossy sheen not seen on the unglazed base of these pots, suggesting that some glaze components still coat these areas.

^{iv} Slip is a homogeneous slurry of clay and water. It may contain colourants as well.

^v Early in her potting career, Sandy Beveridge instructed Halifax native Charles Bezanson in potting and glazing techniques. Bezanson later became a Benedictine monk, working as artist in residence first in Vermont and then in Pennsylvania. He was celebrated as being one of the world's leading experts in ceramic glazes.

^{vi} The history of this company, now known as The Shaw Group Limited since 1993, dates back to 1861, and is described on their website.

^{vii} The body (paste) and glaze of true porcelain (i.e., Chinese-type) are generally fired together during a single high temperature firing (e.g., 1370°C in the case of a sample excavated in Philadelphia (Owen et al. 2018, 617). This particular sample, however, was coated with a lead-rich (low temperature) glaze after the initial firing, and then fired at a lower temperature (~1000°C) creating a partly crystallized, integrated body-glaze layer.

^{viii} Not all historical Shino glazes crawled, but all represent an attempt by Japanese potters to make a white glaze, the first to be created in that country.

^{ix} Among ceramists, the devolatilization process whereby carbon dioxide is liberated from carbonate minerals is usually referred to as

calcining. The same term is used to describe the loss of water (dehydroxylation) from clays and bone ash during kiln firing.

^x For example, calcite is generally completely dissociated once the kiln reaches about 800°C (e.g., Fabbri et al. 2014, 1900). However, the temperature ranges at which different carbonate minerals liberate carbon dioxide during kiln firing varies with the partial pressure of CO₂ of the kiln atmosphere, but they can be sufficiently high before calcining is complete that the dissociation process overlaps partial melting of the glaze mixture. Evidence for this includes bubbling in the quenched glaze, as is seen on the Mackenzie bowl. It also could be argued that this bubbling was caused by dehydration of clay minerals in the glaze or ceramic substrate.

^{xi} Where preserved in glazes, these bubbles should properly be referred to as vesicles.

^{xii} Notably, very fine-grained magnesite can be a culprit in this regard (see [Glaze Crawling \(digital-fire.com\)](https://www.digital-fire.com/glaze-crawling))

^{xiii} See Glaze Crawling Problems (lakesidepottery.com)

^{xiv} We distinguish creamers from pourers by the absence of a handle on the latter.

^{xv} Not all crawling glazes need to have distinct “islands” form to be considered a *bona fide* crawling glaze. For example, a stoneware tea caddy made by Bernard Leach c. 1960 has a greyish-white glaze with dripped edges that has retracted around a few triple points, exposing small parts of its substrate (a “dark iron glaze” on a stoneware body). It nonetheless was described as a “crawling glaze” by the London auction house that sold it on 17 May 2018. See [Bernard Leach \(British, 1887-1979\) Tea Caddy, circa 1960 Stoneware, creamy grey crawling glaze \(the-sale-room.com\)](https://www.the-sale-room.com/bernard-leach-british-1887-1979-tea-caddy-circa-1960-stoneware-creamy-grey-crawling-glaze).

^{xvi} The term “clayey” is used instead of “clay” because (1) the body of many ceramic objects consist of a mixture of clay and other materials (see text), and (2) the presence of iron-rich beads

between the glaze “islands” and the sheen of the area between the “islands” suggest that the ceramic substrate itself is not exposed, but rather is thinly coated by a residue from surface preparation prior to firing, or from the retracted glaze.

^{xvii} In the caption to this illustration, Crawford (2005, 40) refers to this glaze as a “white crater glaze with feldspar”.

^{xviii} The Beveridges were active 1957-1985, although Eleanor started taking potting classes Oct. 1955. Based on an exhibition pamphlet (Holtz 1999), they produced stoneware for about the first six years of their potting career.

^{xix} It appears, however, that their kiln-firing problems were related to controlling kiln temperatures rather than deficiencies in local clay, because pots made from Moss Glen clay were successfully fired by studio potter Janet Doble at temperatures commonly used for redware (i.e., Orton cones 04 and 06). See Owen and Boudreau (2008, 9).

^{xx} Engobes are similar to slips but they contain less clay and therefore have lower alumina contents.

^{xxi} See [Microsoft Word - Ceramic materials.docx \(lindaarbuckle.com\)](#)

^{xxii} With this caveat in mind, and calculated *exclusive of lead and volatiles* at 1 bar pressure, MELTS predicts that this glaze would have a liquidus temperature of 1082°C. Rutile would form first, followed by oligoclase (An₂₂) at 1062°C.

^{xxiii} Molecular proportions of cation oxides are determined by dividing the concentrations of components of interest (in this instance, MgO and CaO) by their respective molecular weights [MgO: 40.32 g/mole; CaO: 56.08 g/mole], and then determining their ratio.

^{xxiv} In this instance “stoichiometry” refers to the proportions of elements or compounds in a

mineral formula. In the case of dolomite, Mg and Ca are present in a 1:1 ratio.

^{xxv} Ca can be in excess in non-stoichiometric dolomite by up to 0.25 atoms per formula unit (pfu) thereby approaching the composition of non-stoichiometric calcite, which can contain up to 0.287 Mg atoms pfu in magnesian calcite.

^{xxvi} According to Anneke Deichmann Gichuru (pers. comm. Autumn 2022), her mother (Erica Deichmann) gave her notebooks to someone in Fredericton in the 1970s. We have been unable to track them down.

^{xxvii} After which he no doubt received a pension.

^{xxviii} See Canadian Poetry Online: Elisabeth Harvor: Interviews. “Not the Beth of Little Women: Maria Kubacki speaks with Elisabeth Harvor. Books in Canada v. 27(4) May 1998, p. 4-6”. ([Canadian Poetry Online | University of Toronto Libraries | Elisabeth Harvor \(utoronto.ca\)](#)).

^{xxix} For example, both the Deichmanns and Carrie MacKenzie participated in the Canadian Handicrafts Guild and Canadian Guild of Potters joint exhibition held in Toronto (Royal Ontario Museum) and Montreal (Montreal Museum of Fine Art) in 1955 and 1957 (and probably other years as well). The Beveridges, Deichmanns and Lorenzens participated in the same exhibition in 1959. After abandoning stoneware in or before 1967, the Beveridges produced porcelain bowls with a stylized flower motif very similar to that on a Deichmann bowl shown in the 1959 catalogue.

^{xxx} Depending on the composition of the glaze and purity of the carbonate minerals, decarbonation and partial melting could overlap at very approximately 900°C ± 100°C. The formation of metakaolin at the expense of kaolin occurs at much lower temperatures (i.e., optimally, at ~600°C; e.g., Khaled et al. 2023, 1).