Jeanette Varberg, Flemming Kaul & Bernard Gratuze

Bronze Age Glass and Amber

Evidence of Bronze Age long distance exchange

Small beads of glass and amber tell a fascinating story of long distance exchange during the Bronze Age, connecting Egypt and Mesopotamia with South Scandinavia. The beads themselves do not carry any iconography in a narrow sense. However, the material and the colour of the glass beads and of the amber beads may entail a deeper meaning related to Bronze Age religion and cosmology.

Introduction

During the last decades, the methods related to chemical analyses of ancient glass have improved dramatically, complemented by the increasing amount of material available for comparative studies. By recognizing different chemical trace elements related to the vitreous material itself as well as the colorant, it is now possible to identify glass from Egypt and Mesopotamia, and to distinguish glass from these two principal production areas of the Middle Bronze Age. It is also possible identify glass from the later glass production workshops in Northern Italy, in the Po Plain, such as Frattesina (after c. 1200 BC) (Walton et al. 2009; Shortland 2012; Walton et al. 2012; Gratuze 2013; Rehren & Freestone 2015). Thus, every glass bead, from well dated Danish burial contexts, can reveal a history of Bronze Age long distance exchange networks. Only Mesopotamian and Egyptian glass has been identified in the Danish Bronze Age bead material.

Nordic amber and Near East glass meet in some of the Bronze Age finds. In the North, in Denmark/North Germany, glass beads and amber beads are often found closely together, in richly furnished graves. When going from North to South, at the 'middle stations' of the long distance exchange networks, the same pattern of glass-amber-connection can be observed, in burials as well as in votive depositions. Even finds from the Mediterranean demonstrate this connection between those two materials coming from 'each end of the world'. Probably, the association of glass and amber was related to much more than just economics or prestige display. As we shall see below, we may be able to discern additional layers of meanings of the glass/amber interplay, with connotations entrenched into Bronze Age religion and cosmology.

In 2013, a research project was launched (the initiator of the research program being J. Varberg), focusing on Danish Middle Bronze Age glass beads (Early Bronze Age in Scandinavian chronological nomenclature, Nordic Bronze Age Period II and Period III)) from well dated burial contexts, c. 1400-1100 BC. The project has been named: *"Long distance exchange in Bronze Age Europe and beyond."* The broader project-title reflects that it is not just the evidence of the glass beads that are included. Together with beads of amber, the glass beads forms one of the facets illustrating the increasing intensity of long distance exchange, marking important steps towards the globalization of the 'Bronze Age world'. The glass beads and the amber beads connect nearly 'both ends of the Bronze Age world', in the South even beyond the

Mediterranean. By 1400 BC, long distance exchange systems had evolved connecting the shores of the Euphrates and Tigris rivers in Mesopotamia and the Nile in Egypt with the beaches of the Baltic and North Seas, as well as at key sites in between, such a Mycenae. Nordic amber shows the opposite direction, where, among others, the Danish Jutland amber shores are connected with the Mediterranean and Syria and probably even Egypt.

The glass beads have been analyzed by laser ablation-inductively coupled plasma-mass spectrometry (LA-ICP-MS). The technique requires no special preparation of the samples and is virtually non-destructive (Gratuze 2013). The chemical analyses were carried out at Institut de Recherche sur les Archéomatériaux, CNRS, Université d'Orléans, France. Most of the glass beads analyzed are from Danish burials, from West Jutland in the west, to Baltic Sea island of Bornholm in the east. The glass beads belong to the collections of the Danish National Museum and the collections of the Danish regional museums. A smaller number of beads belonging to the collections of German and Romanian Museums are included in the project.

In the present research project, 52 glass beads from 39 Danish Middle Bronze Age burials have been analysed out of a total of 214 registered beads. Since several graves contained more than one bead, morphologically alike, only a few out of the many were selected for analyses. The glass beads from Schleswig-Holstein has not yet been included in our project. Also from this region, being part of the "Nordic Bronze Age Culture", a significant number of glass beads comes from well documented burial contexts (see for instance Aner & Kersten 1978).

In the following, we shall not go into the documentation details of the chemistry of the glass beads (see Varberg et al. 2015; Varberg et al. 2016). Our primary aim is to present and to discuss the context of the glass beads found in Denmark, made of Egyptian and Mesopotamian glass, and with a particular focus on three Period II burials (around 1400 BC).

Glass and amber. Three Middle Bronze Age Burials

As significant representatives of the richly furnished Danish Middle Bronze Age burials with glass beads and amber beads, three burials, all oak coffin graves covered by a large burial mound will be highlighted, including the different find histories. They all belong to Period II of the Nordic Bronze Age, probably of the 'mature' part of that period, between 1400 and 1300 BC. (In Scandinavian chronological nomenclature, this period belong to the "Nordic Early Bronze Age). They are all female burials, which is typical for the gender context of burials, although glass beads occur sporadically in male and children burials (Kaul & Varberg 2017).

Skrydstrup, South Jutland, Denmark, 1944, a prelude

During the Second World War, the Nazi German occupation of Denmark (9th of April 1940 to 5th of May 1945) caused a large number of excavations – or rather rescue excavations – carried out by the National Museum of Denmark. The construction of larger military works such as the coastal defences at the west coast of Jutland caused the destruction of many Stone Age and Bronze Age burial mounds.

Shortly after 9th of April 1940, negotiations between the Danish authorities and the German occupation authorities were commenced, regarding the jurisdiction as to the archaeological excavation work soon to come, when monuments normally protected by the Danish heritage regulations had to be demolished. Even though the Danish heritage regulations was set aside, it was possible to meet a principal Danish demand, namely that the excavation work should remain under Danish control (Nørlund 1946). A Danish archaeologist from the National Museum (or from a local museum, related to the National Museum) should direct the excavation in

question, and therefore, the find material recovered was Danish property. Furthermore, according to this Danish 'agreement', the German occupation authorities should carry the costs of the excavations. The payments came through by means of the so-called 'clearing account'. However, the fiscal coverage of the 'clearing account' was connected to the National Bank of Denmark. Consequently, the Danish State eventually became the primary financial source for these excavations, caused by the imposed military building activities of the German occupation powers. But still, the excavations themselves remained under Danish control. In other countries, especially in Eastern Europe matters were quite different, where Nazi (*"Ahnenerbe"*) excavations were carried out without any cooperation with what may have remained of state or local antiquarian authorities (Halle & Mahsarski 2013; Mahsarski & Schöbel 2013).

Already during the summer 1940, *Luftwaffe* began airfield construction works. At Klosterheden, near Lemvig, North Jutland, the archaeologists of the National Museum soon had to excavate a number of Neolithic burial mounds. In late 1943, a new *Luftwaffe* airfield at Skrydstrup, South Jutland, came on the drawing board. During the winter 1944, dark clouds were emerging for the inhabitants of the Skrydstrup village and neighboring hamlets. Not just the fields of the farmers were confiscated by the German occupation power, but also the homes of the villagers. About 500 people lost their homes, though an economical compensation was given. In August 1944, a larger airfield with cemented runway and hangar facilities was ready for service, named *"Fliegerhorst Hadersleben"*. However, at this time, during the last year of the war, its contribution to the war effort was limited. The plans of a *Luftwaffe* bomber squadron and combat aircrafts being stationed at Skrydstrup could not comply with the increasingly weakened military and logistic power of Nazi Germany. Furthermore, in February 1945, a train with aircraft fuel for Skrydstrup was blown up by resistance movement saboteurs.

From 1953 the airfield was refurbished. Today *Flyvestation Skrydstrup* is the home of "Fighter Wing Skrydstrup", the Danish Air Force F16 squadrons.

Skrydstrup, South Jutland, Denmark, excavation and results

It was in May and June 1944 that curator C. J. Becker from the National Museum directed the excavation of two Bronze Age burial mounds, which had to be demolished prior to the airfield construction works. Even though the area was under German military control, the direction of the excavation itself was entirely in the hands of the National Museum (in Dan-

Fig. 1. Skrydstrup, South Jutland, the Bronze Age barrow with its well preserved revetment wall, excavated May 1944. Three photos combined. Photo. C. J. Becker, the National Museum of Denmark.

ish from the excavation report: *"Ledelsen af Arbejdet var uden Indskrænkning i Hænderne paa Nationalmuseet."*).

The barrow, with a diameter of 28 m, was well preserved, and the excavation revealed a kerb stone arrangement in two phases (Becker 1946; Aner & Kersten 1984, no. 3521). The primary stone kerb was splendidly built, and it appeared as a true revetment wall standing almost vertically to a height of 1 meter (Fig. 1). The primary burial, an inhumation grave in an oak coffin (not preserved) supported by a layer of stones, contained a bronze dagger and an arm ring. A secondary burial in the SE part of the mound, a richly equipped female burial, was another oak coffin inhumation grave, the oak coffin supported by stones. Pieces of tooth enamel was the only physical remains. The wealthy Bronze Age woman carried a spiral decorated belt plate (Fig. 2), and at the belt she also carried a disc shaped amber bead (Fig. 3). At her arms she carried a bronze arm rings and close to her head and shoulders a fibula (dress pin) was found. At the place of her ears, two small bronze rings were found. A complicated neck ornament consisted of a twisted bronze neck ring and a necklace of thin bronze spiral thread beads, five amber beads, and last but not least a blue glass bead. Even though the bronze parts of the neck ornament are poorly preserved, the glass bead keeps still its clear translucent, blue glow (Fig. 4).

This female barrow burial from Skrydstrup (Becker 1946; Aner & Kersten 1984, no. 3521 D) provides an excellent example of how beads of glass and amber are closely connected. Here, in the necklace, the glass bead and the amber beads were virtually touching each other (Fig. 5). When C.J. Becker in June 1944 left Skrydstrup, in time of war, where Junkers and Messerschmitt aircrafts were soon to come into service, he might have pondered over the find of the blue glass bead, and the evidence of peaceful long distance exchange, which this particular valuable and exotic object seemingly presented (Becker 1946). At any rate, ten years after, in a scholarly article, C.J.

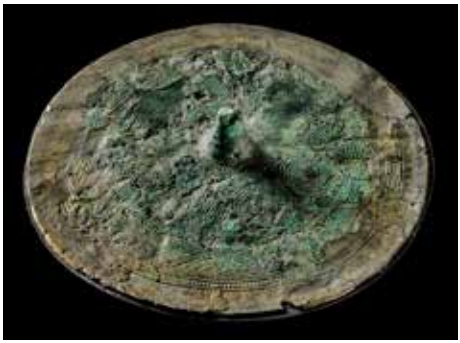

Fig. 2. Skrydstrup, the spiral decorated belt plate, c. 1400 BC. Diameter: 8.7 cm. Photo: J. Lee, the National Museum of Denmark.

Fig 3. Skrydstrup, the disc shaped amber bead found close to the belt plate, c. 1400 BC. Photo: J. Lee, the National Museum of Denmark.

Fig. 4. Skrydstrup, a blue glass bead, part of a neck ornament, c. 1400 BC. Diameter: 0.8 cm. Photo: A. Mikkelsen, the National Museum of Denmark.

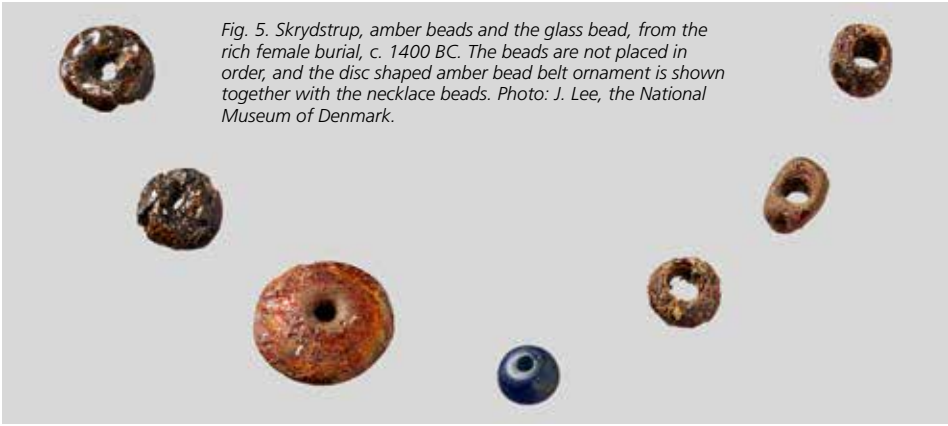

Fig. 5. Skrydstrup, amber beads and the glass bead, from the rich female burial, c. 1400 BC. The beads are not placed in order, and the disc shaped amber bead belt ornament is shown together with the necklace beads. Photo: J. Lee, the National Museum of Denmark.

Becker expresses most clearly his opinion of the glass beads demonstrating the widest extent of the Bronze Age exchange networks: "The… place of production has not yet been determined with certainty, but undoubtedly it must be sought so remotely as the countries around the eastern Mediterranean, if not more distant still. The various imported beads, some of which also occur in Danish finds, illustrate the wide extent of commercial exchange in Europe's Bronze Age and must naturally be viewed in connection with the appearance of Nordic – presumably Jutlandic – amber – over the greater part of Europe in the same centuries." (Becker 1954, 251).

Today, through the development of archaeometrical chemical analyses methods, it is now possible on a scientific basis, to determine the origin of our Bronze Age glass material. The glass of the bead from Skrydstrup was produced beyond the Eastern Mediterranean, in Mesopotamia (in a wide geographical sense, including areas of Iraq, Syria and SE Turkey) (Varberg et al. 2015).

As with all the glass beads treated here, the chemical analyses demonstrated that the Skrydstrup bead is of soda glass, with soda as the primary flux (lowering the smelting point of the quartz powder), the high magnesia and potash values indicating plant ash as source for the soda, ashes from plants such as Salicornia sp. or Salsola kali. The colourant is determined as cobalt oxide. By means of other metallic trace elements related to the cobalt it is possible to distinguish between Mesopotamian and Egyptian cobalt coloured glass. The colorant trace elements shows resemblances with the elements seen in a series of small blue votive glass axes deposited in the temple precinct of Nippur, Iraq (Walton et al. 2012; Varberg et al., 2015).

Melby, North Zealand, Denmark, 1967

Even though the burial mound at Skrydstrup was excavated at war time, the excavation was well organized, and the finds and their position was thoroughly documented. When coming to our next example of a rich Middle Bronze Age burial, from Melby, North Zealand, there was no such planned procedure. An almost totally obliterated burial mound had been ploughed over for many years – not included as a protected monument – and in October 1967 the plough apparently came deeper, and some stones came to light (Aner & Kersten 1973, no. 243 I). A local, interested in archaeology, made some diggings where the stones had turned up, where the plough had gone deep. When he had found a bronze dagger, a bronze neck collar and some bronze tubes, he contacted the National Museum. Curator H. Thrane was the one who led this salvage operation, where the plough

had disturbed so much. It turned up that it was an oak coffin burial, the oak coffin supported by some stones. Thrane found some objects in 'disturbed soil', not *in situ*, though probably not far from their original position in the grave. This includes some amber beads, and a blue spherical glass bead.

From the description of the find situation, it is possible to relate the dress ornaments and equipment of the Melby woman to her body (Fig. 6). She was equipped with a spiral decorated belt plate, a neck collar, also decorated with spirals, and two tutuli, all in bronze. About 100 small bronze tubes represent a corded skirt (like the famous corded skirt of the "Egtved girl" from the same time). The remains of the woollen cord are still preserved inside some of the tubes. At her belt she carried a bronze dagger, the hilt with spiral decoration. Probably at her left arm/wrist she carried a set of beads: Two amber beads, one of them in the shape of an axe, a spiral bead of bronze and the blue glass bead (Fig. 7).

As with the bead from Skrydstrup, the chemical analysis shows that the glass of the Melby bead was of Mesopotamian origin (Fig. 8). Again, we are dealing with a cobalt colourant as seen in the votive glass axes from the temple precinct in Nippur, Iraq (Walton et al. 2012; Varberg et al. 2015; Kaul et al. 2015).

Fig. 6. The objects of the Melby grave, North Zealand, Denmark, c. 1400 BC. The many bronze tubes tell us that the women wore a corded skirt. Photo: J. Lee, the National Museum of Denmark.

Fig. 7. The beads from the Melby grave, a blue glass bead of Mesopotamian glass and two amber beads, one in the form of an axe. Diameter of the glass bead: 0.8 cm. Photo: J. Lee, the National Museum of Denmark.

Fig. 8. The blue glass bead from Melby, North Zealand, Denmark. Diameter: 0.8 cm. Photo: John Lee, the National Museum of Denmark.

Ølby, East Zealand, Denmark, 1880

The excavation of the Ølby Bronze Age barrow was well planned. Although it was carried out 140 years ago, the documentation standards are admirable. Even the stratigraphy of the mound was described, including a sketch of the layers (Boye 1896; Aner & Kersten 1973, no. 299; Jensen 1998; Randsborg & Christensen 2006; Reiter et al. 2019). When the farmer had removed more than a third of the burial mound, he contacted the National Museum, so that the central part of the mound could be excavated by the specialists. The researcher, who conducted the excavation, was (to come) the leading Danish archaeologist of the time, Sophus

Fig. 9. The Ølby Bronze Age burial mound, East Zealand, Denmark. Photo: F. Kaul, 2017.

Müller. Twelve years after, he became director at the National Museum. After the excavation, the Ølby mound became a protected heritage site. Today, it still stands as a great monument, the mound reaching a height of about 4.5 m. (Fig. 9).

Close to the centre of the mound, the still visible though decayed oak coffin contained the remains of the Ølby woman. Her maxilla and mandible was well preserved. Although other parts of the skeleton was recognizable, they were not well preserved. The Ølby woman was equipped with a spiral decorated belt plate (Fig. 10), a neck collar, also decorated with spirals, and four tutuli, all in bronze. She carried a dagger made from the lower part of the blade of the sword. More than 125 bronze tubes in two rows below the belt plate represent a corded skirt, the remains of the woollen cord still preserved inside some tubes. (Fig. 11). At her left arm, she carried four beads: a bronze spiral bead, two amber beads and a blue glass bead (Fig. 12). The chemical analysis of the glass shows that it was made of Egyptian cobalt glass (Varberg et al. 2015; Kaul et al. 2015; see also below).

Most recently, new investigations of the Ølby woman and her bronze objects have been carried out (Reiter et al. 2019). Multi-

Fig. 11. The excavation plan of the Ølby oak coffin grave, East Zealand, c. 1400 BC. The place of the glass bead is marked. Drawing: The excavation report archive, the National Museum of Denmark.

Fig. 10. The belt plate of the Ølby woman, East Zealand, c. 1400 BC. Diameter: 19.6 cm. After Boye 1896.

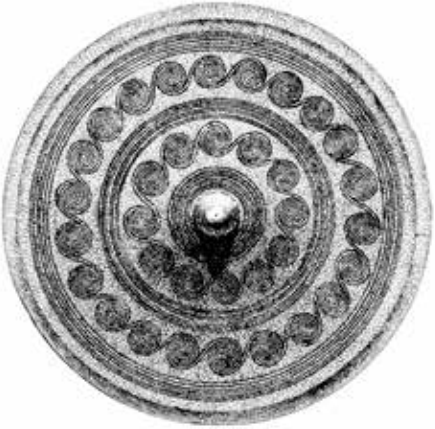

Fig. 12. The blue glass bead from Ølby, East Zealand, c. 1400 BC. Diameter: 1.2 cm. Photo: A. Mikkelsen, the National Museum of Denmark.

strontium isotope analyses of three of her teeth, molars, yielded strontium isotope values that seem to indicate a local provenance. Additionally, differences in the strontium isotopic signatures (especially evident between the second and third molar) suggest the possibility of mobility during early adolescence, most probably within the local region of Zealand. Thus, according to the strontium isotope provenance evidence, the Ølby Bronze Age elite woman has not been on the move, such as her famous Jutland 'cousins' from Egtved and Skrydstrup (not the same Skrydstrup mound as the one with the glass bead, highlighted in this article). Recent provenance investigations built on strontium isotope analysis of the female oak coffin burials from Egtved, East Jutland, and Skrydstrup, South Jutland, have revealed that they through their childhood lived in areas far away – far away from where they were buried (Frei & Mannering 2015; Frei et al. 2015; Frei et al. 2017).

Even though the Ølby woman was not on the move, as her Jutland cousins, still, she was integrated into a long distance exchange network. Lead isotope analyses and chemical trace elements analyses of the bronze objects indicate from where the copper in the bronze came from. The copper of her sword/dagger probably came from the mining area of Mitterberg of the Austrian Alps, South of Salzburg, the copper of her belt plate probably came from the copper sources of Trentino in the Italians Alps, east of Trento, in the areas at the Redibus Pass. The copper of her neck collar probably came from ores in the mountains of Slovakia (Reiter et al. 2019). Thus, as suggested by the data (presented by Reiter et al. in 2019), the Ølby burial mirror the three main metal suppliers that by other archaeometrical projects have recently been recognized for Scandinavian artifacts: Mitterberg, Austria, Trentino, Italy, and the mountains of Slovakia (Ling et al. 2014; Ling et al. 2019; Bunnefeldt 2016).

Ølby and the beads of Egyptian glass

While S. Müller directed the excavation of the Ølby mound, he probably pondered over the blue glass bead, and its connection to areas beyond the Mediterranean. In an article printed just two years after the excavation, in 1882, he discussed the potential Near Orient origins of the Danish glass beads, and he seems to be the first who specifically pointed at Egypt. In Danish: *"Blandt andre Sager i de nordiske Fund, som skrive sig fra Orienten, maa først nævnes de blaa Glasperler, der undertiden forekomme i Bronzealderens Fund; Perler ganske af samme Art kjendes fra Ægypten. Hvorfra skulde mange Aarhundreder f. Chr. F. disse Glasperler være komne til Norden, om ikke fra Kulturlandene ved Middelhavets sydøstlige Kyster?"* (Müller 1882: 319). Our recent chemical analyses have confirmed his words.

The bead from the oak coffin in the barrow at Ølby is not the only bead of Egyptian glass from Denmark. A bead from a rich female burials at Hesselager on the island of Funen, Denmark, share the Egyptian chemical fingerprint with that of Ølby. It belongs to the same time. The Hesselager woman was equipped with a large spiral decorated belt plate, two arm rings and a fibula, all in bronze. At her neck she carried six beads: the bead of Egyptian cobalt glass and five amber beads (Aner & Kersten 1977, no. 2014 A).

It is now possible to identify glass from Egypt and Mesopotamia, and to distinguish glass from these two principal production areas of the Middle Bronze Age and early Late Bronze Age (Walton et al. 2009; Shortland 2012; Walton et al. 2012; Gratuze 2013; Rehren & Freestone 2015). By the ratios of certain trace elements it is possible to identify the origin of the glass. The two Danish beads in question are characterized by low chromium/lanthan and variable zirconium/titanium ratios, indicating an Egyptian origin. The remaining Danish glass beads exhibit higher chromium/lanthan and lower zirconium/titanium ratios, thus indicating a Mesopotamian origin (Varberg et al. 2015, Kaul

et al. 2015, Varberg et al. 2016, Kaul and Varberg 2017).

The Egyptian origin of the Ølby and Hesselager beads is confirmed by their colourant composition: in these beads, cobalt correlates with nickel, zinc, and manganese. This correlation has been shown to be typical of the cobalt colourant extracted from Egyptian alum deposits such as those at the Kharga and Dakhla oases in the Western Desert, 200 and 350 km west of the Nile. The same trace elements related to the cobalt colourant was observed in glass waste from 14th century BC glass workshops at Malkata and Amarna, Egypt, as well as in the glass ingots found in the Uluburun shipwreck at the Turkish southwest coast and in Mycenaean glass beads (Shortland *et al*. 2006; Shortland *et al*. 2007; Jackson & Nicholson 2010: Smirniou & Rehren 2013). It is fascinating to realize that the glass of beads from Ølby and Hesselager could have been produced in workshops in Amarna, pharaoh Akhenaten's (reign: 1353-1338 BC) great city, and that the cobalt colorant was extracted at oases far out in the western desert. Thus, it is possible to follow the Egyptian cobalt colorant from its source in the Western Desert, over workshops in Malkata and Amarna, further along the Mediterranean trading routes represented by the Uluburun shipwreck, then to Mycenae, and finally at Ølby and Hesselager in Denmark (Varberg et al. 2015; Kaul et al. 2015; Varberg in press).

Most recently, due to the work by a Polish research team, the geographical gap between Mycenae and the North has been narrowed by a blue bead of Egyptian cobalt glass from a Middle Bronze Age burial at Kietrz, Southwest Poland, of the same composition as the Ølby and Hesselager beads. (Purowski et al. 2016). The find spot is at the upper Oder River, not far from the Oder sources and the watershed for the Danube tributaries. Thus, the Kietrz Egyptian cobalt bead marks a point on the roads of exchange, the Oder River from here leading to the Baltic Sea. If the Bronze Age traveler sailed westwards from the mouth of Oder into the Baltic Sea, he or she would find the island Zealand, with the Ølby burial, and the island of Funen with the Hesselager burial.

Naturally, there were many routes of exchange during the Bronze Age, including western routes along the main rivers. Recent chemical analyses have demonstrated the occurrence of Egyptian glass beads at Bronze Age settlement sites at Landunvez and Plomeur in Finistère, Brittany, France, in their chemical composition to be compared with the bead from Ølby (Cherel & Gratuze 2018).

A polychrome bead of Mesopotamian glass, Søviggård, West Jutland.

The glass of the remaining Danish beads can be determined as Mesopotamian. In our project also German and Romanian glass beads have been included, such as glass beads from a burial at Jänkendorf, Saxony, a burial from Esperstedt, Sachsen-Anhalt and burials from Cluj, Transylvania and furthermore from the sacrificial cave of Cioclovina cu Apa, Transylvania. The chemical analyses has demonstrated the Mesopotamian origin of these beads (Varberg et al. 2015; Varberg *et al*. 2016; von Richthofen et al. 2017; Varberg in press).

Among these beads of Mesopotamian glass, a rare polychrome bead should be highlighted; from an inhumation grave under a burial mound at Søviggård, West Jutland, dated to Nordic Bronze Age period II (around 1400 BC) (Aner & Kersten 1986, no. 4170). The colourant of the bead itself is copper oxide, which is the most common colourant of the Mesopotamian glass. There are three other colours represented, reddish – like amber – white and yellow. It is only the amber-like colour, which is clearly visible (Fig. 13). The amber, white and yellow glasses, which compose the eyes of the polychrome bead are respectively colored by iron (probably iron polysulfides), calcium antimonate and lead antimonate (Varberg et al. 2015).

Once again, a precious glass bead was found in a richly equipped female grave, and together with amber. The Søviggård

Fig. 13. The polychrome eye bead from Søviggård West Jutland, c. 1400 BC, diameter: 1.2 cm. Photo: A. Mikkelsen, the National Museum of Denmark.

woman was buried with two amber beads, five amber buttons, a ribbed neck collar, a wheel headed pin and tutulus, all in bronze. Her dress ornaments shows that she probably originated in the Lüneburg area, Niedersachsen (Lomborg 1969; Bergerbrant 2007), though buried about 450 kilometers north.

The rare glass bead first reached Lüneburg via one of the amber routes, in this case probably following the Elbe River, which passes through the Lüneburg area. Then, as a part of the ornament of a 'Lüneburg woman', the bead was carried from the Elbe mouth northwards along the amber rich Jutland west coast, perhaps by boat. Also on the beaches at the Elbe mouth, at the root of the Jutland peninsula, at Cuxhaven, amber can be collected (Kaul 2018 a; Kaul 2018 b). Among the amber routes, such as the these following the Elbe and its tributaries, amber was transported deep into Central Europe. Middle Bronze Age finds of amber at the Elbe/Vltava, also in Bohemia, Czechia, yield evidence of this particular amber route (Woltermann 2014; Cvojka et al. 2017). From the sources of Vltava/Moldau, over a low watershed, you can reach the Danube river system.

Amber and glass

As we have seen, glass and amber is often occurring together in the same burial, or in the same hoard. It is not just in Denmark and Schleswig-Holstein, North Germany, that amber and glass were found together. A large hoard, c. 1200 BC, from Neustrelitz, Mecklenburg-Vorpommern, Germany, consist of 880 objects including 179 blue glass beads, one polychrome glass bead and 20 amber beads (Mildner et al., 2010; Varberg et al. 2016). In a burial belonging to the tumulus culture, from around 1400-1450 BC, at Schwarza in Thuringia, Germany, blue glass beads and amber beads were found together (Wolterman 2014). Also belonging to the tumulus culture, a rich female grave from Ilmendorf south of Ingoldstadt, Bavaria, Germany (1500-1300 BC) contained around 250 amber beads and three blue glass beads. Furthermore, the Ilmendorf woman was carrying bronze arm rings, tutuli and gold *Schleifenringe* (Classen & Berger 2013).

Further to the east, in the Carpathians, Transylvania, Hunedoara Jud., Romania, in the sacrificial Cioclovina cu Apa Cave, large amounts of amber beads have been found together with large amounts of glass beads (Fig. 14 A & B). The hoard – or rather an accumulation of depositions – is without any comparison the largest Late Bronze Age hoard found in Europe. It contains more than 7500 objects. The majority of the find consists of beads made of different material. By now 520 tin beads, 2339 glass beads, 1784 amber beads and 572 faiance beads from 1300-1200 BC have been found in the cave's sanctuary. Chemical analyses of the present project has determined the origin of the glass as Mesopotamian. Also cheek pieces for horses made of bone and bronze objects as tutuli have been found (Petrescu-Dâmbovita 1977; Varberg et al. 2015; Varberg et al. 2016; Rotea 2017).

Even though the Cioclovina cu Apa Cave is situated up in the Carpathian Mountains, it is in a strategic position, regarding Bronze Age routes of exchange – the amber (-glass) routes. From the high

Fig. 14, A & B. Cioclovina. A: The mouth of the Cioclovina cu Apa Cave in the Transylvanian mountains. The Cioclovina Stream has its spring 500 meters inside the cave just opposite the find-spot of the Bronze Age hoards. B: The upper river valley seen from inside the entrance of the cave. Photo: J. Varberg.

valley, the Luncani stream runs down towards the fertile river plain of the Strei river – this river leading to the Mures River, a tributary river to the Danube (Fig. 15).

When going to the Mediterranean, there are a number of examples of amber and glass found together, from burials and settlement sites. Today, a major part of Bronze Age and Early Iron Age amber found in Mediterranean, including North Italy, that has been chemically determined, belongs to the succinite category (Angelini, et al. 2003; Bellintani 2010 a; Bellintani 2010 b; Bellintani 2014). This kind of amber is often called "Baltic amber". Perhaps "Nordic amber" should be preferred, when taking into account the rich amber sources at the North Sea: Succinite is that amber, which comes from 'the North' – from the beaches of the southern parts of

Fig. 15. A view of the Luncani stream looking upwards towards the valley of the Carpathians, where the Cioclovina Cave is situated. Photo: F. Kaul.

the Baltic Sea to the beaches of the North Sea, the west coast of Jutland.

In the western Mediterranean, we could highlight a cave burial from the low mountain ridge of Campu Stefanu, at Sartene, South Corsica, France (Fig. 16). A rich Middle Bronze Age burial from the cave contained a necklace of 25 blue glass beads and 28 amber beads, the glass being of Mesopotamian provenance (Varberg, *et al*. 2015; Kaul *et a*l. 2015).

In the Eastern Mediterranean, sites like Mycenae and Tiryns have yielded both blue glass and Nordic/Baltic amber

Fig. 16. The Campu Stefanu ridge in the Corsican landscape, seen from the town of Sartene. The bird is pointing at a place close to Middle Bronze Age cave burial with glass and amber beads, the middle of the three low mountain ridges. Photo: F. Kaul.

(Harding & Hughes Brock 1974; Walton et al. 2009; Shortland 2012; Czebreszuk 2013). Nordic/Baltic amber and ingots of Egyptian cobalt glass formed part of the cargo of the ship wrecked c. 1300 BC at Uluburun near Kas at the Turkish coast. Perhaps, this merchant ship was at its way to a harbour close to Mycenae, when it went down. Nordic/Baltic amber reached areas beyond the Mediterranean. At Qatna at Homs in Syria, amber determined as Nordic/Baltic has been found together with glass beads (Mukherjee et al. 2008; Pfälzner & Rossberger 2009). Thus, in a royal burial vault, c. 1340 BC, or a bit earlier, a beautiful carved lion head vessel – of local production – but cut from a lump of far away amber – has been found together with glass beads and other beads of amber.

From Egypt, a number of candidates of beads and scarabs of Baltic/Nordic amber have been pointed out, though no chemical analyses have been carried out (Hood 1993). The possible items of Nordic/Baltic amber include beads and scarabs from the tomb of Tutankhamen (died in 1327 BC). In the tomb of Tutankhamen, there are many examples of glass objects and glass inlays of the cobalt blue colour. Other examples of amber in Egypt could be pointed out, such as an amber bead found on the floor of a possible representative building in Pi-Ramesse in the Nile delta, in use during the reign of Rameses II (1279-1213 BC) (Pusch 2003), or an amber scarab being part of a complex pectoral, from the burial of the scribe Hatiay at Luxor, 1350-1333 BC (Bongioanni et al. 2001).

By 1400 BC, long distance exchange systems had evolved connecting the shores of the Euphrates and Tigris rivers in Mesopotamia and the Nile in Egypt with the beaches of the Baltic and North Seas, as well as at key sites in between, such a Mycenae. Nordic amber and Egyptian and Mesopotamian glass linked the widest expanse of world, the two materials forming a sort of dialogue between exotic materials from mutually distant lands.

Glass and amber give evidence of the long distance exchange networks that evolved during the Middle Bronze Age. Even though Nordic/Baltic amber reached Central Europe during the Early Bronze Age (Unetice culture) in the centuries around 2000 BC, important changes took place in the exchange pattern of amber at around 1700 BC. A Bohemian centre of wealth and power lost importance, and the massive influx of amber here stops in the decades before 1700 BC (Ernée 2013). New exchange routes appeared at this time; most important is that Nordic/Baltic amber now reached the areas south of the Alps. Somehow, the bearers of the Central European Early Bronze Age culture blocked for the further distribution of amber, or the contact networks over the Alp passes were relatively weak. The earliest Nordic/Baltic amber from the area immediately south of the Alps comes from the *palafitta* settlement Lagazzi di Vho at Piadena south of Lago di Garda. Seventeen amber beads have been found in layers attributed to the latest phase of the Early Bronze Age (c. 1700 BC). First from the beginning of the Middle Bronze Age (c. 1600 BC) we find Nordic/Baltic amber in Central and South Italy, represented at a *palafitti* settlement at Lago Albani, near Rome, and a number of sites of different kind from Apulia (Bellintani 2002; Angelini et al. 2003; Bellintani 2010 a; Bellintani 2010 b).

For long distance exchange of glass beads some discernible historical limitations are evident. Although the beginning of glass production dates back to the middle of the 3rd millennium BC, most likely in Mesopotamia, the manufacture on a larger scale, the fist regularly produced glass, started at around 1500 BC or perhaps some decennia later, in both Mesopotamia and Egypt (Shortland 2012). Thus, the first flow of glass beads into Denmark and North Germany came in soon after the beginning of large scale production of glass in Egypt and Mesopotamia.

When considering the points or places where these two materials, glass and amber, met, in the Mediterranean and in the

North, then this meeting was first possible after 1500 BC, though some ideas as to the magic properties of amber must have reached the Mediterranean about two centuries before. The beads of this highly treasured material did not fly over long distances by themselves, they were carried along the 'amber routes' by leading persons of the Bronze Age societies; on voyages where guest-friendship (*xenia*), was observed as something sacred, connected to the gods (Kaul 2017; Kaul 2018 a, Kaul 2018 b). The connections between the eastern Mediterranean were not direct. There must have been a number of 'middle' stations, for instance in the Alps, where the meaning behind these valuable objects were communicated and discussed.

Obviously, amber and glass beads should be considered as the most prestigious objects related to Bronze Age elite, at the same level as gold objects. When looking at the burials of the Nordic Middle Bronze Age, the close relationship between glass and amber is no coincidence. Particular social values would have been appreciated when carrying glass and amber together: it was the peoples of the highest echelons of society that controlled the collection and distribution of amber and benefitted from the amber export who were the receivers of the valuable and exotic glass beads (Kaul & Varberg 2017).

The magic of amber and glass

As important as the social values of glass and amber were the symbolic values of the materials themselves. In the burials of the Nordic Bronze Age, amber and glass beads are often found as part of the same piece of ornament. Probably glass and amber beads shared some magical values that made it beneficial to carry them together. What in particular unites the two materials is their translucence. Few other (valuable) materials of the time could let the light of the sun shine through. While the translucent golden amber carried solar symbolism, in itself having the colour of the shining sun, the translucent blue glass carried the colour of the heaven and the sea or waters. Thus, combined, beads of glass and amber, could, by these particular (colour) properties, inspire and create – in the mind of our Bronze Age ancestors – references to the paramount mythology of the eternal voyage of the sun: the amber being a representation the sun, the glass being a representation of the heavens where the sun makes its daily voyage.

The beads themselves do not carry pictures, but the properties and colours of the materials gave inspiration for creating narratives built into mythology. A certain object, in its specific context, can be perceived as a materialized metaphor reaching much further than the object itself, making pictures and scenarios in your mind.

When combining Egyptian ideas as to the colour blue and later Greek sources as to mythological explanations related to amber, the iconic properties of the two materials become apparent. Let us start with amber.

Amber

The Greek word for amber was *electron*, with associated meanings like "to shine" or "brilliant". In the *Iliad*, the word is associated with the word elector, which means the beaming sun (Causey 2011 (Homer, *Iliad* 6.513)). An important property of amber is its ability to create static electricity. When friction is applied by for instance a piece of fur, amber becomes negatively charged and it attracts small pieces of straw, fluff or dried leaves. The Greek philosopher Thales of Miletus (c. 624-546 BC) is said to be the first to realize (or rather describe) that if you rubbed amber it could attract small pieces of light material. This phenomenon he noticed because Greek women of the seventh century BC occasionally spun wool with precious amber spindles (Mitchell 2018). Furthermore, under certain circumstances if you rubbed amber, it created small sparks. This additional property must have been intriguing – also in the Bronze Age. Seeing the spark in a dark room and even perhaps feeling the spark would give a feeling of contact

Fig. 17. Phaeton, driving mad on the chariot of the sun, creating dramatic climate changes on earth. Frescoed mural in the loggia of Castello di Buonconsiglio, Trento, North Italy, 1531-1532. Photo: F. Kaul.

with forces larger than the material itself. A spark flashing from the amber may have been appreciated as a release of the solar power in-built in the amber.

It was these peculiar electro-magnetic powers related to amber that gave rise to the word *electricity*, since amber was used in early experiments on electricity. It was the English physician William Gilbert, also Queen Elisabeth I's personal physician, who in a larger work in Latin (1600) introduced this word, in Latin *electricus*, meaning "like amber" (Mitchell 2018). If William Gilbert and the scholars of his time had not been working with Greek or Latin name-giving of matters and phenomena, then *electricity* might have been called "*ambrecity*".

In Greek mythology, amber is of divine nature, in particular related to the sun god Helios and the sun god Apollo. During daytime, the sun god Helios was driving his chariot – the chariot of the sun – over the heavens. The chariot was drawn by four white horses. Phaeton, son of Helios, was permitted to drive the chariot of the sun. That turned out to be a most disastrous permission. Phaeton was not able to manage the strong horses of the chariot of the sun (Fig. 17). He was driving like mad – up and down went the chariot – and he approached too near the earth. Mountains began to burn; fires devastated the forests, drought spread to vast areas that became deserts. Zeus, in his anger over this youngster creating disasters over the world, threw his thunderbolt on Phaeton, who was killed in the crash, in a river called Eridanus. The sisters of Phaeton, the Heliades, became poplar trees and in their sadness over his death, when weeping, their tears turned into droplets of amber. The Phaeton story is found in many classical writings, including Roman authors. However, the story was first recorded by the Greek writer and poet Hesiod, who worked between 700 and 650 BC (Causey 2011). Thus, in time, we are within the final stages of the Nordic Bronze Age.

Another, though later recorded myth, brings us even closer to the sun god itself. According to the Greek author, Apollonius of Rhodes, who in the years about 250 BC was head librarian of the famous library of Alexandria, amber was the tears shed by the sun god Apollo. When Apollo on his yearly winter travel to the North, visiting the land of the Hyperboreans (somewhere up North, perhaps Denmark/South Scandinavia), heard about the death of his son, Asclepius, his tears turned into amber (Jensen 2000; Causey 2011: 55 (Appolonius, *Argonautica* 4.611-18)).

In both of these mythological accounts, amber is closely related to the sun god, most pronounced by Appolonius of Rhodes. Here, amber is the tears of the very sun god, Apollo. Thus, amber was a divine a manifestation of the sun god; and we can go even further, claiming that amber in a mystical way was perceived as being not just a manifestation, but also a materialization of the sun, the tears coming out of the sun itself.

It worth noting that in these mythological narratives, a certain knowledge of the nature of amber seems reflected. The Heliades turned into poplar trees, thus reflecting the knowledge of amber being a sort of resin. The sun god Apollo, shed his tears in the land of the Hyperboreans, in the North of Europe, thus reflecting a knowledge of from where the amber came, in some aspects a mythological land, in some aspects a geographic reality. Phaeton fell into a river called Eridanus. The Greek geographer and historian Herodotus (c. 480-420 BC) wrote: "I do not believe that there is a river called by foreigners Eridanus issuing into the northern sea, whence our amber is said to come." (Causey 2011, 54 (Herodotus, *Histories.* 3.115)). Even when being a negation, the words by Herodotus give evidence of such a tradition. Later writers such as Plinius seems to be confused as to the geographical whereabouts of this primarily mythological river. Sometimes the river are associated with Po and sometimes with the Rhône, among other locations. The most likely explanation of the uncertainty is that the Eridanus at some point became connected in myth to memories of an early riverine amber route through Europe leading from the North Sea or the Baltic Sea (Causey 2011: 54). It is a fascinating thought that knowledge of the old amber routes seemingly was built into Greek mythology.

At any rate, amber was in the myths closely related to the sun. Probably, also at its sources in the North, amber had the same mythological connotations as recorded in the South – amber virtually being the actual material of the sun, a mystical manifestation of the sun – the tears and the rays of the sun (Jensen 2000; Varberg et al. 2015; Kaul & Varberg 2017; Kaul 2018 a). That amber was related to the sun in the North is shown by a miniature figure of a sun disc, presumably Late Bronze Age; the precise provenance is unknown, though probably Jutland. It consists of a round disc of amber mounted in a bronze frame on a stand ending in a tenon. From edge to edge two perforations was carefully drilled through the amber, forming a cross figure (Fig. 18). The 'sun-holder' has its own built-in magic. When you look at the sun through the reddish amber disc, the drillings looks darker. Together with the round frame, the drillings form a wheel cross, the most popular Bronze Age solar symbol. The wheel cross can be perceived as both a solar image, and a symbol of the movement, the voyage of the sun. Thus, by the very beams of the sun, the mystery behind the solar and wheel cross iconography could be revealed at Bronze Age rituals (Kaul 1998; Kaul 2004). The sun-holder has a tenon-shaped foot and was intended to fitted onto something, perhaps a ship model, perhaps a staff, carried by a leading priest. A rendering of a similar sun-holder, with wheel-cross, from the Backa rock carving in Bohuslän, western Sweden, shows that such cult devises could exist also in larger scale, being carried in the rituals, though in that size with no amber inlay (Fig. 19).

Glass and the colour blue

In ancient Egypt, the colours had deep symbolic meanings related to life, death and the gods. The symbolism is ambiguous. The colour black, for instance, was related to death and the darkness of the underworld, but black was also representing fertility and life, since it was the black, wet mud of the Nile that was a creative agent for growth, life and fertility of Egypt (Lurker 1994).

In general terms, the colour blue should be connected with the heavens and with water, sea, lakes and rivers. In Ancient Egypt the colour blue was associated with life and rebirth, and represented (the

Fig. 18. Miniature figure of a sun disc on a stand, bronze and amber, probably Jutland, Denmark. Height: 6.9 cm. Photo: A. Mikkelsen, the National Museum of Denmark.

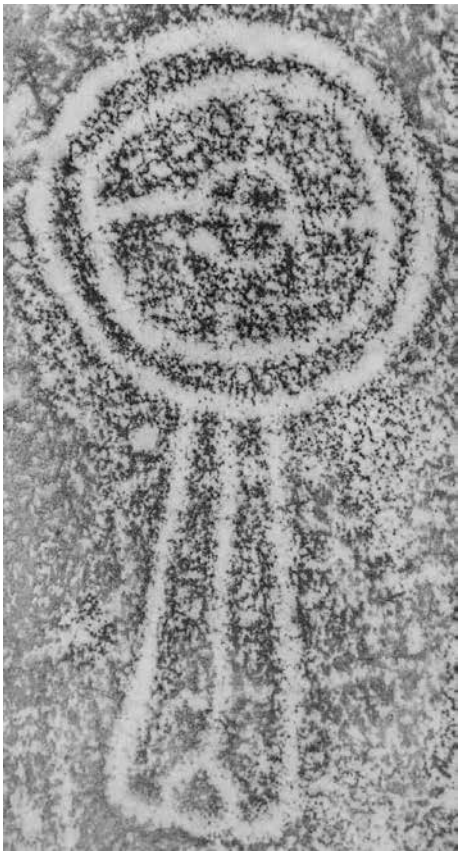

Fig. 19. Rock carving, solar standard, from Backa, Bohuslän, Sweden. Height: c. 70 cm. Rubbing: Inge-Mette Petersen, in collaboration with Tanums Hällristningsmuseum, Underslös.

fertility of) the Nile. The darkest cobalt blue would possibly combine the fertility notions related to both the dark mud and the blue waters of the Nile. The colour blue was associated with the heavens, being seen as an ocean on which the celestial bodies travelled. The sun travelled in the solar barque, the day barque called Mandjet. The skin of the sun-god Amon can be blue, probably due to his heavenly associations (Lurker 1994; Wilkinson 1999).

The colour blue was related to the primeval waters and creation myths. From these waters the first land rose, the primeval mound. The primeval mound was an important symbol of the act of creation. The sun-god Atum is sometimes described in the pyramid texts as 'hill' (Shaw & Nicholson 1995: 229). Because the colour blue came to be connected with the god Amun-Re, a number of portraits of 18th Dynasty kings with blue faces are believed symbolically to show their assimilation to that god (Wilkinson 1999: 108). The Egyptian concepts of creation were closely interlinked with their views concerning rebirth, renewal and life after death. The Egyptians regarded creation not only as a single event at the beginning of the universe but as a phenomenon, which constantly recurred with each new day and season. The deity most regularly

associated with creation was the sun-god, whose appearance at dawn embody the cyclical nature of the creator and creation. One of the creation myths describes how the new-born sun rose out of a lotus flower floating on the primeval waters (Shaw and Nicholson 1995: 74 & 164). This motif, the new born sun being depicted as a baby in a lotus flower, is also a symbolic rendering of the rebirth of the sun every morning. Often, it was the blue variant of the lotus flower that was depicted, or lotus flowers were depicted on blue faience vessels (Shaw and Nicholson 1995; Nyord 2019).

Thus, in the colour blue was embedded powerful universal powers of creation, cyclical re-creation, fertility and afterlife. In Egyptian conceptions, some materials seemingly, also through their manufacture process, obtained and carried a 'hidden sort of existence', an animated potential 'existence' related to creation, transformation and re-creation (Nyord 2019). Thus, even the process of making the glass involved allegorical connotations to creation myths.

It was a whole world-view, philosophical concepts of the universe, of life, death and rebirth that were built into the glass. However, we shall not forget the magical properties of glass (beads), though related to cosmology. Beads (and pieces of charms), different amulets, had protective and healing powers, among other things related to pregnancy, childbirth and infancy. We shall here only refer to a spell meant to protect the child against fever. "Are you hot in the nest? – Are you burning in the bush? – Your mother is not with you? – There is no sister to fan you? – Let there be brought to me a pellet of gold, forty beads, a cornelian seal-stone, with a crocodile and hand, to fell, to drive out this demon; this is a protection". The crocodile (or a piece of crocodile?) was an animal with great protective powers, while the hand represents the magical gesture's of power. The papyrus also tells that the beads and the other objects should be made into a composite amulet in a piece of fine linen to be placed on the neck of the child (Robins 2012: 86).

From Egypt and Mesopotamia, the glass came to the Mycenaean world. Also Mycenaean glass objects, including glass beads, re-melted from imported glass material, would have carried magical and social properties, related to both ritual symbolism and palatial authority. Some Mycenaean beads are in the shape of lily flowers and rosettes, the rosettes being seen as signs of protection. The stylized lily motif could be understood as a manifestation of divine power related to the appearance of a great Minoan female goddess (Walton et al. 2009; Jackson & Wager 2011; Shortland 2012; Varberg *et al*. 2016; Kaul & Varberg 2017).

Glass and amber & final remarks

In a tomb at Luxor, Egypt, of Hatiay, the scribe and superintendent of the granaries of the temple of Aten, amber and glass are connected in the most intriguing way. Hatiay was buried between 1350 and 1333 BC, during the reign of Akhenaten. On a composite temple-shaped pectoral terminating a glass bead necklace, including blue glass beads, an amber scarab is inlaid as the central motif. Close to the amber scarab is seen the *Djed*-pillar sign (Bongioanni *et al*. 2001). The scarab, Khepri, was seen as a manifestation of or the god of the rising sun, and was considered a symbol of eternal rebirth as well as being a powerful amulet, both in life and death. The *Djed*-sign – here as blue glass and lapis lazuli inlay – was probably a stylized representation of plant stems that signified stability and fertility, also related to social matters (Lurker 1994; Shaw & Nicholson 1995; Wilkinson 1999; Bongioanni et al. 2001).

So here, in the pectoral of Hatiay, the colour blue, glass, amber, the scarab, and other materials and symbols are combined, forming an interwoven symbolic palimpsest related to cosmology, creation, re-creation and the eternal voyage and daily re-birth of the sun. Though not for-

getting the general amulet or evil-waring values of these materials.

When returning to the North, the (heavenly) blue glass beads and the sun-golden amber beads may have shared some symbolic or magical values that made it beneficial to carry them together. Also in the North, where the focus of the Bronze Age religion was on the eternal voyage of the sun, a blue glass bead together with an amber bead, could represent a whole, almost iconographic narrative of the main cosmological or religious principles.

The beads, whether of glass or amber, were not just nice prestigious charms, but had deep powerful religious or magical values, including protection against evil and diseases. When the glass beads, according to the burial evidence, are mostly related to women, then it is unavoidable to consider the protective forces of the beads, related to pregnancy, childbirth and maternity – though also including fertility in a broader sense.

The determination of provenance of the glass of the Danish glass beads marks an important step towards an understanding of the long distance contacts of the Bronze Age. The Danish glass beads represent firm physical evidence of the most extended connections, reaching even beyond the Mediterranean, to Egypt and Mesopotamia. Possible intermediate stations could be pointed out, such as Mycenae, Pylos and Tiryns (Walton et al. 2009; Shortland 2012; Varberg et al. 2016). Further places where different trading networks were connected could be in the Caput Adria area, the Po Valley, the North Italian/Austrian/Swiss Alpine regions, in South Germany and in the middle Danube areas (Varberg et al. 2015; Kaul et al. 2015).

With the physical transport of glass and amber there also came about a flow of ideas stemming from the Mediterranean. The idea of the shaven warrior is reflected by the introduction of the razor with the handle in the shape of a horse's head; the idea of a piece of furniture of dignity is reflected by the introduction of the folding stool (Kaul 2013 a; Kaul 2013 b). The Scandinavian rock carvings depicting two-wheeled chariots should also be considered as reflecting influences from the eastern Mediterranean (Winther Johannsen 2010; Varberg 2015). The most elaborate example is seen on one of the slabs of the large stone cist of Bredarör at Kivik, Scania, South Sweden, c. 1300 BC (Randsborg 1993; Goldhahn 2013).

Perhaps even some basic religious iconographic themes so strongly emerging in South Scandinavia, such as the solar barque and the (protective) snake (Kaul 1998; Kaul 2004; Kaul 2009), may eventually stem from distant Egyptian roots. We should bear in mind that the beads and other commodities, like metal, did not fly over the European landscapes by their own wings, but were carried by human beings, who met at certain places on the routes, and while observing guest-friendship, discussing important matters, not just exchanging objects, but also ideas.

Today, we use the word "globalization" as something which belong to the last two or three centuries. However, during the Bronze Age the world opened in a "globalized way", in particular in the years around 1400 BC. Ideas and commodities streamed along the exchange routes, 'the amber roads' and 'the glass roads', or for that sake 'the metal roads'.

Jeanette Varberg
Curator
Ancient Cultures of Denmark and the Mediterranean, the National Museum of Denmark.

Flemming Kaul
Senior Researcher
Ancient Cultures of Denmark and the Mediterranean, the National Museum of Denmark.

Bernard Gratuze
Directeur du Recherche, IRAMAT, CNRF, Université d'Orléans, France.

Literature

Aner, E. & Kersten, K. 1973. *Die Funde der älteren Bronzezeit des nordischen Kreises in Dänemark, Schleswig-Holstein und Niedersachsen*, Band I, Frederiksborg und Københavns Amt. Karl Wachholtz Verlag, Neumünster.

Aner, E. & Kersten, K. 1977. *Die Funde der älteren Bronzezeit des nordischen Kreises in Dänemark, Schleswig-Holstein und Niedersachsen, Band III, Bornholms, Maribo, Odense und Svendborg Amter.* Karl Wachholtz Verlag, Neumünster.

Aner, E. & Kersten, K. 1978. *Die Funde der älteren Bronzezeit des nordischen Kreises in Dänemark, Schleswig-Holstein und Niedersachsen*, Band IV, Südschleswig-Ost, Die Kreise Schleswig-Flensburg und Rendsburg-Eckernförde. Karl Wachholtz Verlag, Neumünster.

Aner; E. & Kersten, K. 1984. *Die Funde der älteren Bronzezeit des nordischen Kreises in Dänemark, Schleswig-Holstein und Niedersachsen*, Band VII, Nordslesvig – Nord. Karl Wachholz Verlag, Neumünster.

Aner, E. & Kersten, K. 1986. *Die Funde der älteren Bronzezeit des nordischen Kreises in Dänemark, Schleswig-Holstein und Niedersachsen,* Band VIII, Ribe Amt. Karl Wachholtz Verlag, Neumünster.

Angelini, I.; Artioli, G. & Bellintani, P. 2003. Progretto "ambre e materiali vetrosi protostorici della valle dell'Adige nel quadro delle coeve attestazioni dell'Italia del nord". Primi risultati sulle ambre. *Preistoria Alpina* 39: 227-241.

Becker, C.J. 1946. Bronzealderhøje ved Skrydstrup. *Nationalmuseets Arbejdsmark* 1946: 30-38.

Becker, C. J. 1954. A segmented faience bead from Jutland. With notes on Amber Beads from Bronze Age Denmark. *Acta Archaeologica* 25, 1954: 241-252.

Bellintani, P. 2002. Bernsteinstrassen, Glasstrassen. Archäologische Zeugnisse aus dem Etschtal im Rahmen der Beziehungen zwischen den Mittelmeerländern und dem transalpinen Europa während der Bronzezeit. In: Hach, B.; Röber, R. & Wesselkamp, G. (eds.): *Über die Alpen, Menchen, Wege, Waren*. Archäologisches Landesmuseum Baden-Württemberg, Stuttgart: 39-48.

Bellintani, P. 2010 a. Ambra, una materia prima del nord (ma non solo). In: Radina F. & Recchia, G. (eds.), *Ambra per Agamemnone. Indigeni e Micenei tra Adriatico, Ionio ed Egeo.* Mario Adda Editore, Bari: 141-146.

Bellintani, P. 2010 b. Materiali vetrosi in Puglia nell'età del Bronzo Medio. In: Radina F. & Recchia, G. (eds.), *Ambra per Agamemnone. Indigeni e Micenei tra Adriatico, Ionio ed Egeo.* Mario Adda Editore, Bari: 147-149.

Bellintani, P. 2014. Baltic amber, alpine copper and glass beads from the Po plain. Amber trade at the time of Campestrin and Frattesina. *Padusa* 50, 2014: 111-139.

Bergerbrant, S. 2007. *Bronze Age Identities: Costume, Conflict and Contact in Northern Europe 1600-1300 BC.* Stockholm Studies in Archeology 43, Bricoleur Press, Stockholm.

Bongianni, A.; Croce, M.S. & Accomozzo, L. (eds.) 2001. *The Illustrated Guide to the Egyptian Museum in Cairo.* The American University in Cairo Press, Cairo / White Star, Vercelli.

Boye, V. 1896. *Fund af Egekister fra Bronzealderen i Danmark.* Andr. Fred. Høst & Søns Forlag, Copenhagen. (Facsimile tryk, Wormianum, Højbjerg/Aarhus 1986).

Bunnefeld, J.-H. 2016. *Älterbronzezeitliche Vollgriffschwerter in Dänemark und Schleswig-Holstein. Studien zu Form, Verzierung, Technik und Funktion.* Studien

zur nordeuropäischen Bronzezeit 3, Mainz 2016.

Causey, F. 2011. *Amber and the Ancient World.* The Paul Getty Museum, Los Angeles.

Cherel, A.-F. & Gratuze, B. 2018. Les perles en faïence et en verre de l'âge du Bronze découvertes en Bretagne: nouvelles données, nouvelles approches. Étude typo-chronologique, composition, provenance. *Bulletin de la Société préhistorique francais*e 115, 2: 327-360.

Chvojka, O.; Chytracek, M.; Metlicka, M. & Michalek, J. 2017. Jantar stredni az pozdni doby bronzové v Cechách (Bernstein der mittleren bis späten Bronzezeit in Böhmen). *Památky Archeologické* CVIII, 2017: 89-120.

Classen, E. & Berger, B. 2013. Bernstein, Bronze, Glas und Gold aus mittelbronzezeitlichen Grabhügeln. *Natur und Mensch, Jahresmitteilungen* 2011 (2013): 27–40.

Czebreszuk, J. 2013. Mysterious Raw Material from the Far North: Amber in Mycenaean Culture. In: Bergerbrant S. & Sabatini, S. (eds), *Counterpoint: Essays in Archaeology and Heritage Studies in Honour of Professor Kristian Kristiansen.* BAR International Series 2508, Oxford: 557-563.

Ernée, M. 2013. Bernstein und der Zusammenbruch der klassischen Aunjetitzer Kultur in Böhmen. In: Meller, H.; Bertemes, F.; Bork, H.-R. & Risch, R. (eds.), *1600 – Kultureller Umbruch im Schatten des Thera-Ausbruchs?* Tagungen des Landesmuseums für Vorgeschichte Halle, Band 9, 2013. Landesamt für Denkmalpflege und Archäologie Sachsen-Anhalt, Halle (Saale): 453-467.

Frei, K. & Mannering, U. 2015. Egtvedpigen kom langvejsfra. *Nationalmuseets Arbejdsmark* 2015: 64-75.

Frei, K. M.; Mannering; U.; Kristiansen, K.; Allentoft, M.; Wilson, A.; Skals, I.; Tridico, S.; Nosch, M.-L.; Willerslev; E.; Clarke, L. & Frei, R. 2015. Tracing the dynamic life story of a Bronze Age Female. *Scientific Reports* 5:10431 DOI: 10.1038/srep10431, 2015: 1-7.

Frei, K. M.; Chiara, V.; Jørkov, M. L.; Allentoft, M. E.; Kaul, F.; Ethelberg, P.; Reiter, S. Wilson, A. S.; Taube, M.; Olsen, J.; Lynnerup, N.; Willerslev, E.; Kristiansen, K. & Frei, R. 2017. A matter of months: High precision migration chronology of a Bronze Age female. *PLOS ONE*, June 2017: https://doi.org/10.1371/journal.pone.0178834*

Goldhahn, J. 2013. *Bredarör på Kivik – en arkeologisk odyssé.* Kalmar Studies in Archaeology IX, Kalmar.

Gratuze, B. 2013. Glass Characterisation Using Laser Ablation Inductively Coupled Plasma Mass Spectrometry Methods. In: K Janssens (ed.), *Modern Methods for Analysing Archaeological and Historical Glass.* John Wiley & Sons, London: 201-234.

Halle, U. & Mahsarski, D. 2013. Archäologie in der besetzten Tschechoslowakei. In: *Graben für Germanen. Archäologie unterm Hakenkreuz.* Focke-Museum, Bremer Landesmuseum für Kunst und Kulturgeschichte, Konrad Theiss Verlag, Stuttgart: 134-139.

Harding, A. F. & H. Hughes-Brock, H. 1974. Amber in the Mycenaean world. *Annual of the British School at Athens* 69: 145-172.

Hood, S. 1993. Amber in Egypt. In: C.W. Beck & J. Bouzek, eds. *Amber in Archæology, Proceedings of the Second International Conference on Amber in Archaeology Liblice 1990*. Praha: Institute of Archaeology, Czech Academy of Sciences, pp. 230-235.

Jackson, C. & Nicholson, P. 2010. The provenance of some glass ingots from the Uluburun shipwreck. *Journal of Archaeological Science* 37: 295-301.

Jackson, C. M. & Wager, E.C. 2011. Glass in the Aegean Bronze Age: value, meaning and status. In: A. Vianello, (ed.), *Exotica in the Prehistoric Mediterranean.* Oxbow Books, Oxford: 115-123.

Jensen, J. 1998. *Manden i kisten. Hvad bronzealderens gravhøje gemte.* Gyldendal, Copenhagen.

Jensen, J. 2000. *Rav. Nordens guld.* Gyldendal, Copenhagen.

Kaul, F. 1998. *Ships on Bronzes. A Study in Bronze Age Religion and Iconography.* Publications from the National Museum (PNM) vol. 3, Copenhagen.

Kaul, F. 2004. *Bronzealderens religion. Studier af den nordiske bronzealders ikonografi.* Nordiske Fortidsminder, Serie B, Bind 22. Det Kongelige Nordiske Oldskriftselskab, Copenhagen.

Kaul, F. 2009: Slangen i bronzealderens mytologi. Orden og kaos. In: Brattli, T. (ed.), *Det 10. nordiske bronzealdersymposium, Trondheim 5.8. okt. 2006.* Vitark 6, Acta Archaologica Nidrosiensia, Trondheim: 80-97.

Kaul, F. 2013 a. The Nordic razor and the Mycenaean lifestyle. *Antiquity* 87: 461-472.

Kaul, F. 2013 b. Forbindelser mellem sydlige og nordlige verdener i ældre bronzealder. *Nationalmuseets Arbejdsmark* 2013: 110-123.

Kaul, F. 2017: The *Xenia* Concept of Guest-friendship – Providing an Elucidatory Model for Bronze Age Communication. In: Skoglund, P.; Ling; J. & Bertilsson, U. (eds), *North Meets South. Theoretical Aspects on the Northern and Southern Rock art Traditions in Scandinavia.* Swedish Rock Art Series: Volume 3, Oxbow Books, Oxford: 172-198.

Kaul, F. 2018 a. Gennem europæiske landskaber. Bronzealderens forbindelser – og hvordan var de mulige? In: Boddum, S. & Terkildsen, N. (eds.), *Status og samfundsstruktur i yngre bronzealders kulturlandskab* Vol. 6. Seminarrapport, Viborg Museum & Holstebro Museum, Viborg & Holstebro: 9-35.

Kaul, F. 2018 b. Middle Bronze Age Long Distance Exchange. Early Glass, Amber and Guest-Frienship, Xenia. In: Nessel, B.; Neumann, D. & Bartelheim, M. (eds.), *Bronzezeitlicher Transport, Akteure, Mittel und Wege.* Ressourcenkulturen Band 8. Tübingen University Press, Tübingen: 189-211.

Kaul, F.; Haslund Hansen, A.; Gratuze, B. & Varberg, J. 2015. Fra Amarna til Ølby, fra Nippur til Melby. Bronzealderens glasperler på rejse. *Nationalmuseets Arbejdsmark* 2015: 76-87.

Kaul, F. & Varberg, J. 2017: Danish beads of Egyptian and Mesopotamian glass in context, and the amber connection. In: S. Bergerbrant & A. Wessman (eds), *New Perspectives on the Bronze Age.* Proceedings of the 13th Nordic Bronze Age Symposium held in Gothenburg 9th to 13th June 2015. Archaeopress Archaeology, Oxford: 375-386.

Ling, J.; Stos-Gale, Z.; Grandin, L.; Billström, K.; Hjärtner-Holdar, E. & Persson, P.-O. 2014. Moving Metals II. *Journal of Archaeological Science* 41: 106-132.

Ling, J.; Hjärthner-Holdar, E; Grandin, L.; Stos-Gale, Z.; Kristiansen, K.; Melheim, A.L.; Artoli, G.; Angelini, I.; Krause, R. & Canovaro, C. 2019. Moving metals IV: Swords, metal sources and trade networks in Bronze Age Europe. *Journal of Archaeological Science, reports,* 2019: 1-34.

Lomborg, E. 1969. Den tidlige bronzealders kronologi. *Aarbøger for Nordisk Oldkyndighed og Historie* 1968 (1969): 91-152.

Lurker, M. 1994. *Ægyptiske Guder og Symboler.* Politikens Forlag, Copenhagen.

Mahsarski, D & Schöbel, G. 2013. Archäologen in besetzten Osteuropa. In: *Graben für Germanen. Archäologie unterm Hakenkreuz.* Focke-Museum, Bremer Landesmuseum für Kunst und Kulturgeschichte, Konrad Theiss Verlag, Stuttgart: 140-146.

Mildner, S.; Falkenstein, F.; Schmidt, J. & Schüssler 2010. Materialanalytische Untersuchungen an ausgewählten Glasperlen des bronzezeitlichen Hortfund von Neustrelitz, Lkr. Mecklenburg-Strelitz. *Bodendenkmalpflege in Mecklenburg-Vorpommern* 57, 2009 (2010): 43-63.

Mitchell, A. 2018. *The spinning magnet. The electronic force that created the modern world – and could destroy it.* Dutton, Penguin Random House, New York.

Mukherjee, A.J.; Rossberger, E.; James, M.A.; Pfälzner, P.; Higgitt, C.L.; White, R.; Peggie, D.A.; Azar, D. & Evershed, R.P. 2008. The Qatna lion: scientific confirmation of Baltic amber in late Bronze Age Syria. *Antiquity* 82: 49-59.

Müller, S. 1882. Den europæiske Bronzealders Oprindelse og første Udvikling, oplyst ved de ældste Bronzefund i det sydøstlige Europa. *Aarbøger for nordisk Oldkyndighed og Historie* 1882: 279-356.

Nyord, R. 2019. Verden i en skål. Bemalet fajance fra det Ny Rige. *Papyrus* 2019, nr. 2: 24-31.

Nørlund, P. 1946. Nationalmuseet i de onde Aar, *Nationalmuseets Arbejdsmark* 1946: 5-14.

Petrescu-Dâmbovita, M. 1977. *Depozitele de bronzuri din România*. Editura Academiei republicii socialiste România, Bucuresti.

Pfälzner, P. & Rossberger, E. 2009. Das Gold des Nordens – Die Bernsteinobjecte. In: Al-Maqdissi, M.; Morandi Bonacossi, D. & P. Pfälzner (eds.), *Schätze des Alten Syrien. Die Entdeckung des Königreichs Qatna.* Stuttgart, Konrad Theiss Verlag, Stuttgart: 213-215.

Purowski, T.; Kepa, L. & Wagern, B. 2016. Glass on the Amber Road: the chemical composition of glass beads from the Bronze Age in Poland. *Journal of Archaeological and Anthropological Sciences,* 10: 1283-1302. (https://doi.org/10.1007/s12520-016-0443-8).

Pusch, E.B. 2003. Hittitisk arkitektur i Ramsesbyen? *Papyrus* 2003, nr. 2: 4-15.

Randsborg, K. 1993. *Kivik. Archaeology and iconography*. Acta Archaeologica 64 (1) (Monograph), Copenhagen.

Randsborg, K. & Christensen, K. 2006, *Bronze Age Oak-Coffin Graves. Archaeology & Dendro-Dating* (Acta Archaeologica 77, Acta Archaeologica Supplementa Monographs), Copenhagen.

Rehren, Th. & Freestone, I.C. 2015. Ancient glass: From kaleidoscope to crystal ball. *Journal of Archaeological Science* 56: 233-241.

Reiter, S. S.; Frei, K. M.; Wrobel Nørgaard, H. & Kaul, F. 2019. The Ølby Woman: A Comprehensive Provenance Investigation of an Elite Nordic Bronze Age Oak-Coffin Burial. *Danish Journal of Archaeology* 2019, vol. 8: 1-22.

Von Richthofen, J.; Kaul, F.; Gratuze, B. & Varberg, J. 2018. 3.000 Jahre „Globalisierung" in der Oberlausitz? Bronzezeitliche Glasperlen aus einem Brandgrab bei Jänkendorf. *Görlitzer Magazin, Geschichte und Gegenwart der Stadt Görlitz und ihrer Umgebung* 30/2017 (2018): 70-81.

Robins, G. 2012. *Women in Ancient Egypt*. Harward University Press, Cambridge, Massachusetts.

Rotea, M. 2017. The hoard from the „Cioclovina cu Apa" cave: content, dating, and significations. *Acta Musei Napocensis,* 54/I: 41-104.

Shaw, I. & Nicholson, P. 1995. *The British Museum Dictionary of Ancient Egypt*. British Museum Press, London.

Shortland, A. 2012. *Lapis Lazuli from the Kiln. Glass and Glassmaking in the Late Bronze Age*. Leuven, Leuven University Press.

Shortland, A. J.; Tite, M. S. & Ewart, I. 2006. Ancient exploitation and use of cobalt alums from the western oases of Egypt. *Archaeometry* 48/1: 153–168.

Shortland, A.J., Rogers, N. & Eremin, K. 2007. Trace element discriminants between Egyptian and Mesopotamian Late Bronze Age glasses. *Journal of Archaeological Science* 34: 781-789.

Smirniou, M. & Rehren, T. 2013. Shades of blue e cobalt-copper coloured blue glass from New Kingdom Egypt and the Mycenaean world: a matter of production or colourant source? *Journal of Archaeological Science* 40: 4731-4743.

Varberg, J. 2015. Where have all the young girls gone? *Adoranten* 2015: 21-28.

Varberg, J. in press. Mesopotamian and Egyptian Glass in Danish Bronze Age Graves. In: Klimscha, F. (ed.), *Ancient Glass and Glass Production*. Berlin Studies of the Ancient World 67, Berlin.

Varberg, J.; Gratuze, B. & Kaul, F. 2015. Between Egypt, Mesopotamia and Scandinavia: Late Bronze Age glass beads found in Denmark. *Journal of Archaeological Science* 64, 2015: 168-181.

Varberg, J., Gratuze, B., Kaul, F., Haslund Hansen, A., Rotea, M & Wittenberger M. 2016: Mesopotamian glass from Late Bronze Age Egypt, Romania, Germany and Denmark. *Journal of Archaeological Science* 2016: s. 375-386.

Walton, M.S.; Shortland A.; Kirk S. & Degryse P. 2009. Evidence for the trade of Mesopotamian and Egyptian glass to Mycenaean Greece. *Journal of Archaeological Science* 36: 1496-1503.

Walton, M.; Eremin K.; Shortland A.; Degryse P. & Kirk S. 2012. Analysis of Late Bronze Age glass axes from Nippur - A new cobalt colourant. *Archaeometry* 54(5): 835-852.

Wilkinson, R.H. 1999. *Symbol & Magic in Egyptian Art.* Thames & Hudson, Paperback edition, London.

Winther Johannsen, J. 2010. The Wheeled Vehicles of the Bronze Age on Scandinavian Rock-carvings. *Acta Archaeologica* 81, 2010: 150-250.

Woltermann, G. 2014. Bernsteinschmuckproduktion in der Hügelgräberbronzezeit. In: Nessel, B.; Heske, I. & Brandherm, D. (eds.), *Ressourcen und Rohstoffe in der Bronzezeit. Nutzung – Distribution – Kontrolle*. Arbeitsberichte zur Bodendenkmalpflege in Brandenburg 26, Brandenburgisches Landesamt für Denkmalpflege und Archäologisches Landesmuseum, Wünsdorf: 74-86.