Neolithic pottery fabrics from Newgrange: a petrographic contribution

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This paper describes the petrographic investigation of a sample of nine Early Neolithic sherds recovered from the area of the Satellite L Passage Grave on the western periphery of the Great Mound of Newgrange, Co. Meath, Ireland. Detailed petrographic analyses are presented of the pottery thin-sections which show the fabrics to be comparable to Neolithic sherds studied from north Wales. Three distinct groups are recognisable according to the dominance of the filler used by either clast-voids ('corky fabrics'), grog or lithic clasts. Clast and matrix analyses suggest that the pots could have been manufactured locally from sterile glacial sediments in the Boyne Valley and with different lithic clasts derived from the crushing of a selected stone erratic specific to each pot in several cases. The present analysis has indicated that selected fillers were used in this sample of Early Neolithic pottery. Since the present sample is small (nine sherds) it would be premature to apply the findings of the analysis to the wider realm of Early Neolithic pottery fabrics elsewhere in Ireland. However, establishing the existence of three distinct fabric types may be significant and since all three suggest an element of choice in their fabrication, the question arises of what may have prompted their selection.

INTRODUCTION

In 1968 one of us (JLlWW) had the good fortune to visit Newgrange and there met a young Frances Lynch who was conducting one of her first excavations in conjunction with the late Professor Michael J. O'Kelly on the Satellite L Passage Grave (O'Kelly *et al.* 1978). In the fullness of time Frances and the two authors became lecturing colleagues at Bangor University and from that contact grew a close friendship, and for the authors deep respect for her academic prowess. It is with that respect that we offer the present paper which describes the petrographic investigation of a sample of nine early Neolithic sherds recovered from the area of the Satellite L Passage Grave on the western periphery of the Great Mound of Newgrange which were received from Michael O'Kelly in 1968. Better late than never, but the Williams and Jenkins mills in Bethesda grind ever so slowly in comparison with the super efficient Lynch mill at Half Way Bridge. The paper offers a detailed analysis of the pottery fabrics identified and attempts to relate the fabrics to the solid and superficial geological environment of the Boyne Valley (Fig. 1). It will further assess the correlation between the fabric classification and the typology and it will consider how this may impinge on the organisation of pottery manufacturing at Newgrange in the Early Neolithic period.

TYPOLOGICAL FEATURES OF THE POTTERY

A detailed typological analysis of the pottery from the Satellite L Passage Grave has been presented by Lynch in the excavation report (O'Kelly *et al.*1978). The sample consisted of eight sherds in the undecorated shouldered bowl tradition that characterises early western Neolithic pottery in the Irish Sea province. This pottery was associated with a habitation horizon that preceded the construction of the passage grave and its cairn. The ninth example was a heavily gritted Carrowkeel sherd from the disturbed area of the mound, but sherds associated with the passage grave chamber itself were not presented for analysis. The most common fabric type, as described by Frances Lynch (O'Kelly *et al*. 1978, 267), has a relatively uniform brown colour shading to buff or dark brown and was characterised by its 'corky' texture: of these 4 sherds have been sampled. Less common are buff/orange-coloured fabrics with sandier textures or softer orange-coloured fabrics that come from other locations on the old ground surface. The open shouldered bowl is the predominant vessel type in the assemblage (Table 1).

Table 1: Sherd samples analysed from Satellite L Passage Grave, Newgrange

sherd no.	context and site reference no.	fabric group	fabric colour	fabric texture
1	buried ground surface, Grid 15 NEQ	1	nd	nd
2	buried ground surface, Grid 3 (068)	1	nd	nd
3*	buried ground surface, Grid 16 NEQ	1	red	vesicular
4*	disturbed area, Bank 10/11 SWQ	2	–	coarse
5*	buried ground surface, Grid 16 NEQ	2	yellow	–
6*	buried ground surface, Grid 16 NEQ	3a	brown	burnished
7	buried ground surface, Grid 9 SWQ	3b	nd	nd
8	buried ground surface, Grid 10 SWQ	3c	nd	nd
9	turf mound, disturbed area (Carrowkeel ware)	3d	black	coarse granular

nd = not determined. * sherd sample remaining

PETROGRAPHIC ANALYSIS AND FABRIC CLASSIFICATION

Prior to thin-sectioning seven of the sherds were refired at 500°C overnight under oxidizing conditions to remove dark un-oxidized carbonaceous matter from their matrices. Thin-sections were then prepared for all sherds adopting standard methods of production. Photographs of thin-sections were prepared using a Nikon Coolscan IV (×1) and Nikon Coolpix 990 (×10–50). The sections were studied with a petrographic microscope and analysed quantitatively for standard components (voids/matrix/grains /grog/ clasts) using a Swift Point Counter, with counts of 400 points being recorded for each sherd: detailed descriptions of the fabrics are available from the authors' archive. The compositional data have been plotted on triangular diagrams which enables relationships between three selected components to be displayed (Figs 2a and b) allowing types and groups to be discriminated; the analytical data are presented in Table 2, and the main fabric classification groups summarised in the section entitled 'Neolithic pottery fabrics' below.

Matrix definition

The various constituents described below are present in mostly sandy-clay textured matrices although 5 differs in being a silty-clay, and 9 loamy in texture. A parameter of the 'sand' component (i.e.

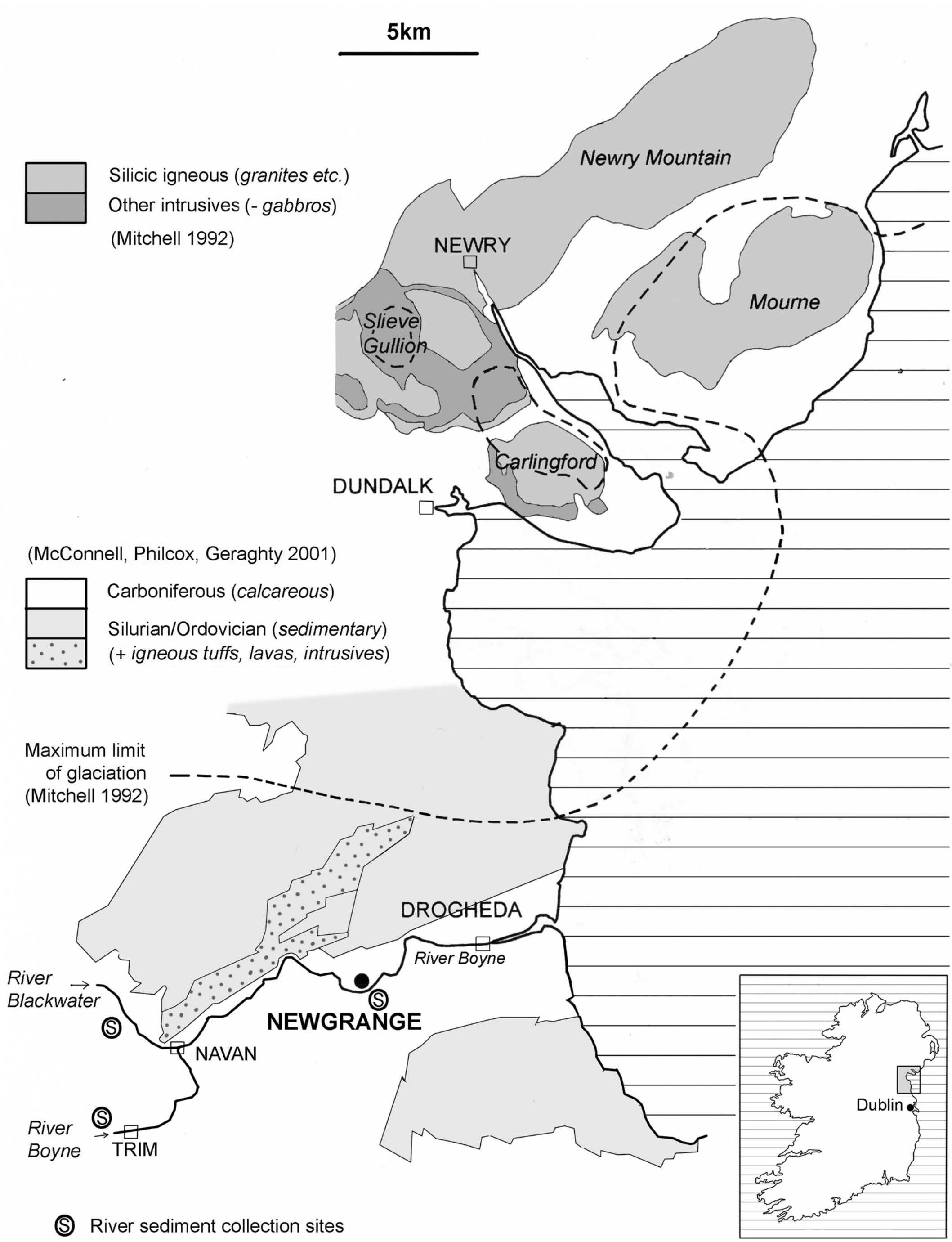


Fig. 1. Location and geology relevant to the Newgrange area.

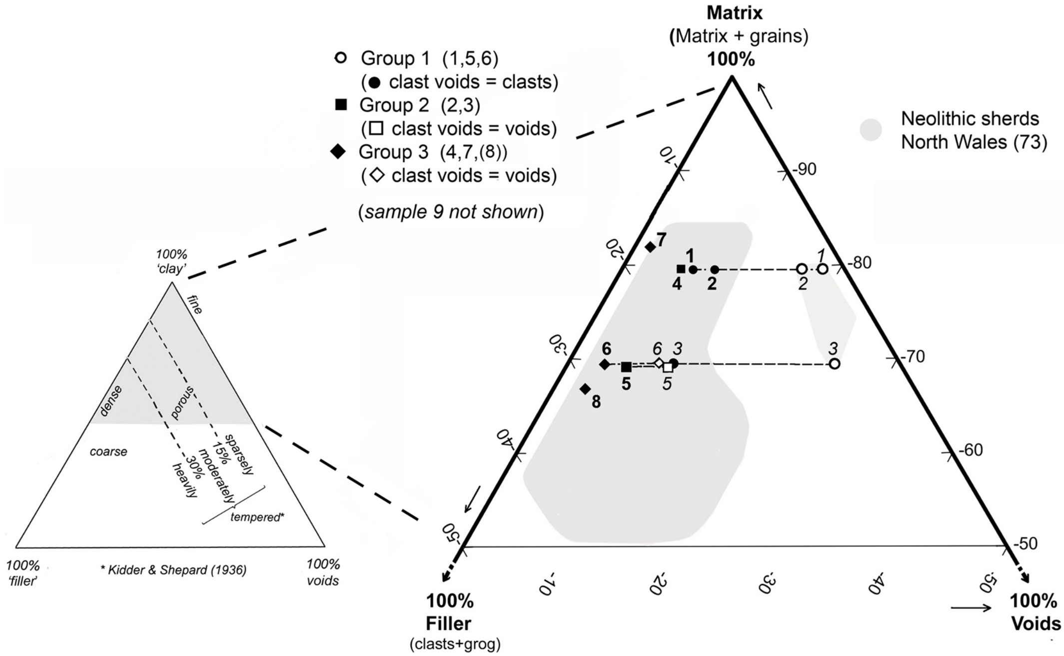


Fig. 2a. Classification according to fabric.

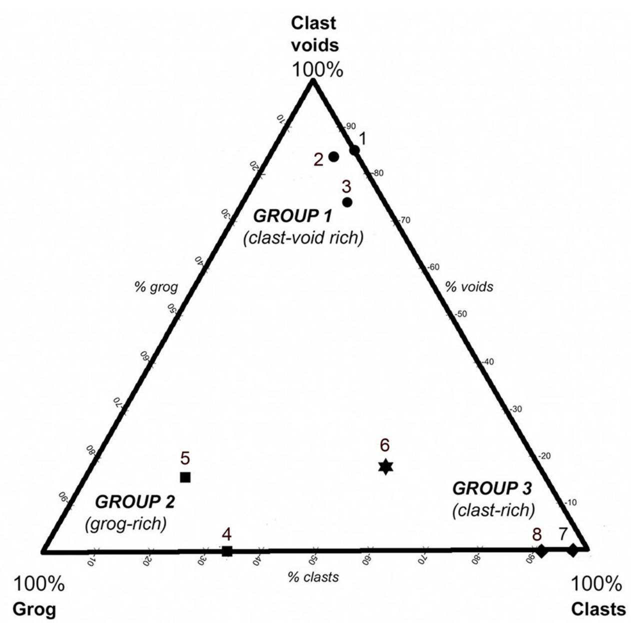


Fig. 2b. Classification according to type of filler.

>63µm) is available in the % grains/(grains + matrix) which is given in Table 2 and supports the visual assessment. The sand grains comprise an abundant detrital suite of angular quartz, flakes of muscovite, and (in 2 and 4) calcite together with occasional grains of feldspar and pyroxene, and (in sherds 1, 3, 6) clinozoisite. The matrices show weak to moderate aggregate birefringence. A restricted suite of small (<0.6mm) relict rock fragments are also sparsely represented, including sub-angular/sub-rounded quartz grains, quartz aggregates, angular schist/quartzite fragments, chert (in sherds 2 and 4) and sub-rounded micaceous sandstone fragments. No bioliths (phytoliths, diatoms, sponges) were noted in a careful search of all the matrices under high power. This implies that the materials used for the pottery 'clays' were derived from sterile glacial deposits rather than from subsequent soil or lacustrine/estuarine environments.

Clast lithologies

Clast contents vary from low (2–6% in sherds 1–5) to high (15–27% in sherds 6–8, and to 57% in sherd 9). The clasts encompass a wide variety of rock types, although these are sometimes difficult to identify due to their small size and degree of alteration. They include shales and diverse sandstones, metaquartzites and schists, and vein quartz. There are also contributions from limestone sources indicated by the presence of calcite (as micrite) and chert. Igneous rock types are common, and some of these individually dominate the clasts in a sherd, as in 9 (hornblendite) and 7 (intermediate igneous – granodiorite?): similarly an orthoquartzite dominates the clasts in sherd 8. This suggests that the filler for these sherds was probably derived from the crushing of a single rock fragment.

In other sherds igneous and other rock types occur as rare clasts. Granite and trachyte are present in sherd 1 and altered dolerites (Palaeozoic?) in sherds 2–3 and 5: they are even present as a component clast within a lithic sandstone/tuff in sherd 8, and within grog in sherd 5. Combinations of most of these diverse rock types can be found in one sherd or another (see Table 3), which would imply that a common source of 'potters clay' of heterogeneous composition was used, such as the local glacial deposits.

Fabric classification

When variation in fabric is considered in terms of the three components, matrix (+ grains), voids and filler (as plotted in Fig. 2a), clusters are evident. One consists of sherds with high void content (25–35%, sherds 1–3), compared to the remainder of lower void content (<10%). If, however, fabrics are recalculated for these 'corky' fabrics with the clast-voids as clasts, as they would have been in the original material used, then it can be seen that the two groups coalesce, although a minor division then remains between those which are relatively dense (matrix *c*. 80%, sherds 1–2, 4 and 7) and those which are less so (matrix *c.* 70%, sherds 3–6 and 8). These fabrics are also seen to fall within the shaded area of equivalent fabrics analysed from north Wales.

In the next stage of classification, based on the type of filler used, three clusters are evident as shown in Figure 2b. One is of sherds that are dominated by clast-voids (>70%, i.e. 'corky', Group 1), a second by grog (>60%, Group 2) and the third by clasts (>90% Group 3), whilst in sherd 8 (Group 3) the admixture of filler types is more even (50% clasts, 30% grog and 20% clast-voids). Group 3 could be divided into 4 subgroups according to clast lithology but the significance of these subgroups is limited by there being only the 4 sherds in this group. This classification is given below in Table 3**.**

The nature of the three groups identified from the data in Table 1 is described below.

Group 1: clast-void fabrics (sherds 1–3, Table 2, Fig. 3 – fabric 1)

The term 'clast-void' has been used to describe fabrics in which an original clastic constituent has apparently been removed from the matrix by dissolution, thus creating a vesicular or 'corky' fabric (Williams and Jenkins 2004). In the present examples some of the original constituents were calcite cleavage fragments distinguished in thin-section by rhombic shaped voids in the matrix, others were shell fragments as evidenced macroscopically by the imprint of organic features (growth rings) within the void cavity. Grog and clast contents are low (<4%) although rare clasts of mafic rock types are present.

Group 2: grog-rich fabrics (sherds 4–5, Table 2, Fig. 3 – fabric 2)
Large (>1mm in diameter), angular grog particles form the dominant component in these fabrics and account for >11.7% of the fabric composition. Grog particles are present in a number of other fabrics but always as a minor constituent. The grog particles are of similar composition to the host matrix, thus suggesting that a local, 'in-house' process of fragmentation and re-incorporation may have taken place. Clast contents are low (<6%) but, whilst clast-voids were not detected (<0.2%) in sherd 4, they are present in 5 at 2%.

Group 3: fabrics containing lithic clasts (sherds 6–9, Table 2, Fig. 3 – fabric 3)
In sherds 7 and 8 grog and clast-voids are sparse (<3%), but they are higher in 6 which is intermediate in nature (Group 3 verging to 2, 1): sherd 9 is dominated by a single clast. The four sherds in this Group are distinguished by dominant clasts, each of different lithology.

The fabric of *subgroup 3a* (sherd 6) contains assorted angular to sub-rounded fragments of various metamorphic and sedimentary rocks, none of which forms a dominant constituent. Included is a large, single, sub-angular clast of foliated quartzite, sub-angular fragments of mica schist and sub-rounded clasts of a fine grained, foliated micaceous sandstone. A single large sub-rounded grog fragment is also present. Singly, these constituents may give an unrepresentative count but combined (clasts 15%, grog 8%, clast-voids 5% = 28%) they contribute to one of the most coarsely textured fabrics in the series.

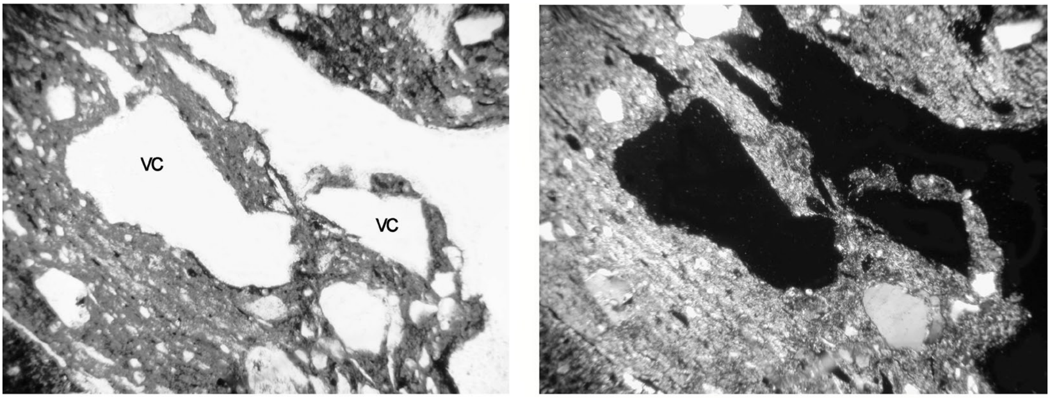
The fabric of *subgroup 3b* (sherd 7) contains almost exclusively angular to sub-angular clasts of a highly altered igneous rock of basic composition (Palaeozoic dolerite?) in fragments that grade from silt size to coarse sand size. These rock fragments account for 16% of the fabric. Rare fragments of grog(?) and a sub-rounded fragment of siltstone are also present in a sandy matrix.

The fabric of *subgroup 3c* (sherd 8) contains angular fragments of a quartz-rich sandstone, with rare accessory muscovite, bonded in an altered and often iron-stained matrix which characterises this fabric. Detached clasts of metamorphic quartz and a fine-grained siltstone are also present in the matrix. In this section a single, large fragment of calcite/chert skews the volumetric count in the fabric, but it does incidentally imply that the calcite-derived 'clast-voids' in Group 1 are original (pre-deposition) features rather than the result of decalcification in post-Neolithic soils.

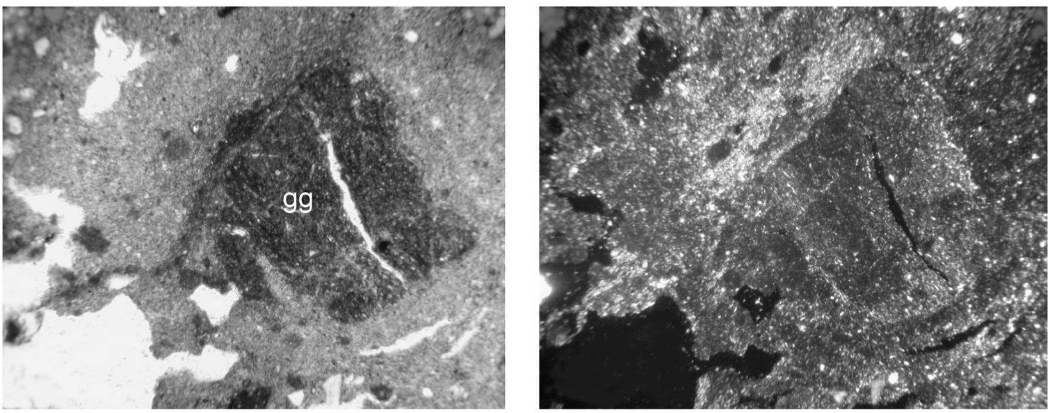
The fabric of *subgroup 3d* (sherd 9) is a hornblendite-rich fabric containing a large (>3mm), angular fragment of a distinctive amphibole-rich, coarse grained rock dominating a fabric characterised by a dark, highly fractured matrix. The size of the rock clast (half the sherd thin-section) precludes the compilation of a meaningful quantitative assessment of this fabric.

GEOLOGICAL PROVENANCE OF THE FABRICS

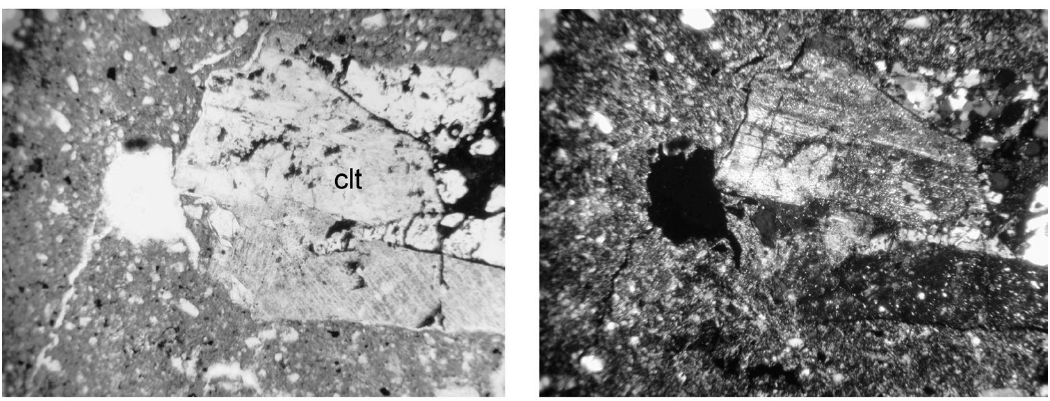
Provenancing pottery fabrics in areas of glacial deposition can be problematic (Williams and Jenkins 1997). Glacial tills and glacifluvial deposits may contain, in addition to components that reflect the



FABRIC 1: Clast-voids rich (Slide 3: vc - rhombohedral voids in Satellite 1, Grid 16, NE)



FABRIC 2: Grog-rich (Slide 5: gg - contrasting grog fragment in Satellite 1, Grid 16 NE)



FABRIC 3: Clast-rich (Slide 7: clt - igneous clast + fels/qu/apat, Satellite 1, Grid 9 SW)

(*in plane polarised light*) 0.5mm (*between crossed polars*)

Fig. 3. Micrographs of fabric groups recognised.

Table 2: Petrographic analyses of Satellite L Passage Grave pottery at Newgrange

Sherd no.	1	2	3	4	5	6	7	8	9[1]
	% (component **points counted in Σ of 400+**)								(200)
Matrix[2]	**70.2**	**67.8**	**58.2**	**64.7**	**67.0**	**56.0**	**70.0**	**59.5**	**39.0**
Texture[3] (% 'sand')	s/12	s/16	s/17	s/16	z/4	s/19	sz/13	s/12	zc/1?
Voids	**17.5**	**16.0**	**24.4**	**4.7**	**9.5**	**8.0**	**3.0**	**3.0**	**3.5**
	70	80	122	19	38	32	12	12	?
constructional	17	25	33	19	8	9	6	12	
rhombic	46	41	79	–	17	19	–	–	
others	7	14	10	–	13	4	6	–	
Grains	**10.2**	**13.2**	**12.0**	**12.7**	**2.5**	**13.5**	**10.5**	**8.0**	**0.5**
	41	60	60	51	?	54	42	32	?
angular quartz	35	45	45	31	?	34	24	19	
rounded quartz	6	14	14	12	?	15	5	9	
feldspar	–	6	–	–	?	–	–	?	
other minerals[4]	–	1	1	8	?	5	13	4	
Grog	–	**0.8**	**1.4**	**11.7**	**19.2**	**7.7**	**0.5**	**2.7**	–
Clasts	**2.0**	**2.2**	**4.0**	**6.0**	**1.7**	**14.7**	**16.0**	**26.7**	**57.0**
	8	11	20	24	?	59	64	107	114
hornblendite	–	–	–	–	–	–	–	–	(114)
altered mafic	–	p	p	–	p	1	–	–	
altered igneous (int.?)	–	–	–	–	–	–	63	–	
altered trachytic	p	–	–	–	–	–	–	–	
granitic	p	–	1	–	–	–	–	–	
metaquartzite/schist	p	2	8	21	p	39	–	2	
orthoquartzite	–	7	11	p	p	20	–	60	
lithic sandstone/tuff	–	–	–	–	–	–	–	p	
greywacke	8	–	–	–	–	p	p	–	
shale/slate	–	p	p	2	–	3	1	–	
chert	–	–	p	p	p	–	–	5	
vein quartz	–	p	–	p	–	–	–	–	
calcite	–	–	–	1	–	–	–	40	
unidentified	–	2	–	–	2	p	–	–	
Fabric Group	**1**	**1**	**1**	**2**	**2**	**3a**	**3b**	**3c**	**3d**

Notes
1. Incomplete data due to 57% area one clast.
2. Matrix = <0.06mm–>0.002mm.
3. Textures: s = sand, z = silt, c = clay, sz = sandy silt, zc = silty clay.
4. Other minerals = biotite, muscovite, chlorite, hornblende, clinozoisite, tourmaline, zircon, rutile.
5. p = not in the count, but seen in the thin section; – = not in the count nor seen in thin section.

Table 3. Fabric classification of Neolithic sherds from Satellite L Passage Grave, Newgrange

fabric group	1	2	(3+2,1)	3		
subgroup			a	b	c	d
early western Neolithic ware	1, 2, 3	4, 5	6	7	8	–
Late Neolithic Carrowkeel Ware	–	–	–	–	–	9

local solid geology, exotic constituents that have been transported over long distances by the ice.

Under these circumstances the sensitivity of ceramic petrography must take both solid and superficial sources into consideration. In the sherds analysed, some assemblages of clast lithologies (Table 4) occur in trace to minor amounts across the groups proposed above in Table 3. This implies, perhaps surprisingly, that the materials used for 'potter's clay' had a common origin rather than different sources for the individual groups. This would be consistent with a local glacial deposit as a source, as would also the lack of bioliths as noted above in the previous section.

Table 4: Clast lithologies within the groups proposed

	Group 1	Group 2	Group 3
Clast lithology			
one dominant clast type			7, 8, 9
mixed lithologies + major			
shales/greywackes	1, 2, 3	4	6, 7
chert + micrite*	3	4*, 5	8*
altered mafic igneous	1	5	

The solid geology relevant to the Boyne Valley (Fig. 1; McConnell *et al*. 2001) is complicated by the heavy mantle of thick glacial deposits that extends south into the area from beyond the Newry-Carlingford ring dyke complex covering the local Lower Carboniferous limestone strata (Hill and Prior 1968). The southern margin of the Clogher Ice sheet lay approximately 12 kilometres north of the monuments in the bend of the Boyne. In the immediate vicinity of Newgrange the sediments are composed of glaciofluvial sands and gravels deposited by meltwater debouching through the narrow Boyne Gorge from the west (McCabe 1972; Meehan and Warren 1999). The tills contain mixtures of local Ordovician and Silurian mudrocks, siltstones, sandstones and greywacke with Carboniferous limestones and cherts forming the most abundant components. The tills also contain a significant proportion of erratic material foreign to the immediate local area such as Carrickdexter basalt, granite from Bellananagh in Cavan and Triassic sandstone from the Kingscourt area, indicating ice movement from the north-west (Colhoun and McCabe 1973). In the northern part of the valley the tills are clay-silt rich reflecting the dominance of the underlying shale and siltstone bedrock. Nearer the coast the erratics indicate glacial movement from the north with rocks from the Newry/Slieve Croob granodiorite, Mourne Mountain granite and gabbros from the mafic igneous intrusions of Slieve Gullion and Carlingford Mountain. In the lower part of the Boyne Valley the glacial deposit is a clay-rich till. It is therefore highly likely that the complex drift geology will have an important influence on the composition of any pottery fabrics made in the Boyne Valley. Erratics of igneous, metamorphic and sedimentary rocks that are foreign to the area will be intermixed with local Carboniferous limestone, and the sedimentary deposits formed in the valley will contain detrital fractions derived from the residual and more resistant members of these rock suites.

Brindley (Eogan 1984, 333–8), in a petrographic study of Beaker sherds from the Boyne Valley which included nine from Newgrange, has provided a detailed description of the various clast lithologies contained in the pottery, and further identified their respective sources in the solid geology of the region to the north and west of the Boyne. Identified are olivine dolerites from Tertiary dykes and sills in the Donegal-Kingscourt swarm to the north-east, quartz sandstones from the New Red Sandstone outcrops of the Antrim plateau and Lagan valley, coarse grained quartzose sandstones and calcareous sandstones, respectively from the Silurian beds of the Cavan-Down area, and extensive Carboniferous Limestone outcrops in north-eastern Ireland. Other rock types identified include felsite, orthoquartzite and vein quartz. All these rocks indicate the complex combinations that may be represented in the pottery fabrics, and Brindley concluded that such lithics have been transported and widely distributed from their original point of origin as erratics or their disaggregated components in the glacial drift deposits of the Boyne Valley. A provenance in the glacial deposits of the Boyne Valley is therefore advocated by Brindley and he concludes that the pottery could have been locally made within the vicinity of Newgrange and other major valley sites.

Of the three major fabric types identified in the present study only the lithic constituents in Group 3 fabrics may be considered as sensitive indicators of provenance. The components in Group 1 (shell) and Group 2 (grog) fabrics are poor identifiers of provenance but, by definition, constitute deliberate additions to the clay matrix as filler constituents. The question therefore arises whether some Group 3 fabrics may also be the products of deliberate selection or whether they have resulted from utilising unprocessed raw materials as suggested by Brindley (1984). In the petrographic study the exclusive presence, volumetric abundance and angularity of clasts in subgroups 3a, 3b and 3c suggest that they had been obtained by crushing selected rocks from the till and adding them as filler, whilst in 3d the variety of lithic inclusions suggests that an original heterogeneous glacial deposit was used. In all four subgroups the presence of quartz, calcite, feldspar and small sandstone fragments in fabric matrices suggest that they derive from local glacial sediments.

This possibility has been checked by analyses of the 2.0–0.6mm clast fraction in deposits from the river Boyne at Newgrange and also upstream at Trim and the Blackwater tributary (Table 5). It can be seen that the Boyne sediments at Newgrange are, not surprisingly, intermediate in their composition between the two, all being dominated by Carboniferous and Lower Palaeozoic sedimentary rock material. Exceptions are the small amounts of silicic and mafic igneous material at Newgrange which are rare in the other two Boyne sediments, and of metaquartzite which is absent. The mafic (olivine dolerite) and silicic igneous clasts are generally sparse in these Boyne sediments but have been recorded in local tills by Brindley (1984). A further contribution of igneous clasts could derive from a limited outcrop, some 5–10 kilometres west-north-west of Newgrange, of tuffs, basalt, andesite of Ordovician (Llanvirn-Caradoc) age, together with small intrusions of syenite (McConnell *et al.* 2001). Dark mafic cobbles which were used in construction of the later mound are therefore not relevant to the discussion of this project. The reason for the lower amounts of metaquartzites in the Newgrange sediments is not obvious.

Table 5: Clast composition of river sediments in the Boyne Valley

Site location in Boyne Valley (see map, Figure 1)	Newgrange	Trim	Blackwater
Clast lithology (2.0–0.6mm)	% (100 counts)		
limestones (micrites/sparrites)	34	66	11
calcite cemented sandstones	3	<	9
cherts	17	24	5
greywacke	10	<	22
lithic sandstone	5	2	2
shales, siltstones	23	2	34
vein quartz	1	1	6
igneous – silicic	2	p	<
igneous – mafic	2	<	p
metaquartzites	<	3	4
amphibolite	<	p	<
opaques/unidentified	3	2	7

p = present, but not in count; <1% – not detected.

NEOLITHIC POTTERY FABRICS

In the small sample of nine sherds studied, the seemingly typologically homogeneous Neolithic assemblage underlying the cairn of Passage Grave L divides between three principal fabric combinations, whilst the additional Carrowkeel sherd from the mound presents a further sub-fabric. These are discussed in sequence below.

In general the high percentage values recorded for clasts in three of the nine sherds indicate that medium to heavily tempered fabrics are the norm for Group 3, and the abundance, the relative large size and angularity of the clastic constituents describe the overall unrefined texture of the pottery. However, this does not mean that the pottery was poorly fabricated and the relatively low incidence of constructional voids (<9%) and the compacted quality of the matrix indicate a standard that is closely comparable with Neolithic pottery from elsewhere in Ireland and the British Isles. The three fabric types identified also correspond with Neolithic fabric types that command a wider distribution in both Ireland and Britain (Sheridan 1985; Hodges 1965; Peacock 1988; Williams and Jenkins 2004).

However, vesicular Group 1 shell-tempered fabrics are not common in Ireland. A small group of undecorated western Neolithic sherds with a vesicular texture was excavated from the old ground surface underlying the north-eastern side of the main mound at Knowth (Eogan 1984, 216, 252, fig. 88) and they probably represent a similar clast-void fabric to the type described from Newgrange. Beyond the Boyne such fabrics are not consistently associated with Early Neolithic pottery. Sheridan (1985, 252, 291) refers to two examples only, the first in a plain ware bowl from Armagh (Co. Armagh) and the second a decorated shouldered bowl from Altanagh (Co. Tyrone).

In Britain, Neolithic fabrics containing calcium carbonate inclusions as the principal form of filler have a wide distribution. Included in this category are fabrics incorporating fragmented calcite, crushed limestone, crushed fossil shell or bioclastic matter and disaggregated oolitic limestone (Morris and Woodward, 2003) and, in general, they originate in areas of southern and eastern England where calcareous rocks dominate the solid geology but their distribution may extend beyond their geologic source areas through glacial action. On the other hand vesicular shell-tempered wares of the Group 1 type are more widely distributed in western Britain and are particularly common in north-west Wales where positive microscopic identification can confirm their presence at a number of early Neolithic sites (Williams and Jenkins 2004). Vesicular fabrics have been recorded from elsewhere in Wales (Paterson 2003; Darvill 1990), thus widening the area of their distribution, but without in each case verifying microscopically the nature of their vesicularity. The Boyne Group 1 fabric described above may, therefore, have a close affinity with the Neolithic vesicular shell-tempered wares of western Britain and most particularly with north-west Wales but, unfortunately, establishing a closer relationship between these fabrics is difficult to advance by further petrographic analysis due to the absence of recognisable diagnostic components.

In the present context it is pertinent to enquire whether the vesicular pottery in the Boyne Valley could be the product of the post-depositional environment, since in this valley the drift deposits would result in neutral/alkaline conditions. In this respect, however, the problem also arises as to why limestones were only recognised in sherds 4 and 8. One can suggest either, that the pottery was brought into the Boyne from outside with a pre-formed vesicular texture or, and most intriguingly, a shell-tempered clast void fabric was deliberately fabricated to meet an, as yet, unrecognised domestic function.

Grog-tempered fabrics represent the second important type identified in the Newgrange sample**.** Grog appears to be a rare component in Early Neolithic fabrics from Ireland and is not described by Sheridan (1985) as a fabric type within its own right in Northern Irish pottery assemblages. Identification from elsewhere in Ireland remains equally unconfirmed and so its identification in the Boyne Valley may be significant. As an exclusive filler component grog is consistently represented in Neolithic fabrics from southern Britain (Morris and Woodward 2003) and forms a significant contributor in the pottery assemblages of sites such as Windmill Hill (Hodges 1965) or Peak Camp in Gloucestershire (Darvill 2011). In Early Neolithic pottery from Wales such fabrics are very rare and, at present, there is only one petrographically authenticated example from Trefignath, Anglesey (Jenkins 1987). In later Neolithic wares grog-tempered fabrics are more common, as exemplified by Peterborough pottery from Llandygai (Williams and Jenkins 2004), and Grooved Ware from Walton, Powys (Jenkins and Williams 1999) and at Parc Bryn Cegin, a recently excavated site adjoining the Neolithic henge complex at Llandygai (Kenney 2009). It must, however, be noted that grog, and to a lesser degree shell clasts, do appear as trace components in much Early Neolithic pottery in Wales, as indeed the volumetric data of three of the sherds (sherds 3, 4, 8) does confirm for Newgrange. Grog as a fabric constituent was therefore used by the Early Neolithic pottery makers and it is likely that a rigorous petrographic programme of analysis would reveal its more extensive use in Irish Neolithic pottery.

The inclusion of selected crushed rock fillers appears to be standard practice in Early Neolithic pottery making in Britain and a variety of rock types were selected ranging from calcined flint in southern England (Hodges and Cornwall 1963), oolitic limestone in central southern England (Hodges 1965), quartz in the Midlands (Williams 1982), gabbro in Cornwall (Peacock, 1969), and a variety of metamorphic, serpentinite and mafic igneous rock clasts in Wales (Jenkins 1987; Williams and Jenkins 2004). In this respect it is unlikely that Ireland should prove to be an exception to this practice as three of the four group 3 fabric types from Newgrange demonstrate. Sheridan (1985; 1989; 1991) in her comprehensive study of Neolithic pottery from Northern Ireland noted that most fabrics did indeed contain a heterogeneous range of rock fragments that were derived from the local drift deposits. She moreover observed that selected rock fillers appeared to be associated with typologically evolved, and thus chronologically later, decorated Neolithic shouldered bowls. Amongst the selected rock types noted are olivine dolerite, biotite schist and biotite granite. It is, however, apparent from the small sample in the present study that specific rock types from the drift deposits were selected and crushed to form fillers in typologically earlier Neolithic pottery in Newgrange: this may apply elsewhere in Ireland if fabric components were to be analysed in future by quantitative methods.

Finally, the single example of Late Neolithic Carrowkeel Ware (sherd 9) from a disturbed area in the turf mound of the Satellite L Passage Grave may also indicate the use of a selected rock filler. However, as noted previously the thin-section in question presents very limited detail of the overall fabric. The section consists of one very large gabbroic rock fragment loosely bonded into a weakly compressed isotropic matrix which contrasts markedly with the better fabricated Early Neolithic fabrics described above. It is likely that the gabbro can be provenanced ultimately to the Slieve Gullion igneous complex and cobbles from this source are present in the tills of the Boyne area. This fabric remains as a tantalising example of what might be learnt if a more comprehensive study of Carrowkeel pottery was to be instigated, particularly since Sheridan (1985) has reported the use of 'sea shell temper' as a counterpart in Carrowkeel Ware, noting examples from such widely distributed sites as Tara and Fourknocks in County Meath, Carrowkeel in County Sligo and Ballynahatty in County Down. Such a study, if undertaken systematically, might reveal a pattern of selective fillers that could be as varied and as interesting as those identified in the Early Neolithic pottery of the Boyne, and would also undersign the type of filler assemblages employed in Late Neolithic and Early Bronze Age fabrics in Ireland and other regions of the British Isles.

CONCLUSION

The present analysis has indicated that selected fillers can be identified in the small sample of Early Neolithic pottery which lay under the Satellite L Passage Grave at Newgrange. Three distinct fabric types have been recognised with shell (dissolved to produce clast-voids), grog and rock particles forming the principal components, and the last group can be further sub-divided into four sub-fabrics according to the lithological identity of the dominant clastic inclusions. Although the surface deposits of the Boyne Valley are dominated by glacial tills and boulder clays which contain erratic constituents that have been transported over long distances, systematic petrographic investigation can, despite the complexity of the surface geology, produce results that are relevant to the development of prehistoric pottery manufacture in Ireland.

Since the present sample is small (nine sherds) it would be premature to apply the findings of the analysis to the wider realm of Early Neolithic pottery fabrics elsewhere in Ireland. However, establishing the existence of three distinct fabric types may be significant and since all three suggest an element of choice in their fabrication the question arises as to what may have prompted their selection. Recent petrological studies of Later Neolithic/Early Bronze Age pottery in Ireland (Sheridan 1989) and Britain (Gibson 1995; Williams and Jenkins 1999; 2004) indicate that particular fabric compositions appear to have been selected for the manufacture of specific stylistic pottery types.

It may be that a similar selective process underlies the fabrication of the present compositions although it could be argued that the range displayed here does appear to reflect the range of selections which are apparent in the Early Neolithic pottery of Britain though, given the different geology, not necessarily replicating the variety of constituents that have been identified. These constituents do reflect in the main the geology of the areas in which the pottery has been produced, and so therefore the question might be orientated in a different way so as to enquire what may have been the motive behind the selective process. It may be that the different fabrics meet the different domestic uses to which the pottery was designed—clast fabrics for cooking purposes, clast void fabrics for diffusion/evaporation processes, and grog fabrics for general domestic container purposes. Such conclusions enter the realms of conjecture but offer intriguing possibilities when combined with lipid analysis and other investigative techniques. Finally, it gives us great pleasure to be contributing with others to this Festschrift to acknowledge Frances' major contribution to Welsh archaeology

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