Re-visiting the Roman Iron Age Hoby chieftain's burial 100 years after its discovery – adding the strontium isotopic perspective

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ABSTRACT
The remains of one of Northern Europe's richest graves, the Hoby chieftain's burial, were found in 1920 on the island of Lolland (southern Denmark). The grave revealed a large number of luxurious Roman goods, including two silver drinking cups decorated with Greek-inspired scenes from Homer's Iliad. The burial dates to the Early Roman Iron Age (c. 1CE -150/160CE), and represents a key site from the time period when the Roman Empire failed to expand towards the north and altered its strategy towards a more political and diplomatic relationship with the tribes in Northern Europe. Hence, the Hoby burial is considered a key example reflecting this strategic transition. Here we revisited the Hoby burial materials and present the first strontium isotope analysis of the so-called chieftain's skeletal remains. Analyses of three of the individual's teeth, complemented by 10 environmental samples, shed light on this individual's provenance. We discuss the results in light of the new insights provided by recent excavations of a contemporary nearby settlement. Our results indicate that the Hoby individual was most probably of local origin, corroborating previous interpretations. Furthermore, the nearby settlement seems to confirm the central role of the Hoby site in the Early Roman Iron Age society.

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Introduction

In the area of present-day Denmark, the beginning of the Common Era (first century AD) marks a time of increasing contact with the Roman world (e.g. Hedeager 1992; Jensen 2003; Lund Hansen 1987). Exotic burial goods such as Roman glass, bronze vessels, and silver wares provide evidence of increased connections with Rome and its provinces. These types of luxury goods were reserved for the elite. At first, these imported goods remained concentrated in the southern regions of Denmark, such as the islands of Funen and Lolland-Falster. Later on, Roman objects appear throughout present-day Denmark. The Hoby burial is situated on the island of Lolland in southeast Denmark (Figure 1), and based on the characterisation of the burial goods, dates to the beginning of the 1st century CE, i.e. the Early Roman Iron Age (1CE -150/160CE), corresponding to new contact strategies established by the Roman Empire.

The Hoby grave represents one of the richest Early Roman Iron Age burials in Northern Europe.

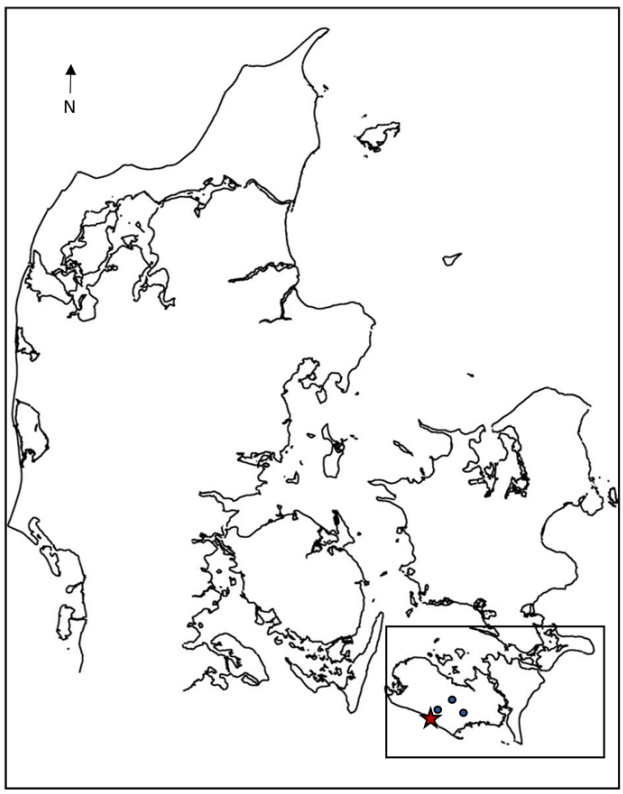

Figure 1. Map of Denmark, with the location of the Hoby site (red star) and additional baseline locations made in connection to this study (dots).

Figure 2. Close up image of the scene depicted on one of the Hoby grave's silver cups where the Trojan King Priam kneels before Achilles while asking him to hand over his son's corpse (Photo: Lennart Larsen, National Museum of Denmark).

Besides the unique assemblage of grave goods, the burial also contained the skeletal remains of a middle-aged adult male, likely a prominent local chieftain (Friis Johansen 1923).

The grave goods in the Hoby grave include a Roman table service consisting of a washing dish, a wine bucket and ladle, a jug, a tray and two silver drinking cups decorated with scenes from The Iliad (Figure 2, 3). Both cups are depicting scenes from the Trojan war as described by Homer. Figure 2 shows a close up of the Trojan King Priam kneeling before Achilles asking him to hand him his son's corpse. Achilles had killed the Trojan Prince Hector. Driven by his anger, Achilles first refuses but ends with allowing King Priam to take with him his son's corpse (Friis Johansen 1923, 121-124). In addition, the grave also contained a silver cup with a bronze handle, a drinking horn, a bronze knife, a bone pin, a wooden casket, bronze and iron sheets, a belt buckle, two gold finger rings, seven fibulae, three pottery vessels and two cut pork femora, presumably the remains of cured hams which had been placed in the grave (Figure 3).

The first centuries CE are known to have been a key period for the Roman Empire's relations with Germania in the Northern world. This is because the Roman Empire failed to expand northward after being defeated at the famous Battle of Teutoburg Forest in present-day Germany, during the summer of the year 9 CE. Consequently, this battle was a game changer for the Roman Empire. The defeat left a deep impression on Roman society, and particularly on the Emperor Augustus who in the course of just a few days lost somewhere around three legions of soldiers, a third of his standing army (Jørgensen et al. 2003, 110-111). As a consequence, and after a few years of punitive campaigns to follow, the Romans abandoned their invasion of Germania and changed course towards a more politically diplomatic relationship with the northern tribes (summary in: Burmeister and Kaestner 2015).

In Denmark, the Early Roman Iron Age has been intensively investigated archaeologically. However, it is only fairly recently that investigations have focused on human remains dating to this period (Holst et al. 2018). We have therefore conducted strontium isotope analyses on the remains of the male individual from Hoby in order to provide new information on one of the most important archaeological finds of this period from present-day Denmark.

Figure 3. The grave goods from the Hoby burial discovered in 1920 (Photo: Lennart Larsen, National Museum of Denmark).

The archaeological context

The grave was discovered in 1920 during the laying of a drain in connection with a newly-built property (Friis Johansen 1923; Klingenberg 2011; Lund Hansen 1987). At a depth of 2 meters in the gravel-rich subsoil, the two large silver cups resting on a bronze tray came to light. The workers continued digging until they thought there were no further goods to be found at the location. Shortly after, the National Museum of Denmark in Copenhagen was informed of the find and two days later archaeologist Thomas Thomsen visited the site. Fortunately, the burial was still open when Thomsen arrived, enabling him to obtain a significant amount of contextual information from what remained of the burial. During subsequent excavation, skeletal remains and additional bronze fragments were recovered. Surface water percolated into the grave and froze shortly after, preventing further investigations at that point in time. However, already in February 1920, another archaeologist from the National Museum of Denmark, H. C. Broholm, was able to carry on the excavation at the site. On the day prior to Bornholm's arrival, the landowner had back-filled the grave, during which a silver brooch was also recovered from the fill of the grave itself. Broholm arranged for the grave fill to be

carefully sieved, which resulted in the identification of further objects, including a number of potsherds, bronze fragments, a bronze brooch and a fragment from a drinking horn. Additionally, and of importance to the present study, further skeletal remains from the individual buried in the grave were also recovered. These remains included fragments of a human mandible. The skeletal materials also included animal remains from two young pigs as well as fragments of bones from sheep or goats (Friis Johansen 1923; Klingenberg 2011).

The grave and human remains (NM I C17946-64, skeleton 1, B):

The grave was a flat inhumation grave with a NE-SW orientation. Upon excavation, it contained an incomplete human skeleton lacking parts of the lower extremities. Parts of the deceased's legs still lay in situ at the time of Thomsen's investigation. This indicated that the deceased had been lying with his head at the northeast end of the grave. Beneath the legs, a wooden layer was observed which was probably the remains of the base of a wooden coffin. There is unfortunately no information on the width of the grave. The fragmented mandible was found with some teeth still present in situ. From these, it was later determined that the individual was possibly an adult male (Sellevold et al. 1984).

Artefacts recovered from within the burial (NM I C 17946-64 and Dnf. 2-11/1920):

As mentioned above, the artefacts recovered from within the burial consist of numerous objects (Figure 3). These included a large bronze basin with a base (in Eggers (1951) E 97), a bronze saucepan with manufacturer´s mark (E 140), a bronze pitcher with a trefoil mouth (E 126), a tray of bronze (E 115), a bronze situla with face motifs (E 24) and two silver cups (E 168). In addition, other grave goods consisted of yet another small silver cup with a handle made of bronze (E 166), drinking horn mountings, a bronze knife, a bone pin, a wooden casket with bronze mountings, bronze and iron sheets, a belt buckle of bronze, two gold finger rings, and seven metal fibulae. These comprise two bronze ´Rollenkappen´ fibulae of type A II 25 and five of silver, of which three were ´Rollenkappen´ of type A II 25-26 and two were strongly profiled of type A IV 71 (Almgren, 1897). One of the silver ´Rollenkappen´ fibulae and both of the profiled fibulae exhibit additional gold plating. Moreover, three of the silver fibulae (A II, 25-26) are noteworthy in that they are very early examples of Germanic art with zoomorphic decoration (Klingenberg et al. 2017). In this connection, it is also worth mentioning the small silver cup and the bronze handle, as these did not originally belong together. The upper part of the cup handle is formed like an animal´s head with the animal´s open jaw gripping the rim of the very cup. While the silver cup is of Roman make, the bronze handle with its animal shape and motif is typical of Scandinavian design. Therefore, it is assumed that the handle was locally made and then affixed to the imported Roman cup.

The two gold finger rings from the Hoby burial are of Beckmann's type 1 and 11 (Beckmann 1969 No. 25 and No.171) which are seldom seen in the beginning of first century CE. Gold is apparently quite rare for this period in the North, and any gold objects were likely regarded as expressions of high social status (Klingenberg et al. 2017, 122). Likewise, the presence of two gold finger rings is similarly indicative of high status; in fact, two gold finger rings are otherwise only known from one grave at Byrsted in north Jutland from this period (Schuster 2010, 288).

In 1953, H. J. Eggers introduced the term ´Lübsow type´ as a designation for richly equipped burials in Northern Europe, the so-called 'princely graves,' that date to the first two centuries CE (Eggers 1953). The Hoby grave dates within this period and represents one such richly equipped grave of this type. The similarities between graves of this type include the presence of imported Roman vessels, the use of gold and objects with zoomorphic decoration (Klingenberg et al., 2017). Hence, the Hoby (Lund Hansen 1987, 403) and Byrsted (Lund Hansen 1987, 405) grave goods support that contacts with the Roman world existed between the highest levels of society in various geographical regions of present-day Denmark.

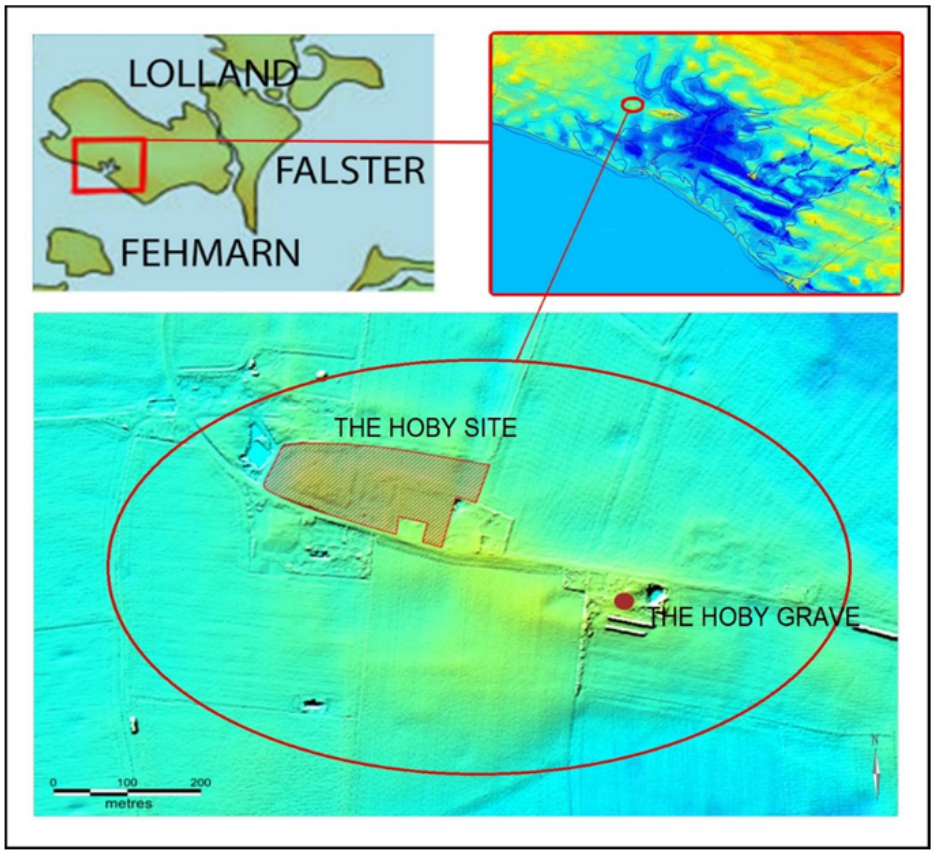

Figure 4. Location of the Hoby site (settlement) and the Hoby grave near the Rødby Fjord. The coastline depicted is based on the reconstruction of c. 1776 (courtesy of Museum Lolland-Falster).

With respect to the dating of the Hoby burial, several suggestions have been made. Lund Hansen (2000) proposed that the grave dates to Phase B 1a or possibly to the very early Claudian period (41CE-54CE). Schuster (2010, 309) argues that it is contemporary with the Lübsow-Sandberg 1 grave and dates the burials to the Claudian period within Phase B 1b. This last interpretation is based on the two fibulae of type A IV 71 as well as on the presence of the large number of fibulae in the grave, which has not been observed in earlier inhumation graves in the region. Overall, the contextual chronological dating of the Hoby grave places it towards the end of the first half of the 1st century CE (Klingenberg et al. 2017, 121)

The landscape and the settlement

The landscape surrounding Hoby has changed considerably since the Iron Age. The south coast of Lolland consists of low-lying land, which is today protected by a major sea-dyke constructed following a severe storm in 1872. The sea-dyke covers the entire south coast of Lolland along the Baltic Sea. The Hoby burial and the nearby settlement are situated on a minor elevation in the otherwise flat terrain of Lolland. In the Early Roman Iron Age, a small branch of the nearby Rødby fjord probably extended almost all the way to Hoby and from there it was most likely possible to sail out to the Baltic Sea (Figure 4). Therefore, the location was ideal from a strategic point of view, as the site was somewhat away from the Baltic Sea, yet still within easy access to it. Furthermore, the low-laying landscape and fertile soils of south-western Lolland offered rich farming and grazing potential. Scientific analyses of pollen and macrofossils from the nearby settlement area revealed that the landscape around Hoby and the Rødby fjord to the southeast was, at that time, an open cultural landscape (Klingenberg et al. 2017, 132).

The nearby Iron Age settlement was discovered in 1999 when the remains of pottery were observed in a field near Hoby. Staff from the Museum Lolland-Falster and the National Museum

of Denmark in Copenhagen examined the site, and concluded that the remains of pottery and areas of dark soil observed represented parts of a settlement area from the Early Iron Age. It was clear that there was a need for an archaeological excavation, and a collaboration between the former Lolland-Falster´s Stifsmuseum now Museum Lolland-Falster and the National Museum of Denmark was initiated. In 2000, 2001 and 2005, minor excavations consisting of machine-made trenches were undertaken. The aim of these initial investigations was to establish the extent of the settlement and to identify the culture layer, as well as to ascertain the preservation of the site. The most recent excavations took place between 2010-15, after a new partner, Zentrum für Baltische und Skandinavische Archäologie, Schloss Gottorf, joined the project in 2010 (Blankenfeldt and Klingenberg 2011). The site has not yet been excavated to its full extend, but large parts of the central settlement and activity area have been so far investigated. A fundamental question with regards to the Hoby individual remains still open: that is, was the nearby settlement actually home to the individual buried in the chieftain's grave? To address this question, several aspects should be highlighted. One is the relatively short distance between the inhumation grave at Hoby and the settlement area, as well as the location of both in the landscape. The distance between the grave and settlement is roughly 200 meters, and both the settlement and the burial are situated on the same slightly elevated terrain. An examination and characterization of other finds from around the Hoby burial, and their comparison with grave finds from neighbouring sites, reveals that the other closest nearby settlements from this period lie between 2-5 kilometres away from the grave. In other words, there are no other known settlements from this period in the immediate vicinity of the Hoby grave besides the one situated close to the site. Another aspect which supports the assumption that the grave and the settlement are contemporaneous, is based on studies of the pottery from the Hoby burial and the settlement area which revealed great similarities in style and manufacture (Klingenberg et al. 2017). Yet, another interesting aspect, is that investigations of the nearby settlement showed that the structures are different from those seen at other known settlements from this period. This suggests a somewhat special and perhaps unique type of settlement, probably one of a certain status type.

Remains of the settlement and associated activities have been found in an area of more than 150 x 100 meters. To date, roughly one third of this has been excavated. Across large parts of the settlement area, the cultural layer is preserved up to a thickness of 60-65 cm. The remains of 52 buildings have been identified – large longhouses, small longhouses and other minor buildings. Additionally, also wells, pits, cooking pits, two large water-filled holes and massive refuse accumulations containing bones from animals have so far been identified. The cultural layer is not preserved in the west of the settlement area. There, remains of houses c. 10-15 meters in length have been located, together with a number of small square buildings. The habitation area is situated in the southern part of the settlement area, while to the north there is an activity area dominated by two large water-filled holes, cooking pits and accumulations of animal bones. In the central part of the settlement there are rows of longhouses with E-W-orientation as well as a building with a N-S-orientation. It has not been possible to identify the existence of stables in the longhouses. Remains of the well-preserved houses point to clay floors running over the full length of the buildings, and inside some of the houses several remnants of hearths or ovens are evident. The remains of the houses at Hoby differ markedly from those of most other longhouses of this period, in which the living quarters were at one end and a stable at the other (Klingenberg et al. 2017).

Two very long buildings dominated the settlement (Figure 5). The fence around the N-S-oriented building suggests that special functions could be associated with this particular structure and to the enclosed area: one possible interpretation is that these reflect a kind of gathering place or perhaps a precursor of the hall-like buildings that appear in the Late Iron Age (375 CE-1050 CE). The three buildings stand out on account of their dimensions, their construction and the long duration of their use. While common houses in this period usually had stables at one end, no traces of such areas could be detected in the three very well-preserved buildings (Warmers 2017, 46).

Figure 5. Site plan showing the excavated areas of the Hoby settlement. To the south and to the west there a number of longhouses. To the North is the activity area dominated by two large water-filled holes, cooking pits and accumulations of animal bones. Remains of longhouses are marked in grey, postholes in black, large water-filled holes and wells in blue, bone accumulations in yellow and cooking pits have a black outline (Illustration: Josefine F. Bican, National Museum of Denmark).

The activity area was dominated by the two water-filled holes. These revealed several wattle fences made of hazel. The fences were raised immediately after the holes were dug, as no deposits were accumulated beneath the fences. Furthermore, there was a large wooden construction in the central part of the southernmost hole, where more extensive excavations were made. There is no apparent explanation to the function of the southernmost hole, where more extensive excavations were made. Three separate horizons in these holes have been scientifically investigated using microscopy and DNA analysis. The results of these investigations reveal evidence of intestinal worms and dietary components. While these analyses produced interesting results documenting a change in the use of the holes over time (Tams et al. 2018), they did not provide any clarifying information regarding original purpose or function. It is however clear that animal bones, including jaw bones, had been thrown into the holes shortly after they had been dug. The practice of offering animal bones and stones is well-documented by offerings found in bogs and votive wells. Such an interpretation could perhaps explain the purpose of the large holes and the numerous finds contained therein. The work of Jesper Hansen (2006, 170) supports this assumption. The finds of many animal bones left over from meals, together with the many coeval cooking pits, should perhaps be seen as a result of people gathering at the Hoby settlement, perhaps of people coming from a wider area/region around Hoby, with the aim to participate in some kind of ritual events such as communal feasts (Klingenberg et al. 2017).

Materials and Methods

Materials:

The anthropological material (NM I C17946-64, skeleton 1, B) herein investigated has been previously studied by Sellevold, Lund Hansen and Jørgensen (1984). In relation to the sampling for this investigation, physical anthropologist Charlotte Primeau, with dentist Verner Alexandersen, conducted a new anthropological study of the Hoby individual's mandible and concluded that 11 teeth were still in *in situ* position, while three were loose and four other teeth were lost postmortem. The teeth were all well-developed, including the roots of the third molars, which indicates a minimum age of between 19-21 years. Based on the tooth wear, the individual was estimated to have been an adult of about 25-35 years of age at the time of death. The fragmented state of the mandible made it difficult to estimate the sex of the individual, but the corpus of the mandible and the shape of the chin suggest that it belonged to a male. This correlates well with the conclusions from the previous physical anthropological studies drawn by Sellevold, Lund Hansen and Jørgensen (1984) as well as with the archaeological context which also suggest the grave of a high-status male. Future aDNA analyses may shed further light on this issue.

Strontium Isotope Analyses:

In order to investigate the provenance and/or potential mobility of the Hoby individual, we sampled tooth enamel from three of the individual's teeth on which we conducted strontium isotope analyses. We sampled the first molar which was still in an *in situ* position in the mandible, and performed analyses of two of the additional loose teeth, a canine and a third molar.

In order to interpret results of strontium isotope analyses from human remains, it is important to have knowledge of the local bioavailable strontium isotope baseline range. For the area of present-day Denmark, several baselines have been established based on different types of environmental proxy samples, including surface and ground waters, soil samples and fauna remains consisting of over 500 total samples (e.g. Frei 2013; Frei and Frei 2011; Frei and Price 2012; Frei and Frei 2013; Frei et al. 2020a; Frei et al. 2020b; Nielsen et al. 2020a; Price et al. 2007; Price et al. 2011; Reiter et al. 2019). Furthermore, though more general, a recently published strontium isotope baseline study encompassing almost 1200 soil samples taken from throughout Europe (including Denmark) adds yet another layer of measurements and general knowledge of regional baselines in Europe (Hoogewerff et al. 2019). All these studies suggest that the local bioavailable baseline of present-day Denmark (excluding the island of Bornholm) ranges between $^{87}Sr/^{86}Sr = 0.7081$ to 0.7111.

While this range is widely applied and accepted, a study aiming at investigating the effect of agricultural liming in surface waters in areas of western Jutland claimed that the surface waters are not suitable proxies for characterizing baselines (Thomsen and Andreasen 2019). However, newer studies within the same areas as those investigated by Thomsen and Andreasen (2019) clearly showed that agricultural lime is effectively retained near the surface, thus minimizing the effect of agricultural liming on surface waters. As a consequence of this, rendering baseline maps constructed on the basis of surface waters are still relevant for the use in provenance studies (Frei et al. 2020a). Furthermore, it is important to recognize that single sampling points across the landscape are not sufficient enough to fully characterize the bioavailable strontium isotope baseline spectrum of an area. For this purpose, the isotope signatures of larger water bodies for example are likely more representative as they characterise the averaged-out isotope composition of bioavailable fractions from an entire catchment area or aquifer, respectively.

Further, not all the measurements might be of significance for the characterisation of the diet of a human (e.g. Frei et al. 2020a; Montgomery 2010). There are therefore many factors to be considered when interpreting strontium isotope analyses from various materials and proxy archives. For example, one such factor is the concentration of the strontium sources investigated and how different sources of strontium have more or less relevance in the mass budget balance with respect to the food intake of a human (Watts and Howe 2010).

It appears that for humans, the plant share of the diet is one of the more dominant contributors to skeletal strontium signatures with a comparatively negligible input being derived from animal (meat) sources (Montgomery 2010). Water, depending on its strontium concentration, seems also to be an important source of strontium for humans (Watts and Howe, 2010). So, for example, while Thomsen and Andreasen (2019) measured a few surface waters from ponds in Western Jutland with strontium isotopic compositions higher than those within the above mentioned baseline, the strontium concentrations of these samples are so low that they lose their relevance in a mass budget calculation of a human (Frei et al. 2020a). As a result, these few water sources or ´points´ in the landscape with high strontium isotope ratios, but with low strontium concentrations, do not seem to be relevant for human provenance studies or in characterizing strontium isotope bioavailable baselines, and should therefore be considered with caution (Frei et al. 2020a).

In the present study, we also conducted 10 additional strontium isotope analyses of environmental samples from the burial area in order to add supplementary information to the already large baseline coverage of the area. To this aim, we collected plants, soil and surface-water samples from four different localities from the island of Lolland where the Hoby burial is located. Of these, three were soils, three were waters and four were plant samples (see location of the sampling sites in Figure 1). The environmental samples were treated and analysed as described in Ladegaard-Pedersen et al. (2020).

Tooth enamel samples were pre-cleaned by removing the enamel's surface with a drill bit. Subsequently, a few milligrams of enamel were sampled from each tooth. The tooth enamel samples were dissolved in 7 ml Teflon beakers (Savillex™) in a 1:1 solution of 0.5 ml 6 N HCl (Seastar) and 0.5 ml 30 % H_2O_2 (Seastar). The samples dissolved within a few minutes, after which the solutions were dried on a hotplate at 80 °C. Thereafter, the enamel samples were taken up in a few drops of 3N HNO_3 and then loaded onto disposable 1 ml pipette tip extraction columns into which we fitted a frit to retain a 0.2 ml stem volume of pre-cleaned mesh 50-100 SrSpec™ (Triskem) chromatographic resin. The elution recipe essentially followed that of Horwitz et al. (1992), albeit scaled to our needs (insofar as strontium was eluted / stripped by pure deionized water and then dried on a hotplate).

Thermal ionization mass spectrometry was used to determine the Sr isotope ratios. Samples were dissolved in 2.5 µl of a Ta_2O_5-H_3PO_4-HF activator solution and directly loaded onto previously- outgassed 99.98% purity single rhenium filaments. Samples were measured at 1250-1300 °C in a dynamic multi-collection mode on a VG Sector 54 IT mass spectrometer equipped with eight Faraday detectors (Institute of Geosciences and Natural Resource Management, University of Copenhagen). Five nanogram loads of the NBS 987 Sr standard that we ran during the time of the project yielded $^{87}Sr/^{86}Sr$ = 0.710239 +/- 0.000011 (n=5, 2σ).

Results and Discussion

Since its discovery 100 years ago, one of the central questions has been whether the Hoby burial was a single grave or whether it was part of a larger cemetery. It is evident from the archives of the National Museum of Denmark, which registers incoming objects, that already in 1897 another find from this site was discovered and recorded. This early find consisted of a bronze vessel containing cremated human remains (burnt bones) and remains of an iron sword scabbard (Figure 6). The bronze vessel, which had been used as a funerary urn, is a so-called situla with a heart-shaped leaf decoration by the handle (Figure 6). Only one other example of such type of vessel is known from the area of present-day Denmark, which was found in a burial at Stenløse on the island of Zealand (Liversage 1980 No A 57:32 and PI:51; Lund Hansen 1987, 458). Otherwise, this type of bronze vessel has its main area of distribution in Germany. Bronze vessels of this type were imported from the Roman Empire and are dated to the time around the beginning of the CE. The vessel has been interpreted to be an example of an early Roman import. Given that this grave also contained the remains of a weapon (sword), it suggests that an individual of high status already lived at Hoby around the beginning of the CE. This discovery suggests that there may have been several graves here originally. Further confirmation of this hypothesis was provided by locals who indicated

Figure 6. The grave goods from the cremation grave that was found in 1897. The cremated bones were in the bronze vessel. The two mountings were originally on the sides of the vessel, and the handle was attached to these. The handle is terminated on each side by a bird´s head. The vessel originally stood on three feet. On the bottom of the vessel one can see traces of brazing (Photo: Arnold Mikkelsen, National Museum of Denmark).

that bones and pottery – presumably urns – came to light during gravel digging activities. However, excavations in 1922 conducted by Hans Kjær from The National Museum of Denmark were not successful in finding additional graves. But, the extent of the area investigated at that time is unknown, and seen from a modern perspective, it was probably limited. As mentioned above, the National Museum of Denmark – in cooperation with Zentrum für Baltische und Skandinavische Archäologie (ZBSA), Museum Schloss Gottorf – also undertook another investigation of the area in 2010. At this time, a magnetometer survey was conducted, but it did not reveal any additional burials either. In September 2016, Museum Lolland-Falster and the National Museum of Denmark conducted yet an additional minor investigation of the area to the south and to the east of the Hoby burial, this too was unsuccessful in locating additional graves. The areas to the north and to the west of the Hoby grave remain still to be investigated, leaving the possibility for the existence of yet unidentified graves in the area (Klingenberg et al. 2017, 124). Nevertheless, the early find from 1897 of a bronze vessel containing cremated human remains and the remains of an iron sword suggest that more graves may yet to be found in the vicinity.

Social structure during the period at the beginning of the CE in present-day Denmark has traditionally been perceived as consisting of tribal chiefdoms characterised by ´personal-bound´ relationships (e.g. Holst et al. 2018, 1) with little to no evidence of largescale conflicts. However, recent excavations and investigations at the site of Alken Enge in East Jutland have provided evidence of human remains that have been interpreted to be those of a defeated army, with a minimum of 82 fallen individuals, suggesting opposing forces comprising a considerable number of combatants (Holst et al. 2018). Still, rich graves with Roman objects like the one from Hoby, or the female grave from Juellinge (e.g. Lund Hansen 1987, 402-403) also from the island of Lolland, suggest a group of high status individuals (of both

sexes) with potential ´personal-bound´ diplomatic connections to regional trade networks (e.g. Jørgensen et al. 2003, 110-111).

In Denmark, strontium isotope analyses on human remains have been conducted on individuals dating from the Mesolithic to the Middle Ages, with strong focus on the Neolithic, the Bronze Age and the Viking Age (e.g. Croix et al. 2020; Felding et al. 2020; Frei et al. 2019; Frei et al. 2015; Frei et al. 2017; Nielsen et al. 2020a; Nielsen et al. 2020b; Price et al. 2011; Reiter et al. 2019). However, relatively few individuals from the Iron Age have been investigated using this technique thus far. Consequently, there is a gap with respect to the potential information that this type of scientific analysis can provide with respect to the Iron Age within present-day Denmark.

In our present study, we complemented the already large existing strontium baseline data from plants, soils, fauna and water samples mentioned above with 10 additional environmental samples from plants, surface water and soils collected from the surroundings of the Hoby site (Figure 1). The area around Hoby is partially agriculturally cultivated therefore we aimed at avoiding sampling within farmed areas as much as possible.

The strontium isotope results from the bioenvironmental samples range from $^{87}Sr/^{86}Sr$ = 0.70868 to $^{87}Sr/^{86}Sr$ = 0.71087 (Table 1). This range compares well with the strontium isotope ratios measured in bioenvironmental samples in a previous, though similar, local baseline study of the surrounding area of the Bronze Age burial mound of Ølby, on the island of Zealand north of Lolland. Here the bioenvironmental samples yielded ratios between $^{87}Sr/^{86}Sr$ = 0.70871 to $^{87}Sr/^{86}Sr$ = 0.71031 (Reiter et al. 2019). In sum, the bioenvironmental samples measured herein from Hoby fall within the above mentioned baseline range for present-day Denmark.

The results of the strontium isotope analyses of the Hoby individual are also presented in Table 1 and yielded $^{87}Sr/^{86}Sr$ = 0.71095 in the first molar, $^{87}Sr/^{86}Sr$ = 0.71084 in the canine, and $^{87}Sr/^{86}Sr$ = 0.71077 in the third molar. Hence, the three tooth enamel samples yielded strontium isotope ratios that fall within the baseline for present-day Denmark and straddle the upper limit of the local bioavailable strontium signature range at Hoby, therefore suggesting a local origin of the Hoby individual. However, it should be mentioned that similar strontium isotope values are widespread across Europe (e.g. Hoogewerff et al. 2019), hence we cannot exclude the possibility that the Hoby individual originated from another area with a baseline range similar to that of present-day Denmark.

These new strontium isotope results should also be seen in light of the above mentioned re-

Lab Nr.	Museums Nr./Site	Material	Sr (conc.) ppb	$^{87}Sr/^{86}Sr$	2σ(abs.)
Human remains					
KF 804 1	NM 1 C17946-64, skelet 1, kiste B	M1		**0,71095**	0,00001
KF 804 2	NM 1 C17946-64, skelet 1, kiste B	Canine		**0,71084**	0,00001
KF 804 3	NM 1 C17946-64, skelet 1, kiste B	M3		**0,71077**	0,00001
Baseline environmental samples					
KF 2064	Maribo (by the lake)	soil	**504**	**0,71048**	0,00001
KF 2065	Hoby grave	soil	**189**	**0,71068**	0,00001
KF 2066	Røgbølle (by the lake)	soil	**136**	**0,70868**	0,00001
KF 2067	Maribo lake	water	**36**	**0,71074**	0,00001
KF 2068	Small lake (near the Hoby site)	water	**17**	**0,70947**	0,00001
KF 2069	Røgbølle lake	water	**28**	**0,71047**	0,00001
KF 2070	Maribo (by the lake)	plant	**1906**	**0,71087**	0,00001
KF 2071	Hoby grave (bush a)	plant	**3436**	**0,70944**	0,00001
KF 2072	Hoby grave (bush b)	plant	**8738**	**0,71004**	0,00001
KF 2071	Røgbølle (by the lake)	plant	**2869**	**0,70868**	0,00001

Table 1. Strontium isotope results from tooth enamel from the Hoby individual and environmental samples.

cent investigations of the nearby settlement which confirmed the central role of Hoby in the Early Roman Iron Age society (Klingenberg et al. 2017, 131). This and other previous research focusing on the Iron Age population and infrastructure on the island of Lolland, as well as on investigations of the landscape, provide evidence for an open cultural landscape including numerous settlements, richly furnished burials, and fortifications. If one also considers other rich burials from Lolland-Falster such as those at Stangerup, Alsø, Juellinge, Munkehøjgård (Lund Hansen 1987, 402-403) and Toreby (Klingenberg et al. 2017, 133), we see Roman luxury goods reached the western shores of the Baltic Sea in the Early Iron Age. In the wealthy female graves from Juellinge some of the earliest glass vessels have been found in the Baltic Region. The burials testifies the region's contact with the Roman Empire south of the Baltic Sea (Klingenberg et al. 2017, 133-134).

While the valuable drinking set has been interpreted as either a reward for participation in a punitive expedition or as a diplomatic gift, both interpretations suggest that the Hoby chieftain held sway over a large area. The various building types and finds suggest a relatively populous community and show that gatherings (including potential ritual activities) likely took place within the settlement. The numerous cooking pits, the large holes and the offerings made in them, and perhaps even the areas with large accumulations of animal remains, should perhaps be interpreted as evidence of gatherings involving many people from the surrounding areas, potentially land holdings which the Hoby chieftain either controlled or had some influence over.

Together with the new strontium analyses, which corroborates previous assumptions that the chieftain from Hoby was a ´local´ individual, it seems plausible that the Hoby individual may have maintained a two-folded social- and exchange-network(s): i) one within the local community of Lolland including potentially some kind of ritual significance, and ii) one with far-reaching extra-regional contact, potentially of a diplomatic character. In other words, the Hoby chieftain seems to have had strong connections both at the local and region scales as well as to the distant Roman World.

While this study adds new information directly from human remains dating to the Iron Age, we emphasize the need to investigate more individuals from this period (by e.g. conducting strontium isotope or/and biomolecular analyses), including non-elites, in order to gain a better understanding of Iron Age society in the region of present-day Denmark. It is our hope that this study will awaken interest in conducting several types of scientific analyses directly on archaeological human remains, and including anthropological, archaeological and historical perspectives to the overall interpretative synthesis of the past.

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Declaration of Interest Statement

No conflicts of interest are known by the authors in relation to the material addressed in this manuscript.

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