Analysis and Interpretation of a Unique Arabic Finger Ring from the Viking Age Town of Birka, Sweden

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Summary: In this work we used non-destructive SEM imaging and EDS analysis to characterize the material composition of an Arabic finger ring, which was found in a 9th c. woman’s grave at the Viking Age (A.D. 793–1066) trading center of Birka, Sweden. The ring is set with a violet stone inscribed with Arabic Kufic writing, here interpreted as reading “il-la-lah”, i.e. “For/to Allah”. The stone was previously thought to be an amethyst, but the current results show it to be coloured glass. The ring has been cast in a high-grade silver alloy (94.5/5.5 Ag/Cu) and retains the post-casting marks from the filing done to remove flash and mold lines. Thus, the ring has rarely been worn, and likely passed from the silversmith to the woman buried at Birka with few owners in between. The ring may therefore constitute material evidence for direct interactions between Viking Age Scandinavia and the Islamic world. Being the only ring with an Arabic inscription found at a Scandinavian archaeological site, it is a unique object among Swedish Viking Age material. The technical analysis presented here provides a better understanding of the properties and background of this intriguing piece of jewelry. SCANNING 9999:XX–XX, 2015. © 2015 Wiley Periodicals, Inc.

Key words: scanning electron microscopy (SEM), archaeology, Allah, Kufic Arabic, Islamic jewelry

Introduction

Birka, often considered Sweden’s first town, had a strategic location on the island Björkö, 25 km west of modern-day Stockholm (Ambrosiani, 2012). Archaeological excavations of Birka have unearthed numerous objects from distant places, testifying to Birka’s importance as a trading center during the Viking Age (A.D. 793–1066) (cf. Hägg, ’83; Jansson, ’85a, ’88; Duczko, ’97; Ambrosiani and Gustin, 2003; Sindbæk 2012; Ambrosiani, 2013). One of the most significant finds is an Arabic-style finger ring (Fig. 1), found by archaeologist Hjalmar Stolpe during the 1872–1895 excavations of the Birka grave fields. This ring is now housed at the Swedish History Museum in Stockholm, where the inventory catalogue describes it as being of gilded silver, set with a violet amethyst inscribed with the word “Allah” in Arabic Kufic writing. Even though a few rings of similar design have been encountered at Birka and other archaeological sites (Jansson, ’88), this is the only Viking Age ring with an Arabic inscription found in Scandinavia, which affords it a unique status. However, a proper technical analysis of the ring has so far not been carried out, and its material composition has been questioned. It was recently decided that a replica of the ring should be made, and this provided us with an opportunity to examine the ring using non-destructive methods. Here, we present the results of this investigation, which mainly is based on SEM–EDS imaging and elemental analysis.
Materials

The ring was found in grave 515 (Swedish History Museum; SHM 34000, Bj 515; FID 106842), located in grave field 2A north of Borg on the Björkö Island. The grave contained a rectangular wooden coffin, and although the skeleton was completely decomposed, the clothes, jewelry, an equal-armed brooch, and two characteristic oval brooches of type P 27b (Jansson, ’85b) show it to be a female burial dating to circa AD 850. The ring was encountered where the woman’s chest would have been, slightly below the right oval brooch and next to a pair of scissors (Arbman, ’55). From the left oval brooch a needle case was hanging in a chain, and it seems possible that also the ring and the scissors had been attached to the (right) oval brooch, i.e. with a now-lost string. Yet, as the burial position of the woman is unknown, it is also possible that she was laid to rest with her hands on her chest, and with the ring on one of her fingers. Between the two brooches was a row of beads made from glass, rock crystal, and carnelian (Fig. S1). The last two materials could originate from India or Caucasus, although also Yemen was known for its carnelian (Danielsson, ’73; Arrehnius, ’78; Jansson ’85b, cat. no 15). In addition, some of the glass beads have a foreign appearance, and were likely imported. The woman’s brooches and clothing are however typical Scandinavian. The clothing included an undergarment of flax and a garment of blue wool, likely dyed with woad (Geijer, ’38; Hägg, ’74; Jansson, ’85b).

The ring is a normal-size finger ring, measuring 19 mm in outer shank diameter and 26 mm from the bottom of the shank to the top of the stone. It is made of white metal, set with a pink/violet stone with an Arabic inscription (Fig. 1 and S2). The overall design, with four low prongs holding the oval cabochon-cut stone, is also Arabic (Arne, ’14; Jansson, ’88). Three other rings of this design have been found at Birka: one as a stray find in the Black Earth, and the other two in graves Bj 526 and 791 (Figs. S3–5). The ring in the latter grave displays flower ornamentation typical for the Seljuk culture in Asia Minor. At Birka, it was not used as a finger-ring, but had been made into a decorative amulet together with an added silver bead (Fig. S5). Other Birka finds include a similar ring missing a stone, and a stone of carnelian thought to belong to a ring (Fig. S6). Rings of this Arabic type have furthermore been encountered in trading posts in Eastern Europe, such as Polom, Poltava, and Verchnee Saltovo (Arne, ’14, Figs. 326–328), and in what appears to be a male grave in the Tankeevka cemetery in Tatarstan (Androshchuk, 2013 Fig. 81:4). These other rings do however not carry inscriptions. During the Viking Age rings with Arabic writing are rather uncommon in Europe, and only a handful have so far been encountered (Roman Kovalev, personal communication). The Birka ring is the only one found in Scandinavia, and because of its engraving, it has often been interpreted as a signet ring (Arne, ’14; Arbman, ’40; ’55; Aiken and Arwidsson, ’86).

Methods

The ring was examined with a standard optical stereomicroscope (E. Leitz GmbH) as well as with a table-top Hitachi TM-3000 scanning electron microscope (SEM), operating at 15 kV and equipped for elemental analysis (SEM–EDS). The SEM investigation was done without coating the object, using high vacuum (10⁻⁵ Torr) for the metal surface analysis, and low vacuum (10⁻³ Torr) for the analysis of the stone (to avoid charge build-up). SEM-EDS data was recorded for five minutes at each measured point. Multiple photographs of the ring, taken from different angles with a digital SLR camera (Canon EOS 600D), were stitched together into a 3D model using the Agisoft PhotoScan software (Agisoft LLC, Russia).

Results

Photographs of the ring are shown in Fig. 1, and a 3D model of the ring is shown in Fig. S8. Digital 3D models
have previously proven useful for visualizing intricate details (Neiß et al., 2014) and for accurate metric measurements (Sholts et al., 2011) of archaeological material. The current 3D model is included to give the reader a better visual understanding of the ring. SEM images of details of the ring are shown in Fig. 2. Remnants of organic material are present in the crevices under the stone (Fig. 2), which is not uncommon in archaeologically excavated objects. The ring shank is broken in three places, and the parts have been clumsily glued together. SEM-EDS analysis showed the joins to contain only organic material – no traces of soldering material were observed. It is not clear whether the ring was broken when it was unearthed in the late 1800’s, but it might have been. The appearance of the glue is not consistent with 1,000-year old animal glue, which anyway would be too weak to hold small metal parts. Most likely it is a modern polymer adhesive, although no documentation regarding such repairs has been found. The alloy was found to consist of 94.5% Ag and 5.5% Cu (Fig. 3 and Table 1). Also Cl and S were detected, indicating the presence of the common silver corrosion products AgCl and AgS. This is consistent with the blackened metal surface. No gold was detected on the metal surface. In many places natural interdendritic surface corrosion in the eutectic reveals the microstructure of the material (Fig. 2), alleviating the need for surface-etching or destructive cross-section sampling. The dendritic patterns of this microstructure (Berthelon, 2007) allow us to conclude that the ring was cast without further manipulation (as expected). The metal surface furthermore exhibits ubiquitous parallel striations (Fig. 2). These striations arguably originate from filing carried out to remove flash and mold lines after the casting, and the presence of file marks on the prong tops (Fig. 2) indicates that the filing took place before the stone was set (otherwise the stone would have been damaged). Together with the absence of gold on the metal surface (i.e., the SEM-EDS results), the file marks clearly show that the previous description of the ring as gilded was mistaken: if the surface had been gilt and the gold layer had worn away, also the file markings would have been gone. But the metal surface displays no wear, and as the original file marks are still in place, this ring has never been much used.

For the stone, SEM–EDS analysis identified the elements O (70.4%), Si (20.6%), Na (3.7%), Mg (2.5%), Ca (0.8%), K (0.7%), and Al (0.7%) (Fig. S7). This is a composition typical for soda-lime glass, even though the amount of oxygen is at the high end (this might relate to the calibration of the table-top SEM). Examination under a light microscope revealed numerous spherical air bubbles inside the stone. Such bubbles are typical for manufactured glass, but unheard of in natural crystalline
materials (they might be found in e.g. amorphous volcanic rock). We conclude that the stone is not an amethyst, as previously thought, but consists of coloured glass. The colouring agent(s) is unknown, as the elements responsible for the violet hue appear to be below the detection limit of the employed SEM instrument. Further elucidation of the colouring agents would likely require destructive analysis. In difference from the metal, the stone displays moderate use-wear in the form of scratches and dents. This could be interpreted as the stone being older than the mounting – perhaps the stone was reused from an older piece of jewelry? On the other hand, the stone is the most exposed part of a ring, and here it is made from a relatively soft material, i.e. glass with a typical Mohs hardness of 5.5–6.5. It is therefore not surprising that the stone displays more wear than the silver mounting. When jewelry was inscribed in ancient times, the gemcutters usually preferred slightly harder quartz-based materials such as agate, amethyst, and onyx (King, 2003; Schumann, 2011), all of which have a Mohs hardness around 7. Considering that the inscription is located on top of the stone, it is actually quite well preserved, which is in line with the ring body displaying minimal use-wear.

The inscription is written in a lapidary form of Arabic Kufic script (Figs. 1, 4, and S2). This angular script was developed in the 7th c., dominated Arabic writing in the 8th–10th c., and waned in popularity during the 12th c. when it was replaced by the cursive Naskh style. In our

### Table 1  
Elemental composition of the ring surface, analyzed with SEM-EDS (cf. Fig. 3). The results are interpreted as a 94.5/5.5 Ag/Cu alloy displaying AgS and AgCl₂ corrosion. Al, Na, P, Si, and Mg are typical earth elements, and are commonly found on the surface of archaeologically excavated objects.

<table>
<thead>
<tr>
<th>Element</th>
<th>AN</th>
<th>Series</th>
<th>Net unn. [wt.%]</th>
<th>C norm. [wt.%]</th>
<th>C Atom. [at.%]</th>
<th>C Error [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silver</td>
<td>47</td>
<td>L-series</td>
<td>222622</td>
<td>81.42</td>
<td>84.42</td>
<td>63.54</td>
</tr>
<tr>
<td>Chlorine</td>
<td>17</td>
<td>K-series</td>
<td>28205</td>
<td>5.96</td>
<td>6.18</td>
<td>14.15</td>
</tr>
<tr>
<td>Copper</td>
<td>29</td>
<td>K-series</td>
<td>2187</td>
<td>2.79</td>
<td>2.89</td>
<td>3.70</td>
</tr>
<tr>
<td>Sulfur</td>
<td>16</td>
<td>K-series</td>
<td>11877</td>
<td>2.41</td>
<td>2.49</td>
<td>6.32</td>
</tr>
<tr>
<td>Aluminium</td>
<td>13</td>
<td>K-series</td>
<td>4283</td>
<td>1.22</td>
<td>1.27</td>
<td>3.81</td>
</tr>
<tr>
<td>Sodium</td>
<td>11</td>
<td>K-series</td>
<td>1718</td>
<td>0.94</td>
<td>0.97</td>
<td>3.44</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>15</td>
<td>K-series</td>
<td>4183</td>
<td>0.92</td>
<td>0.95</td>
<td>2.50</td>
</tr>
<tr>
<td>Silicon</td>
<td>14</td>
<td>K-series</td>
<td>1816</td>
<td>0.43</td>
<td>0.45</td>
<td>1.30</td>
</tr>
<tr>
<td>Magnesium</td>
<td>12</td>
<td>K-series</td>
<td>983</td>
<td>0.36</td>
<td>0.37</td>
<td>1.25</td>
</tr>
<tr>
<td>Total:</td>
<td></td>
<td></td>
<td>96.46</td>
<td>100.00</td>
<td>100.00</td>
<td></td>
</tr>
</tbody>
</table>
case, the angular style and the absence of a shidda sign indicates an early version of Kufic, which is consistent with the grave at Birka dating to around AD 850. From right to left, the characters appear to read “AL__LLH”, which we interpret as “il-la-lah”, i.e. “For/to Allah”. Compare Figs. 1 and S2.

For the stone, we must remember that even though coloured glass might today be perceived as a “fake” material of lower value, this was not necessarily so in the past. Even though glass production began around 5,000 years ago in the Levant (Nicholson and Shaw, 2000; Glover et al., 2003), it was still an exotic material in Viking Age Scandinavia. Judging by archaeological finds from pre-historic Scandinavian workshops, it appears that the craftsmen had learned the basics of glass-working, but did not yet master glass-production (Callmer, ’77; Glover et al., 2003; Wärmländer et al., 2010). Glass was consequently a prestigious material that had to be imported, either as ready-made objects such as bottles and beakers, or as rods or shattered fragments that the local artisans could work into highly valued coloured beads. Even if the woman in grave 515 knew that the stone in her ring was made from glass, she would not have considered it “fake”.

For the ring body, the presence of original filing marks is in stark contrast to most objects in the Birka graves, where the standard copper-alloy jewelry almost always displays some degree of wear. Grave goods in expensive silver were relatively uncommon during the Viking Age, and a proper use-wear study of the existing silver jewelry still needs to be carried out. The most common silver objects in the Birka grave fields are coins, all of which were imported: the first indigenous Swedish coins were minted in A.D. 995 in the city of Sigtuna, i.e. just after Birka had been abandoned (Malmer, 2002; 2010). Many of the coins at Birka came from the Caliphate, and had high proportions of silver, mainly provided by the rich silver mines in Panjshir, Afghanistan (Negmatov, ’99). Such silver coins were frequently used as raw material by Scandinavian silver smiths (Kovalev, 2002; Eniosova and Mitoyan, 2011; Boytrup et al., 2013). Given its Arabic style, the high silver content in the studied ring is therefore not unexpected. In difference from the ring, though, the Arabic silver coins that found their way to Viking Age Scandinavia were usually worn and torn (Gullbekk, 2012; Hovén, ’85) from passing many hands along the established trade routes (Noonan, ’89; ’90; Rezakhani 2010).

When items retaining fresh production marks are encountered in excavated graves, it can be speculated that they were purpose-manufactured as grave offerings by local craftsmen (cf. Trotzig, ’69). In our case though, we know that the ring was produced far outside Scandinavia, and being buried in the Birka grave fields was hardly the main rationale behind its production. We can only guess what purpose the ring originally was meant to serve, although it was likely not intended for everyday use. The previously suggested idea that it was a signet ring (Arne, ’14; Arbman, ’40; ’55; Aiken and Arwidsson, ’86) should probably be discarded: even though engraved rings were often used for such purposes in societies where most people could not read or write

Discussion and Conclusions

Our analysis shows that the studied ring consists of a high-quality (94.5%) non-gilded silver alloy, set with a stone of coloured soda-lime glass with an Arabic inscription reading some version of the word “Allah”. Thus, the previous description of this item as a signet ring consisting of gilded silver set with an amethyst was not entirely correct. This raises the question whether the absence of expensive materials in the ring (from a modern point of view) demotes its historic importance or value? The simple answer is: not at all. The significance of this ring has never been based on its purported material composition, but on its connection to the Islamic world. This connection is now not only confirmed, but actually strengthened due to the mint condition of the ring’s metal body, as will be discussed below.

Fig 4. The Arabic inscription in the stone, engraved with early Kufic characters. From right to left it appears to read “AL__LLH”, which we interpret as “il-la-lah”, i.e. “For/to Allah”. Compare Figs. 1 and S2.
and where written signatures had no legal status, it would be unusual to employ a god’s name as your seal. Although harder than wax (as used in seals), glass is furthermore not an ideal material for a signet ring, although in this case such use would be compatible with the stone displaying much more wear than the metal body. The lack of wear on the silver surface suggests that the ring passed from the Arabic silversmith who made it to the woman in grave 515 with few, if any, owners in between. Even though the decomposed state of the bones in the grave precludes any biochemical analysis, which otherwise could have shed light on the geographic or ethnic origin of the buried woman, it is not impossible that the woman herself, or someone close to her, might have visited - or even originate from - the Caliphate or its surrounding regions.

Such long-distance travelling during the Viking Age is of course mentioned both on Swedish rune stones and in Mediaeval written texts (Birkeland, ’54; Androshchuk, 2012; Mikkelsen 2012; Montgomery, 2012; Shepard, 2012; Jonsson Hraundal, 2013). In addition to Scandinavian expeditions to distant places, it appears also northermost Europe was visited by foreigners. For example, the Hiberno-Arabic traveler Yacoub al-Tartushi has provided a lively description of the Viking Age town of Hedeby, which makes it likely that he visited at least southern Scandinavia (i.e. Jutland) (Birkeland, ’54 with references; Mikkelsen, 2012). However, the ancient texts also mention encounters with giants and dragons (as in the Icelandic Saga of Ingvar the Far-Travelled (Pålsson and Edwards, ’89). Thus, it is not always easy to tell fact from fiction, especially as the old texts usually were written down based on hearsay. When backed up by physical evidence, on the other hand, peoples’ stories become much more credible. By that standard, the importance of the studied Birka ring is that it most eloquently corroborates ancient tales about direct contacts between Viking Age Scandinavia and the Islamic world. Such contacts must have facilitated exchange of goods, culture, ideas, and news much more efficiently than indirect trade involving several merchants in-between. The material analysis conducted here therefore not only improves our understanding of the finger ring itself, but also helps to advance our knowledge of the historic period from which it came to us.

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References


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