The Archaeology of Medieval Europe

Vol. 2 • Twelfth to Sixteenth Centuries

EDITED BY MARTIN CARVER
AND JAN KLÁPŠTĚ
TWELFTH TO SIXTEENTH CENTURIES

The Archaeology of Medieval Europe

Edited by Martin Carver and Jan Klápště

Acta Jutlandica
Humanities Series 2011/9

Aarhus University Press
CONTENTS

13 FOREWORD
   Else Roesdahl

15 CHAPTER 1
   AIMS AND METHODS
   Part 1  Scope and Agenda, Martin Carver  15
   Introduction – Organisation of the volume – Scope of the volume – Medieval archaeology in theory and practice: The nature of the resource; Field method; Landscape survey; Site survey; Excavation; Studying buildings; Analysis – Agendas and rewards

   Part 2  Medieval Archaeology and the Sciences, Aleks Pluskowski  48
   Multi-disciplinarity – Environmental archaeology – Biomolecular archaeology – Archaeometallurgy – Conclusion

     Box 1.1  Shapwick: Investigating an English Village
              after Mick Aston and Christopher Gerrard  28

     Box 1.2  Developing an archaeology of buildings in Italy Gian Pietro Brogiolo  40

     Box 1.3  Investigating a house of the Military Orders at Ambel in Spain.
              Christopher Gerrard  49

58 HABITAT
   Introduction, Martin Carver

60 CHAPTER 2
   THE MEDIEVAL LANDSCAPE
   Part 1  Investigating the Medieval Environment in France, Joëlle Burnouf  60

   Part 2  Managing the Environment: Examples from France, Holland and Greenland  68
   River management in the middle ages: taming the Loire, Cyril Castanet  68
   Communities and rivers in the Roussillon: confronting environmental change, Jean-Michel Carozza and Carole Puig  71
   Medieval reclamation and land use in the Netherlands, Jan van Doesburg & Bert Groenewoudt  73
   Norse Greenland and the extinction of the settlement there, Jette Arneborg  78
CHAPTER 3
LIVING ON THE LAND

Part 1 Investigating Rural Settlement, Jan Klápště
Introduction to the sources – Aims and methods in the study of rural settlement – Archaeological evidence: Tools – Fields – Rural industry – The study of deserted villages – Site formation processes – Two case studies (Svidna and Bystřec) – Studying rural settlement today

Part 2 Four Villages
Skramle – a deserted medieval hamlet in the Scandinavian forest, Eva Svensson & Sofia Andersson
A farm in Tärnby, Denmark, Mette Svart Kristiansen
Rattray in Moray, north-east Scotland, Martin Carver (after Peter Yeoman)
In the path of a high speed train: Beaume, a hamlet in the Rhône Valley, Odile Maufras, Michèle Bois and Nathalie Valour

Part 3 Growing Food
Food in northern Europe from the thirteenth to the sixteenth century, Reidar Bortelsen
Method; Changes in diet: the example of England; The northern margins; Scandinavia and the Continent; A general northern diet?
Hunting and venison in Medieval England, Naomi Sykes
Stories from seeds: the late thirteenth century granary at Durfort (Tarn), Marie-Pierre Ruas
Inferring diet by stable isotope analysis: a case study from the French Alps, Estelle Herrscher – The medieval population at Saint-Laurent in Grenoble (Isère); The diet of the Grenoble adults; Infants at Saint-Laurent: breastfeeding and weaning; Medieval miners at Brandes-en-Oisans (Isère, France); Conclusion

CHAPTER 4
HOUSING

Part 1 Palaces and Palace Life in the North, David A. Hinton
Buildings and physical settings – Status of place – Status in death – Conspicuous consumption
Part 2  Vernacular Housing in the North: the case of England, Kate Giles 159
History of research – High status medieval houses – Lower status 'peasant' houses – Urban housing – The material household – Conclusion

Part 3  Southerners: House and Garden in Al-Andalus, Julio Navarro Palazón and Pedro Jiménez Castillo 176

Houses  History of research – Layout – Interiors – Conclusion
Gardens  History of research – The archaeology of gardens – A history of the Andalusian garden 182

Box 4.1  Hungarian Tiled Stoves, Tibor Sabján 157
Box 4.2  English Hygiene, Isla Fay 172

189  CHAPTER 5
MATERIAL CULTURE – ARTEFACTS AND DAILY LIFE
Else Roedsahl and Frans Verhaeghe

Part 1  Medieval Portable Artefacts – A Survey 190

Part 2  Method and Interpretation 213
Artefacts and identities – Influences from beyond Europe – Diversification, increasing comfort and standardization – Social communication, status markers and changing worlds

Box 5.1  Pictorial sources Else Roedsahl and Frans Verhaeghe 202
Box 5.2  Object and Identity in Estonia Heiki Valk 218

228  POWER
Introduction Martin Carver

230  CHAPTER 6
ARCHAEOLOGIES OF COERCION

Part 1  Castle Archaeology – An Introduction, Werner Meyer 230
Investigation methods and techniques – castle construction and repair – Questions of typology and terminology – Use of space – Defence – Catastrophe and war – Abandonment and transformation

Part 2  Fortification in the North (1200-1600), Kieran O’Conor 243
Communal fortifications: Urban – Linear fortifications and territorial defences – State fortifications and early artillery forts – Private fortifications: castles; Earthwork / timber castles; Masonry castles; Minor strongholds: Tower houses, fortified houses, moated sites and crannogs
Part 3  Four Fortresses and a Battle
Town Walls at Carcassonne, Oliver Creighton  261
The castle at Alt Wartburg in Aargau (AG, Switzerland), Maria-Letizia Boscardin  263
The Castle of Cēsis, Latvia, Gundars Kalniņš and Kaspars Kļaviņš  265
Claregalway Castle – an Irish tower house, Rory Sherlock  269
The Bloody Battle of Towton (England), Tim Sutherland  272

277  CHAPTER 7
MANUFACTURE AND PRODUCTION

Part 1  Craft into Industry, Ricardo Córdoba and Ulrich Müller  277
Pottery – Glass – Leather: Tanneries and shoemakers’ workshops – Bone and antler –
Oil and sugar mills – Craft into industry

Part 2  Pottery and Glass  287
Supply and demand – pottery in medieval Southampton, Duncan Brown  287
Stoneware production, Hans-Georg Stephan  291
The Anabaptist potters of Moravia, Jiří Pajer  295
Pottery manufacture in al-Andalus, Julio Navarro Palazón and Pedro Jiménez Castillo  296
The influence of Islamic pottery in the Mediterranean, Alberto García Porras  302
The versatile bote: Spanish decorated jars and their uses, Alejandra Gutiérrez  305
The production of glass in al-Andalus, Pedro Jiménez Castillo and Julio Navarro Palazón –
Archaeology; Workshops; Products; Stained glass  307

Part 3  Textile Production in Western Europe Eva Andersson Strand  315
Sources – Production – Wool – Flax and hemp – Spinning – Weaving – Dyeing – Finishing – Conclusion

Part 4  Metal-workers and Mining, Marie-Christine Bailly-Maître, Ricardo Córdoba and
Ulrich Müller  321
Processing – The nature of medieval mining – Documentation – Archaeological investigation – Conclusion

328  CHAPTER 8
THE RISING TIDE OF TRAVEL AND TRADE

Part 1  Sea Trade. The Development of Ships and Routes, Jan Bill  328
Mediterranean seafaring to the fourteenth century – North European shipbuilding to the
fifteenth century – The merging of traditions: European shipbuilding in the late Middle
Ages – Transport capacity
PART 2  Archaeology of a Trade Network: the Hanseatic League, 1200-1500 AD,  
David Gaimster  340

The Hansa in the North Sea and Baltic: commercial and cultural networks – Archaeology 
of the Hansa – The Baltic ceramic market 1200-1500 – The smokeless ceramic tile-stove: 
a Hansa type-fossil – Conclusion

PART 3  Coinage and Money in Late Medieval Europe, Alan M Stahl  351

The Penny of the Central Middle Ages – Proliferation of denominations and means of 
exchange – Coins and the archaeological record

PART 4  Pushing Back the Frontiers  357

The trade in exotic beasts, Aleks Pluskowski  357 
— Living marvels; Horns and claws; Ivory and fur

The rising trade with Africa, Sam Nixon  361 
— Trade with North Africa and trans-Saharan connections; The fifteenth-century Age 
of Discovery; Sub-Saharan trading settlements; Shipwrecks south of the Sahara; The 
goods trade south of the Sahara

Box 8.1  Travel on Snow and Ice, J.-P. Taavitsainen  338
Box 8.2  Hanseatic Kontore, Visa Immonen  350
Box 8.3  Reused Coins in the English Later Medieval Period, Richard Kelleher  355

CHAPTER 9
TOWNS

PART 1  The Development of Medieval Towns, Hans Andersson  370

Definitions – The re-emergence of towns in the late twelfth and thirteenth century 
— Urban trajectories in northern and western Europe – Crisis: fourteenth and fifteenth 
centuries

PART 2  The Anatomy of Medieval Towns, Barbara Scholkmann  379

Sources – The emergence of towns – Town plan and structure – Towns and their hinter-
sacred topography – Public health – Decline in the fourteenth and fifteenth centuries and 
the consequences of the Reformation

Box 9.1  Wroclaw in the twelfth-sixteenth century, Jerzy Piekalski  376
Box 9.2  A preserved Medieval Suburb – Sezimovo Ústí (Czech Republic), 
  Jan Klášť  386
Box 9.3  English Guildhalls, Kate Giles  396
Box 9.4  The Middle Ages in a Roman ruin: Crypta Balbi, 
  (Martin Carver after Daniele Manacorda)  401
Box 9.5  The Islamic town in medieval Europe, Julio Navarro Palazón and Pedro 
  Jiménez Castillo  404
SPIRITUALITY

Introduction Martin Carver 409

CHAPTER 10
ARCHAEOLOGIES OF BELIEF

Part 1 Religious Life in Public and Private, Christina Vossler 412

Part 2 The Materiality of Christian Worship – A Brief Guide, Martin Carver 428

Part 3 The Archaeology of Judaism, Samuel D. Gruber 437
Box 10.1 A Christian Topography: Viborg in Denmark, Hans Krøngård Kristensen 416
Box 10.2 Pilgrim Badges: A Case Study from the Netherlands, Marjolijn Kruip 420
Box 10.3 Pagan-Christian Co-existence in Medieval Estonia, Heiki Valk 430
Box 10.4 A Medieval Prayer Finger Ring from São João de Tarouca (Portugal), Mário Jorge Barroca 432

CHAPTER 11
RELIGIOUS BUILDINGS

Part 1 Cathedrals and Monasteries, Martin Carver 442
Cathedrals: Designing and building – The Precinct – Cathedral archaeology – Monasteries – Form of Sites – Monastery archaeology – Two case studies: Fontenay Abbey; Bordesley Abbey – Fortified cathedrals and monasteries

Part 2 The Archaeology of Parish Churches in Late Medieval England, Aleksandra McClain 467
Introduction – Church buildings – Churches, landscapes, and lordship – Form, space, and art – Conclusion

Part 3 Jewish Religious Buildings, Samuel D. Gruber 479
Synagogues – Schools – Baths: Mikva’ot

Part 4 Islamic Religious Buildings in Spain, Julio Navarro Palazón and Pedro Jiménez Castillo 486
Sources – Mosques: form and typology – The mosque in the town – Rural mosques
Box 11.1 How Cathedrals Collapse: The Case of Beauvais, Jacques Heyman 444
Box 11.2 The Building of St Peter’s in Rome, Martin Stanchiffe 448
Box 11.3 Establishments of the Mendicant Orders, Hans Krøngård Kristensen 466
Box 11.4 How churches Change: St Colman’s, Portmahomack, Scotland 1100-1580, Martin Carver 472
Box 11.5 A Sicilian Rural Mosque and Its Context, Alessandra Molinari 490
CHAPTER 12
LIFE, DEATH AND MEMORY

Part 1  Life, Death and Memory Andrea Augenti and Roberta Gilchrist 494
The medieval lifecycle – Climate and catastrophes – Health and lifestyle – Medieval medicine and healing magic – Medieval hospitals: Christian bodies and souls – Cemetery location – The topography of cemeteries – The burial – Memory

Part 2  The Evolution of Churchyard Burial: Three Case Studies from France Elizabeth Zadora-Rio 516
Introduction: the rise of churchyard burial – Raunds Furnells (Northamptonshire, England) – Rigny, in Touraine (Indre-et-Loire, France) – Vilarnau en Roussillon (Pyrénées Orientales, France) – Models for the development and meaning of rural cemeteries

Part 3  Jewish Memorial Practice Samuel D. Gruber 522
The cemetery – Memorials – History of practice – Archaeological investigation

Box 12.1  The Black Death Barney Sloane 511
Box 12.2  Islamic burial rites Andrea Augenti 514

529  BIBLIOGRAPHY

579  LIST OF CONTRIBUTORS

581  INDEX
The production of glass in al-Andalus
by Pedro Jiménez Castillo and Julio Navarro Palazón

Arabic texts that offer information about glass production in al-Andalus are very scanty and of unequal value. According to the historian al-Makkari, the poet Ziryab, who was exiled by the Abbasid dynasty and settled in Córdoba at the court of 'Abd al-Rahmân II, introduced glass tableware in place of goblets of precious metal at official dinners. Al-Makkari also reports that the physician Abbas ibn Firnas from Córdoba, a vassal of Muhammad ibn 'Abd al-Rahmân (852-886), discovered the secrets of glass and founded numerous
workshops in al-Andalus. This information belongs to a seventeenth century compilation and so should be treated with caution as source for earlier periods, but it is not improbable that glass-working had revived in al-Andalus by the mid-ninth century (AME 1, 213).

A treatise about the management of the *souk* (market) of a Saqati, written in the first quarter of the thirteenth century, refers to the production of glass and (among other things) advises that freshly blown glass should be allowed to cool for a day and a night. Indeed, this is an essential tenet for glass-makers: a glass vessel needs to cool slowly once blown, since a sudden change in temperature will cause it to fracture. This requirement was served by intermediate chambers of gradually diminishing heat. Another contemporary reference to the production of glass comes from Ibn Sa'id al-Maghribi, a native of Granada writing in the mid-thirteenth century. In his eulogy of al-Andalus, he highlights the craftsmanship of glass, citing the most important production centres: Murcia, Málaga and Almería. Having praised the embroidered handkerchiefs, rugs and metal-work made in the first mentioned city, he continues: “Murcia was also renowned for the manufacture of glass and ceramics, [making] great vessels of the most elegant and exquisite manufacture, likewise glazed ceramic and others bathed in gold” (Gayangos 1840, Vol I, 51, 93, II, 311).

Archaeology

Whether in Arab or Christian sources, written or pictorial references to the production of glass in al-Andalus are perfunctory and rare. Therefore, archaeology is an essential means of study, aimed both at the objects themselves and the workshops where they were made. The study of production is still in an early stage, and we know of only two workshops so far, both excavated in Murcia (Jiménez 1996), plus a furnace found in the town of Pechina (Almería). The study of these objects has yet to produce a narrative account of the development of the forms and functions encountered. Vessels in museum collections were previously noted by Gómez Moreno (1951, 341-343) and Torres Balbás (1949a, 219-221) and later briefly by Alice Frothingham (1941, 1963). The development of Spanish medieval archaeology since the 1970s has not achieved a breakthrough in the study of glass comparable to that in ceramics (p 296, above), but this may change following publication of the proceedings of a recent conference (AAVV, 2000c), the catalogue of a later exhibition (AAVV, 2006b), organized by the Casa de Velázquez and the National Glass Centre Foundation (Fundación Nacional del Vidrio) and new analysis of glass composition (Carmona *et al*, 2008 and 2009).

Workshops

First-hand archaeological information on glass manufacture has recently come to light in Murcia, endorsing the remarks of al-Maghribi (above). Two glass workshops were found in the vicinity of the ancient congregational mosque, the present cathedral, and a few metres from the main street and market of the early city, now Frenería Street. The first, discovered in 1998 on a plot in Puxmarina Street (Jiménez *et al*, 2000; Jiménez *et
Plan of an Andalusian glass-makers' workshop excavated at Puxmarina Street, Murcia (12th century), showing the direction of flow of drains. Fig 7.15

al. 2005), was dated to the twelfth century by stratigraphy and archaeometric dating (Gómez-Paccard et al. 2006) (Fig 7.15). Among its products were a moulded vessel, decorated with enamel and applied trail, flat glass for windows and a mirror on a lead base. Five relatively well-preserved glass furnaces were found, and remnants belonging to earlier phases indicated that the workshop had been in operation over a long period. Furnaces 1 and 4 presented similar characteristics: an elliptical plan, a ledge in the shape of a horse-shoe on which the crucibles were placed, and a central cavity in which the raw material was heated, before its transfer to the crucibles. The stoke-hole and firing chamber lay outside, though feeding heat directly to the central cavity. Furnaces 2 and 3 were similar, but smaller and simpler, having two side ledges on which crucibles were placed (Fig 7.16). Furnace 5, in the centre of the workshop, was completely different, and resembled the type of kiln used to fire ceramics. The chamber was circular in plan, divided into two parts separated by an openwork grill. It is not clear if this was designed as a chamber for cooling glass vessels or a kiln for making the ceramic crucibles.

The second workshop was located about 50 m from the first, at the junction of Polo de Medina Street with Belluga Square. The excellent state of preservation allowed for a more secure interpretation. The furnace was oblong in plan, oriented east-west, measured 4.20 m long and 3.20 m wide and had survived to a height of 1.25 m from its base.
Fig 7.16
Glass furnace no. 2 on the Puxmarina St. site.
(AME 1, 213). The U-shaped ledge retained the imprints of crucibles and the remains of glass frit, some of it coloured. In the centre of the U was a rectangular tray where the raw material was initially melted.

The presence of ovens of different forms implies that a number of different operations were required, and some of the output may have served other craftsmen (for example potters). Given the fuel used (wood), it is unlikely that the ovens could easily reach a sufficiently high temperature to fuse glass directly. Documents of the sixteenth and seventeenth century imply a two-stage process, whereby the raw material (sand, flux and other minor components) were heated together for about six hours at a temperature of around 750 o C, and so transformed into a glassy mass, with all the impurities ejected to the surface. The pure solidified glass was then broken up with a hammer and placed in a crucible together with any glass for recycling, and melted again ready for moulding or blowing.

Products

Although the finding of the workshops at Murcia has been a considerable advance in the knowledge of glass-making in al-Andalus, we still have little information about the products. This is partly due to the inherent fragility of the glass vessels as well as their relative scarcity compared to other materials such as ceramics. However an attempt will be made in what follows to summarise the types of glass in circulation, focusing on form and decoration.

To our knowledge, the only Andalusian assemblages that have been subject of a percentage study of the decorative technologies are those of Madinat al-Zahra’ (tenth century) and Siyāsa (Cieza, Murcia; mostly of the twelfth-thirteenth century). These differ not only in location and period of occupation but in the type of site, the first being a city of the ruling establishment and the second a hīm, a large settlement that does not reach the category of medina, market town (Table 7.2).

<table>
<thead>
<tr>
<th>TECHNIQUE</th>
<th>MADINAT AL-ZAHRA'</th>
<th>SIYĀSA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mould-blowing</td>
<td>59.5%</td>
<td>77.9%</td>
</tr>
<tr>
<td>Carved</td>
<td>19.5%</td>
<td>0%</td>
</tr>
<tr>
<td>Stamped</td>
<td>9.5%</td>
<td>0%</td>
</tr>
<tr>
<td>Applied</td>
<td>3.5%</td>
<td>17.1%</td>
</tr>
<tr>
<td>Enamel</td>
<td>3.5%</td>
<td>0.2%</td>
</tr>
<tr>
<td>Marvering</td>
<td>1%</td>
<td>0.2%</td>
</tr>
<tr>
<td>Gold painting</td>
<td>4%</td>
<td>2.2%</td>
</tr>
<tr>
<td>Pinched</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>
Mould-blowing is an ancient technology in which glass is blown into a mould with a pipe, and which may have preceded free-blowing (Fig 7.17, left). The mould came in two parts, usually made of wood or clay, and its interior surface could be incised with motifs that would appear in relief on the body of the glass vessel. At Madinat al-Zahrá', this is the most widely used technique, amounting to 60% of all decorated glass recovered during the archaeological work. Among prominent decorative schemes is the “honeycomb” grid, consisting of a network of hexagonal or elliptical depressions that cover almost the entire surface of the glass vessel. This motif, with origins in antiquity, was widely diffused by Muslim glaziers. At Siyásā it was even more common, occurring on 77.9% of the decorated fragments.

In carved cut-glass or crystal vessels, parts of a thick surface are cut away or left raised up. The technique was widespread from late antiquity to the early centuries of Islam, so it is not surprising to find it in early contexts in al-Andalus such as Pechina and Madinat al-Zahrá'. However it is completely absent at Siyásā and does not appear in other Murcian contexts of the twelfth century, so we are inclined to think that it was already rare in al-Andalus by the eleventh century.

Stamped decoration is achieved by pressing a die on the surface of the glass while it is still hot. It was common to use a pair of calipers, one of whose faces was engraved with the chosen ornament. This type of decoration was prevalent in the eastern Islamic world and employed for stamping an omphalos (a boss), rosettes, oval or inscriptions. The earliest Andalusian example of this technique is from Pechina and should be dated to the ninth or tenth centuries. It was a piece of fairly thick wall of dark green glass, ornamented with a band of “eyes.” In Madinat al-Zahrá' this technique of printing or stamping is present in 20% of the decorated pieces found and their motifs are simple: circles, oval shapes, ellipses and diamonds strung horizontally. The eye-band motif was also found on a complete bottle discovered in the excavations conducted in Platería Street (Murcia), and belongs to an assemblage of the Almoravid period (some bottles from this site are shown in Fig 7.17).

Applied decoration is based on the flexibility of glass at high temperatures, which makes it possible to stretch it into threads that attach easily to the hot surface of the glass. The thread may be of the same colour or different from the body. The technique is rare at Madinat al-Zahrá' (4%) but rises to 17.1% at Siyásā.

Pinching is a very simple technique that consists in pinching the glass surfaces while still hot. It occurs on a bottle from Platería Street (Murcia) with a foot-ring, globular body, broad cylindrical neck and a multi-lobed rim with pouring spout. This bottle was found in a midden with an assemblage dating approximately to the end of the eleventh century or first half of the twelfth century.

Marvering involves applying glass appliqué cords (trails) on the vessel and then rolling it on a flat (marble) surface (a marver), so that the trails merge with the body. Usually these cords were smoothed with the help of sharp tools, which were then used to create patterns on the surface in the form of a nib or pin. This technique was used by the Egyptians in the first millennium BC and in the eastern Islamic world it occurs from the eleventh to thirteenth centuries, especially in Egypt and Syria. It was noted
at Madīnat al-Zahrāʾ but in only 1% of the decorated specimens, while in Siyāsā the percentage drops to 0.2%.

Enamelling is one of the most characteristic techniques of medieval Islamic glass, although it too traces its origins to late antiquity. Probably such ornamentation was already practised under the Abbasids, judging by specimens discovered in Raqqa and dating to the ninth century; however, it is in the twelfth century that the production centres in Iraq and northern Syria began to establish their reputation. During the second half of the thirteenth and the fourteenth centuries, enamelled glass from the Middle East reached its peak, spreading from Western Europe to China. We have a fragment from Siyāsā having in its outer surface remains of two horizontal red stripes. A fragment from the Murcia area must have belonged to an open vessel, cylindrical or conical. Judging by the archaeological context, this seems to date to the twelfth century. This is surprisingly early, but enamelling is also seen on a piece of glass belonging to a vase retrieved from Furnace 2 in Puxmarina, firmly dated by archaeological context and archaeomagnetic analysis to the twelfth century.

The technique of gold painting on glass is very similar to that of lustre pottery. Most researchers believe that motifs in gold paint were first applied in Abbasid Mesopotamia to decorated pottery, although Lamm (1929) and others argue that it originated among the Copts in the fourth century. In any case, there is no doubt that it reached its maximum development, both on pottery and on glass, in Islamic territory from the Abbasid period. At the site of Madīnat al-Zahrāʾ fragments of blue glass decorated with golden brown paint represent only 4% of the decorated pieces, and it is not possible to determine if they were manufactured locally or whether they were Eastern imports. From Siyāsā there were about fifteen pieces of gold painted glass (2.2%), of which three are rims belonging to open forms. The painted motifs have a golden tone ranging from
olive to purple forming plant motifs, with details marked by fine incised lines. The archaeological context can be dated to the twelfth and thirteenth centuries. In the current state of research we cannot be sure that the Siyāsa glass was made in Murcia, but it is not improbable since, as it has been demonstrated in relation with the lustre painted pottery, there were artisans in Murcia who knew the technique.

**Stained glass**

Finally, we highlight the finding in Murcia of coloured flat glass, which proves the existence of an element that is still today part of traditional Islamic architecture: coloured-glass window-grilles, in Arabic *samsiyā* or *qamariyya* (Jiménez 1991, 71-80). The discovery was made in an outhouse, perhaps a cess-pit, belonging to a large house (San Nicolás). Found with the window glass was an outstanding collection of ceramics dating back to the mid-thirteenth century (Fig 7.9). Since the house can be dated to the twelfth century and windows were part of the architectural decoration, it is probably more appropriate to date the glass as contemporary with the house, rather than the pottery. Thanks to the fragments of window glass in the workshop of Puxmarina, in a context with dates from the twelfth century, we can say that glass windows were made in Murcia at this early date.

The total number of flat glass fragments exhumed in the house at San Nicolás is forty-eight. The colours include blue, green, yellow and violet. Close examination of the pieces showed circular grooves implying manufacture by the method called 'crowning' (Charleston 1991, 242). In this process, glass was blown into a crown or hollow globe which was transferred from the blowpipe to a pontil and then flattened by reheating and spinning out the bowl-shaped piece of glass (*bullion*) into a flat disk by centrifugal force, up to 1.5 to 1.8 m in diameter. The glass was then cut to the size required. The coloured glass disc thus obtained was placed on a lattice of plaster, but unfortunately none of these has survived. Despite the degradation suffered by the glass at San Nicolás, it was also possible to detect traces of painted decoration. The decorative motifs seem to be of vegetal shapes. The presence of paint on flat glass has been documented at Qasr al-Hayr al-Sharqi (Grabar *et al.* 1978) and Samarra (Lamm 1928). In both cases, a blackish paint was employed, usually called *grisaille*, and used to draw simple geometric and vegetal patterns.

The use of stained glass was prominent in the Umayyad period, as witness buildings at both Qasr al-Hayr, Khirbet al-Mafdjjar, Qusayr Amra and Mafraq. The technique travelled into North Africa in the tenth and eleventh centuries, as traces of these coloured-glass window-grilles have been found at Sabra-Mansouriya and the Qal’a of the Banu Hammad. We know very little about the use of stained glass in al-Andalus, although Torres Balbás (1949b) and Elie Lambert (1957) dedicated some of their works to its study. The earliest documentary reference is to the palace of al-Ma‘mūn of Toledo in the mid-eleventh century.

The window glass at San Nicolás, dated to the twelfth century, is the earliest so far found in al-Andalus. Even the windows of Santa María la Blanca (Toledo), though of uncertain date, are surely later. From the fourteenth century, artisans began to employ
lead frames (calimes) such as those seen in the windows of the Alhambra and the madrasas of Fez (Lambert 1957, 107). The San Nicolás window-glass has a major significance for western Islamic architecture, not only because it is the oldest archaeological evidence for its use in al-Andalus, but also because it was found in a domestic, secular setting, not in a palace or religious centre.