

N.B. This is a very rough, preliminary, draft of the book which was finally published as 'The Glass Bathyscaphe: How Glass Changed the World' by Profile Books, London, 2002. This draft was completed about nine months before the final book. Many arguments are provisional, the footnotes have not been checked, the order is different. But it does contain many bibliographical details and quotations which were excluded from the final published work. It may therefore be useful for those who wish to pursue the matter further or to know the background to certain statements in the published work.

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### GLASS IN WESTERN EUROPE FROM 400-1200 A.D.

Our difficulty in understanding the influence of glass is partly caused by a widespread, but mistaken, impression. Without really thinking about it, most of us would assume that however wonderful the Romans were with glass, all this was more or less lost to the West after the collapse of the Roman Empire. This makes superficial sense; the craftsmen would be killed or dispersed, the market for glass vanish. Furthermore, for a long period this assumption seemed to be born out by the archaeological record. After about 400 A.D. far less glass was dug up and what there was seemed to be of much inferior quality. The apparent dearth of glass seemed a characteristic of Europe until as late as 1400; the destruction of Rome seemed to have left a glass vacuum for nearly a thousand years. 'Up to about two decades ago, the period between about 800 and 1400 AD was largely regarded as a glassless "dark" age. The main reasons for this is that hardly any objects from that period are still extant.'<sup>1</sup> The old stereotype is well shown in book on glass by E. Barrington Haynes written in 1948 and revised in 1959. In a chapter titled significantly 'The Empty Ages' (A.D. 800-1400), the author starts by explaining that 'It remains true that in so far as European glass is concerned no age is so empty and the cabinet is likely to remain in a similar state despite the most accommodating of purses.'<sup>2</sup>

With such a picture it was not surprising that it is very difficult to see that glass could be an important differentiating technology. If western Europe more or less lost glass for seven hundred years, would it not be just like China, Japan or India - and would it not be far inferior to Islamic civilization where glass, with Greek science, was preserved? And if there was little glass in western Europe by 1100, we would tend to think that it would take some centuries for it to revive, making its influence felt only from about the late fifteenth or sixteenth century.

In this chapter I hope to show not only that the whole picture needs to be revised drastically, but also why it was that glass techniques not only improved but flourished. This will provide a very different link in the argument, for it can be shown that while there was certainly decline in certain respects, much of the Roman legacy was maintained and, in certain ways, improved upon even by 1100.

Let us first look at the archaeological reasons for the first misleading impression. There is undoubtedly a very rapid decline in the quality and quantity of glass objects found after about the

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<sup>1</sup> Liefkes, Glass, 36

<sup>2</sup> Haynes, Glass, 47

fifth century, and there seems to be little increase in the quantity even after the economic recovery of Europe from the eighth century. But this may not be a reflection of what happened, but rather of three other factors. 'There are several reasons for the gaps. Firstly, after the conversion of Europe to Christianity in the late Roman and early Medieval periods, very few objects were placed in graves.... Secondly, documents show that in many parts of late Medieval Europe broken glass was collected for recycling; .... Thirdly, most of the glass made in Europe after the ninth or tenth century contains potash as a flux. This makes it more vulnerable to decay, especially in acidic soil conditions, than Roman glass (which contains soda or natron).'<sup>3</sup>

On the last of these points it is worth emphasizing the dramatic technical change which cut down the cost of glass-making in the north. 'After about AD 1000 there was a significant change in the composition of European glassware. The northern glass-makers abandoned marine plant ash from the Mediterranean countries which they had used as a source of alkali (in the form of soda), and came to rely instead on local supplies of potash, derived from the ashes of bracken, beechwood and other woodland plants.'<sup>4</sup> As these authors further explain, 'Unfortunately, potash glass is prone to weathering, and much that came from the forest glasshouses of this period has been lost through deterioration in the ground.... The almost total absence of glass remains on medieval village sites, at least before the fifteenth century, indicates either that glass was not used very far down the social scale, or that much potash glass has simply perished through weathering, or perhaps been ignored by excavators in the past.'<sup>5</sup>

The reference to the ignoring of glass by excavators is an important final factor; it is possible that the assumption that glass had disappeared meant that those who did do some digging did not always notice what glass there was. This is compounded by the fact that until quite recently there was little serious archaeological work on early medieval Europe. The situation has now changed and we are told that 'the relatively new discipline of Medieval Archaeology ....shows that glass-making was widespread in medieval Europe. In some areas there must have been an un-interrupted tradition from late antiquity onward ...it is now clear that during the larger part of the Middle Ages both the quantity of glassware produced and its quality and variety must have been quite considerable. This is not surprising in view of the quantity of stained-glass windows and glass mosaics that have survived from the same period.'<sup>6</sup> Speaking principally of the period after 1100, but having some application to the earlier period, we are now told that 'Excavations in all parts of Europe... have transformed contemporary scholarship of Medieval glass-making ...[the result of two large exhibitions...] The effect was startling. The conventional picture... disappeared. Instead of row upon row of pale green **Waldglas** ('forest glass'), there was glass of almost every size and description. Suddenly, there was a wealth of information, mostly provided by archaeologists, that revealed a new image of later Medieval glass-making: versatile, innovative and technically assured.'<sup>7</sup>

What then is the new picture that is emerging for the period between 500 and about 1100 AD? It firstly incorporates a little of the old story, a half-truth which should not be entirely lost. It is indeed true that particularly in the part of the area south of the Alps, the collapse of the Roman Empire led to a considerable loss of technical skill and quantity of output for a while.

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<sup>3</sup> Sotheby, Enc. 48; on changes in grave goods, see also Liefkes, Glass, 36

<sup>4</sup> Klein and Lloyd, Glass, 46

<sup>5</sup> Klein and Lloyd, Glass, 46

<sup>6</sup> Liefkes, Glass, 36

<sup>7</sup> Sotheby, Encycl. 48

Writing of the fifth century barbarian invasions, we are told that the 'cultural break which resulted brought a decline in production standards, such as an increase of bubbles and black impurities in the metal and less varied decoration.'<sup>8</sup> More specifically, 'In Italy, for example, the production of luxury glass ceased in the late fourth century. After this date, most vessels were made of bubbly, pale green glass.'<sup>9</sup> More widely, 'In the Rhineland the areas between the lower Rhine and the Loire, as in Italy and southern France, the production of glass continued in the Dark Ages. Here, too, however, the quality of the products declined. The glass-makers' repertoire became restricted to beakers, bottles, bowls and hemispherical cups...'<sup>10</sup> Yet rather than a complete break, we can now see a picture of a decline combined with continuity.

A moderate statement of an alternative to the complete destruction argument was put forward many years ago by Dopsch as follows. 'Finally, glass manufacture did not perish with the Romans, as was once thought, but continued, although with a coarser technique. Beads and other glass ornaments were used just as much as before... Even where there was a coarsening of technique or a loss of artistic competence, or where the previous Roman work seemed to have been destroyed, there are to be found transitional forms which are highly significant because they lead up to later modern forms.'<sup>11</sup> This is echoed in another assessment. 'The break-up of the [Roman] Empire must not be taken as implying a general cessation of the industry. There was considerable artistic and technical decay, a dwindling in the range of colours and a gradual loss of the processes of decolorizing and refining the metal, but the manufacture by no means died out or diminished, as some suppose, to the extent that glass ceased to be appreciated.'<sup>12</sup>

One of the reasons for our mistaken assumptions lies in the fact that much of what was continued occurred on the edges of the old Roman Empire. What had happened during the Roman period is well summarized by Singer. 'The story of glass-making during the Roman imperial period to A.D. 400 is simple. Once the glass industry burst its Alpine bounds it moved rapidly up the Rhone and Saone valleys and down the Rhine until during the second century it was planted firmly round Cologne and Treves. It spread quickly north-westward to what is now Belgium and the neighbouring lands, where it settled in the forest-country on the modern frontier between Belgium and France in the valleys of the Meuse, Sambre, and Oise. Thence it came to Britain, where it existed at Colchester, Warrington, and Caistor-by-Norwich, and no doubt elsewhere.'<sup>13</sup> In fact the Roman love of glass spread even further than this. 'Recent finds at Begram (ancient **Kapisa**) in Afghanistan, and others deep in the Sahara, as well as numerous examples in Scotland north of the Antonine Wall, in Scandinavia, and in northern Germany, prove that glass was popular with the barbarian neighbours of Rome and that they delighted especially in the better-class wares, including cut (figure 302) and painted glasses.'<sup>14</sup>

When the barbarians over-ran the Roman Empire, they had already absorbed glass. 'Those craftsmen who had emigrated to the northern provinces were not about to go home with the retreating armies. The Seine-Rhine glasshouses served a surprisingly large area; there were

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<sup>8</sup> Sotheby, glass, 37

<sup>9</sup> Sotheby, Encycl. 48

<sup>10</sup> Sotheby, Encycl. 49

<sup>11</sup> Dopsch, Economic and Social, 70

<sup>12</sup> Glass in Architecture, 30-3

<sup>13</sup> Singer, ii, 323

<sup>14</sup> Singer, ii, 324

miles of wooded forest, good quality sand, and river transport to reach the towns...<sup>15</sup> Further north, 'when the Romans finally left Britain the basic craft would have survived, even in a very primitive and practical form.'<sup>16</sup> We thus need to re-assess the situation. 'We should be wary of making too many hasty judgments about the northern civilization and its glass, which seemed clumsy and crude to experts steeped in the skillful moulded and carved perfection of the Roman period...' Although 'there is the recurring myth of isolation... this does not seem to be borne out by the latest research. The Seine-Rhine glasshouses, like the later Venetian houses, were established and well-known manufacturers of a product which was much in demand throughout the European trading area. Their work turns up in excavations as far apart as Ireland to the west and Russia to the east.'<sup>17</sup> Recent research suggests that the Roman collapse had far less effect on the glass makers north of the Alps than was once thought. For example the 'available chemical analyses of Rhineland glasses (table, p.313) seem to show that there was no interruption of the glassmakers' soda supplies in Merovingian times...In fact, the evidence of the analyses suggest no disruption of the industry in the Rhineland in the immediate post-Roman period...'<sup>18</sup>

The situation was far from static. Much of the old Roman technique was preserved, but through the centuries in the north the making of glass changed. For example the Roman techniques were 'replaced by a new style of glassware, known variously as Frankish, Merovingian or Teutonic. This glass was blown and, like Roman glass, was a soda-lime product, but decoration now consisted of simple techniques that could be carried out at the furnace by the glass-maker. The new style, used mainly for drinking vessels, flourished between the fifth and seventh centuries...Most discoveries have been made in Belgium and the Rhineland...'<sup>19</sup> It is worth noting three especially important influences which bent the early Roman excellence in a new direction as well as helping to preserve the great tradition.

One of these was Christianity, and in particular the new monastic order of the Benedictines. It was they who made glass sacred as well as useful, hence giving it a new use as a way of glorifying God and injecting huge amounts of skill and money into its development. This process accelerated from the ninth century. We are told that 'Among the monastic sites where glass has been found in ninth- and tenth-century contexts are Frafra in central Italy, San Vincenzo al Volturno in central Italy, where window glass, lamps and other vessels were manufactured, and Glastonbury in England. All three were Benedictine abbeys...' This leads the writer to wonder 'what role the Benedictines may have played in the preservation and dissemination of glass-making technology', adding in parenthesis that the 'earliest records of glass-making in Venice, from 982 and 1083, are documents connected with the Benedictine abbey of San Giorgio Maggiore.'<sup>20</sup>

Another author extends the argument somewhat by seeing the Benedictines as transmitters of the Roman legacy. 'In records from the high medieval period (the ninth to twelfth centuries), we often find the names of Benedictine monks and monasteries cited in connection with the production of glass. Benedictines .... preached the virtues of working in the fields and practising crafts. Furthermore, the monasteries were the most important centres of learning,

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<sup>15</sup> Enc. of Glass., 43

<sup>16</sup> Enc. of Glass, 128

<sup>17</sup> Enc. of Glass, 47

<sup>18</sup> Singer, ii, 325

<sup>19</sup> Klein and Lloyd, 41

<sup>20</sup> Sotheby, Encycl. 50

where the writings of Roman antiquity were transcribed and preserved. It is possible that knowledge of glass-working techniques survived through them.<sup>21</sup> The particular emphasis was on window glass and this would lead into one of the most powerful forces behind the extraordinary explosion of glass from the twelfth century that we shall deal with in the next chapter. The reasons for this are curious. 'Since the Church forbade the use of glass vessels for ritualistic purposes but encouraged the use of glass for windows, the monasteries, which had become the new centres of wealth and culture, began to concentrate more on glass for their abbey windows. In north-western Europe several monastic records of the ninth and tenth centuries mention a 'Fra Vitrearius' as a member of the religious community, who would have been in charge of the monastery's glass.'<sup>22</sup>

As well as the welding of two great forces, glass and Christianity, it is worth seeing the re-bounding effects of the Roman legacy. The Romans had learnt from the originators of glass in the eastern Mediterranean, but had then returned the gift by enriching glass making there. Even before Rome collapsed, northern European glass-making was benefiting from the eastern influence and it continued to re-invigorate glass-making after the collapse of the Roman Empire. A reservoir of skills and knowledge was maintained in Syria, Egypt and the Eastern Empire after the fall of the Roman Empire and it is quite clear that this had a dramatic effect on northern glass-makers.

Long ago Dopsch noted that 'A strong Hellenistic influence may also be traced in the glass-industry of the Lower Rhine (Cologne) where the early Christian products go back to the fourth century. As early as the second century glass-workers came from the Hellenistic East to the Rhine, and a similar influx occurred again in the middle of the following century.'<sup>23</sup> From the very beginning, northern European glass was influenced by both Roman and eastern techniques. 'By the second century A.D. the glass industry had spread from Italy to important new manufacturing centres with improved techniques around Cologne and Trier, whence it also reached Britain. Minor technical changes were diffused so fast that there must have been a constant movement of skilled glass-makers from the Near Eastern centres all across the empire.'<sup>24</sup> Likewise, speaking of the Seine-Rhine glass area, we are told that 'during the transition period (third to fourth century to the sixth century) there was a great deal of trading still going on between Syria and Europe.'<sup>25</sup> For example, 'the crown process, also known as the Normandy method, is probably of Syrian origin and was brought to the West by immigrant glassmakers.'<sup>26</sup> It is worth noting that this influence may well even have deeply influenced Italy itself. 'After the Roman decline in the west the blower's art was still maintained at a high pitch in the east... and it was from eastern workers that the Venetians presumably relearned their skilled methods.'<sup>27</sup>

The extensive and growing glass industry of northern Europe produced competing and different techniques. For example, there was a battle between the 'Latin' and 'Germanic' techniques well described as follows. 'There are two traditions of glass making in France. In

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<sup>21</sup> Liefkes, glass, 36

<sup>22</sup> Klein and Lloyd, Glass, 45

<sup>23</sup> Dopsch, European, 242

<sup>24</sup> Derry and Williams, Technology, 87

<sup>25</sup> Enc. of Glass., 43

<sup>26</sup> Enc. of Glass, 162

<sup>27</sup> Singer, ii, 337

and after medieval times glass making in Normandy represents the continuation of the oriental industry in Roman Gaul, perhaps refreshed by later contacts with Italy, especially L'Altere. Normandy stands for Latinity in French glass making. Its characteristic process is 'crown' window-glass made from a disk with a 'bull's-eye' in the centre, spun wider and wider. Lorraine, on the German border, belongs to the north; its process is forest-glass. In the Lorraine code (as in some ancient glass) the converse of 'crown' is 'broad'. In 'broad' the paraison is blown to form a cylinder, and the cylinder is split lengthwise and then unfolded flat. This gives ample area easily, but as a craft is far below 'crown'.'<sup>28</sup> This variation within a small geographical region will be important in later developments as the use of glass expands.

What then were the major uses for glass over this seven hundred year period? The major one was for utensils. 'Medieval glassware mainly consisted of beakers, goblets, bottles, and bowls....'<sup>29</sup> Though less elegant than the Roman ones, these were often of good quality. For example 'One of the most important groups of material found in Anglo-Saxon graves is the series of glass vessels... the variety of form and the attractive colours (yellows, greens, browns and blues) are extremely refreshing... Glass of Anglo-Saxon type, made both in Britain and on the Continent, is found in some profusion. The commonest forms are the squat jars and the palm cups...'<sup>30</sup>

Perhaps most significant, however, was the development of glazed windows, particularly in churches, and particularly the start of painted and stained glass manufacture. We are told that 'There are early references in texts and manuscripts to glazed windows, in Tours during the fifth century, and later in Sunderland...Only a few centuries later, there were at least three churches in the Frankish area which had sophisticated and carefully designed windows with remarkable painted detail... These early designs are clearly developed from mosaics.'<sup>31</sup> Amongst the most interesting of these early developments were those very far north at Jarrow and Monkwearmouth in northeastern England, dating to the period between 682 and c.870. 'Both sites produced thin soda-lime window glass, plain and coloured....Pale blue, olive-green, amber, yellow-brown, red and green-blue glass was found at both sites, and Monkwearmouth also produced emerald-green and dark cobalt-blue colours, and Jarrow **millefiori** glass (slices of coloured glass rods fused together). The panes were cut in triangular, rectangular and other shapes, and were originally set in leaded frames.' This was not unique. 'Window glass of similar date has also been found at Escomb Church and St Wystan's Church in Repton, Derbyshire.'<sup>32</sup> These were early beginnings but the widespread development, as we have seen with the Benedictine influence, occurs from the tenth century. 'By 1000, painted glass begins to be mentioned rather frequently in church records and there is one particularly full account of the furnishing of the first Benedictine Monastery at Monte Cassino with a series of windows in 1066...'<sup>33</sup>

The hints of the great window revolution are present, and there are also the first traces of the second major addition to the Roman repertory, that is glass mirrors. Mirrors as such seem to have been popular in the centuries after the collapse of Rome, but most of them were made of

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<sup>28</sup> Chambers, Encyclopedia, s.v. Glassware

<sup>29</sup> Liefkes, Glass, 36

<sup>30</sup> David Wilson, The Anglo Saxons, 105

<sup>31</sup> Enc. of Glass, 48

<sup>32</sup> Klein and Lloyd, Glass, 45

<sup>33</sup> McGrath, Glass in Arch., 100

metal. 'Small metallic mirrors with a highly polished surface were largely used during the middle ages: pocket mirrors or small hand mirrors carried at the girdle being indispensable adjuncts to ladies' toilets... in early Anglo-Saxon times mirrors were well known in England. It is a remarkable fact that on many of the sculptured stones of Scotland, belonging probably to the 7th, 8th or 9th century, representations of mirrors, mirror-cases and combs occur.'<sup>34</sup> But there were also starting to be small glass mirrors, for we are told that 'Other types of glass from northwestern Europe and the British Isles include ... mirrors, which occur in ninth- or tenth-century contexts at Birka and Haithabu in Denmark.'<sup>35</sup>

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This preliminary sketch of the seven hundred years after the fall of the western Roman Empire puts us in a position to understand certain things. The evidence about the state of glass making in western Europe in about 1100 was previously contradictory. On the one hand there were indications of very considerable knowledge of techniques and skill of manufacture. Two such indications were as follows. The famous book by Theophilus 'On Divers Arts', written in about 1120 contains a very detailed and sophisticated account of glass-making which shows that much of the Roman experience was then known. Consisting of some XX pages it covers, among other topics XXX. A civilization which could produce this, and which considered glass-making to be alongside painting & metal work, one of the very most important 'Arts' was clearly in a good position to exploit the substances. A second indication is the development of stained glass windows from about the middle of the eleventh century, which already showed some sophistication. A third, as we shall see is the way in which glass-making so rapidly developed further from the twelfth century - inconceivable without a widely distributed industry and network already in place. Yet against all this could be placed the fact that, certainly until recently, there seemed, apart from the window glass, so little surviving glass in the way of ordinary objects. We can now see that this was probably not because it could not, or was not, made, but for other reasons.

The implications of this for the larger story are considerable. Even by the eleventh century, things are happening in western Europe, and of course even more so in Islamic societies, which, as we shall see, were not happening in China, Japan or India. After the enormous burst of glass under the Romans, and a temporary and partial decline, the civilization was growing richer and glass working, never forgotten, would be part of that revival. Only when we realize the strength of the tradition will be prepared to understand the even greater divergence that occurred between the two ends of Eurasia from the twelfth century.

Thus there are two rather different and apparently contradictory conclusions to this chapter. On the one hand, up to about 1200 it would be true to say that glass had had only a limited influence on thought, whether in eastern or western Eur-Asia. On the other hand, the trajectory of the knowledge and use of glass in other ways, which would feed into the medieval glass explosion, is very important and needs to be appreciated. The potentials were there, even if they had not yet been exploited.

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<sup>34</sup> Enc. Brit, 576

<sup>35</sup> Sotheby, Encycl. 50