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LARGE CASTLES AND LARGE WAR MACHINES IN DENMARK AND THE BALTIC AROUND 1200 - AN EARLY MILITARY REVOLUTION?

In 1989, the first modern replica in Denmark of a medieval trebuchet was built on the open shore near the city of Nykobing Falster during the commemoration of the 700th anniversary of the granting of the city's charter, and archaeologists and interested amateurs began shooting stones out into the water of the sound between the islands of Lolland and Falster. From this humble beginning, the place has now, twenty years later, developed into a medieval re-enactment centre with more war machines, medieval houses and food, and its own harbour and replicas of ships and small boats, and the centre is visited each year by more than 60,000 guests from Denmark and abroad* (1). Considerable expertise has been assembled by those working in such centres, and experimental archaeology has contributed significantly to our understanding of how these machines actually functioned; how war was actually conducted; and how we should interpret the often fragmentary descriptions and illustrations of weapons in medieval sources. But the interest in war machines also reflects a new interest in warfare itself.

Since the middle of the nineteenth century Danish historians have generally been uninterested in warfare and more or less directly assumed that Danes in the Middle Ages were as pacifistic and peaceful as their

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(1) http://www.middelaldercentret.dk/

modern compatriots have been obliged to be with their transition from a huge Northern European empire in the eighteenth century to a minor and politically insignificant nation-state in the twentieth^. Medieval warfare has been neglected by Danish historians, but a change seems to have taken place since the early 1990's when the first modern historical analyses of the role of warfare in medieval society began to appear[2] [(3)]. Eventually, in 2008, for the first time ever there appeared a History of Warfare in Denmark written by professional historians[(4)]. Meanwhile after one and a half centuries of neutrality Denmark had actively joined a war with its participation in the invasion of Iraq in 2003. Whether this was a result of the renewed historical interest in warfare, or vice versa, is impossible to say At least it reflects a new interest in military history, of which the present article is also a manifestation. It is the aim here to look at castles, at large war machines, and to a lesser extent at ships, in the years around 1200, and to try to argue that what might be understood as a military revolution took place in this period.

Castles

Castellology in Denmark has been characterized by two confident, but unfounded assumptions - that in the high middle ages the building of castles was solely a royal prerogative, and that fortifications were erected as a defence against attacks from neighbouring Scandinavian countries and especially the pagan Slavic or Wendic pirates living in scattered settlements in the areas between Holstein and Rügen (in present day Northern Germany). Castles were defensive and not aggressive, it was claimed[(5)].

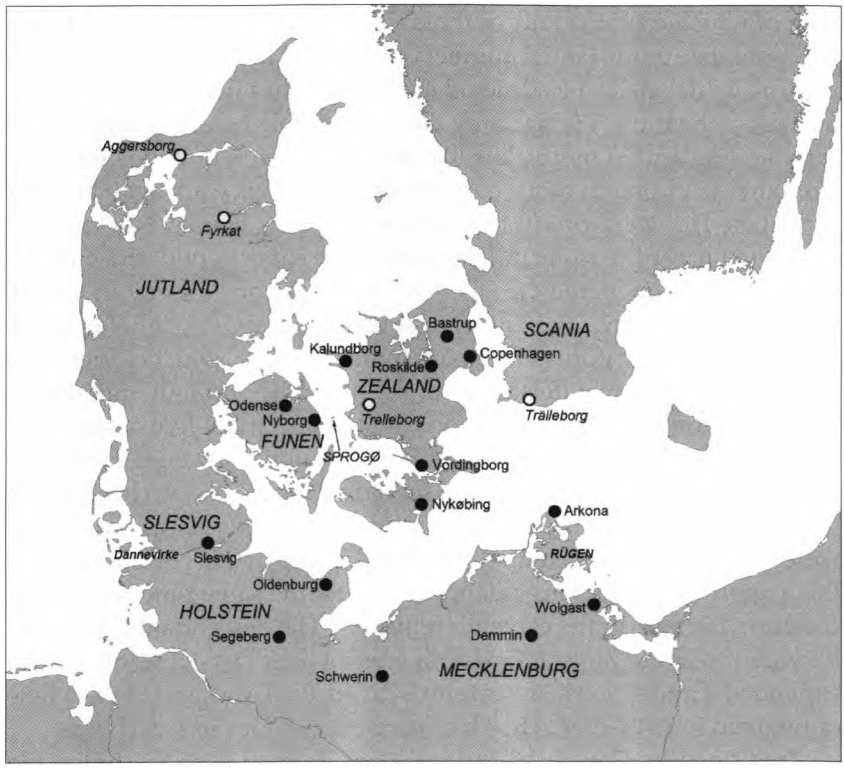
There seems to be a marked empty period with no new fortifications between the late Viking Age and the high middle ages, that is from the late tenth century and into the early twelfth century.

[(2)] For this transition, see Bregnsbo and fensen 2004.

[(3)] Very much inspired by the many studies by Knud J. V. fespersen, which reached a broader Danish scholarly public with fespersen 1992. For all his publications, see Bisgaard *et al*, 2006, pp. 339-346.

[(4)] Frantzen and fespersen 2008.

[(5)] Especially by Rikke Agnete Olsen, e.g. Olsen 1982, Olsen 1986.



Denmark and the Wendic areas in Northern Germany.
Johnny G. G. Jakobsen 2009.

The Viking fortresses of the Trelleborg type have been dated by dendrochronology to the early 980's. They are not mentioned in any written source, but the first of them was found by archaeologists in the late 1920's, and systematic surveys have later identified at least four within the present borders of Denmark and possibly a couple more in former Danish territory(6). They are remarkable for their totally symmetrical lay-out with a perfect circular wall and an interior divided into four quarters by streets running exactly north-south and east-west,

(6) Aggersborg, Fyrkat and Nonnebakken in the city of Odense. For the Trelleborgs, the most recent thorough summary is J. Jensen 2001-2004, vol. 4, pp. 381-392.

each of which contains four or three times four houses that could each accommodate a substantial number of warriors. Their purpose has been vigorously debated. A traditional explanation has been that they were barracks where the Viking army could assemble before setting out to conquer England. A more plausible interpretation is that they were the strongholds of one dynasty of petty kings in their wars against other dynasties. This conforms to the statement of King Harald Bluetooth on a monumental rune stone in Jelling from the same period, in which he claims that he conquered the whole of Denmark and Norway and made the Danes Christians. The Trelleborgs were military strongholds in the war to unite the territory of Denmark under one ruler, and they were also strong ideological manifestations of the new faith through imitating in their form contemporary depictions of the holy city of Jerusalem.

The Trelleborgs lasted for about 50 years, until they were burned or abandoned around 1030. They had served their purpose. Archaeologists have shown that a number of more local Danish petty kings' residences were abandoned or substantially reduced in size in this period, and also that pagan burial customs disappear around the same time, in the first couple of decades of the eleventh century[7]. The descendants of Harald Bluetooth seem to have gained firm control over Danish territory, and expanded it into a North Sea empire with the final conquest of the whole of England in 1014-1016. They had no more use for the Trelleborgs.

Traditionally, Danish historians have claimed that the following centuries were characterised by few, big castles that were all royally controlled, and that not until the middle of the fourteenth century with civil war and no king, could magnates and nobles begin to build their own castles. This is not true. After the Trelleborgs we can find no substantial evidence for castles or fortifications for some generations, but archaeologists have in recent years found so many, and often so small, fortifications from the beginning of the twelfth century that it is absurd to imagine that they were all royal.

An impressive example is the Bastrup Tower from around 1100 or maybe the first half of the twelfth century, a strong donjon that may have risen 30 or even 50 meters over the ground and with its fine travertine stone work is among the most advanced and strongest buildings in

[7] E.g. J. Jensen, vol. 4, pp. 300-308.

Central and Northern Europe at that time[8]. It later belonged to one of the powerful magnate families on the central island of Zealand, but whether it was originally erected by the king, is impossible to ascertain. It belongs to a handful of similar strong towers in southern Scandinavia and Northern Germany that were built in the first half of the twelfth century and which normally belonged to kings or archbishops.

Much more common, however, were the numerous minor fortifications that have been detected and now, for the first time, dated to the twelfth century and not the fourteenth. They normally consisted of a central building in two or more storeys, in wood or a timber construction plastered with clay, and surrounded by an earth wall with timber palisades. Some of these fortifications had a dry or wet ditch around them; some were placed on small islands in lakes or swamps and only accessible by bridge or boat. A few were minor motte-constructions with palisades and a central building on top of a small mount. A mural painting in a church depicts what seems to be a small timber tower on a wooden construction which made it possible to turn the tower. Because of the size of all these constructions it is natural to interpret them as privately owned[9].

In the last half of the twelfth century, the building of stone castles seems to have accelerated in Denmark and the Danish controlled areas of present Northern Germany. The first fortification of Copenhagen is poorly evidenced[10], but in the 1160's it was replaced by a new, octagonal stone wall with a central tower, also in stone. It was built by the bishop of Roskilde, Absalon, who also built two other similar castles on his lands in Scania (in present day Southern Sweden). They had almost exactly the same ground plan and an inner diameter of about 40 meters.

After c. 1170, bricks were used for the first time in Denmark, not only in churches but also for building castles. Kalundborg was fortified by the magnate Esbern Snare with a brick construction following the shape of the small hill on which it is situated. On the other side of the Great Belt, King Valdemar the Great built Nyborg (Newcastle), another

[8] Randsborg 2003.

[9] Especially the surveys carried out by J. Skaarup (e.g. 2005) on the islands of Funen and Langeland have been fundamental in the new interpretation of the twelfth century fortifications.

[10] Randsborg 2003, p. 78.

castle on the very small and strategically important island of Sprogo, and repaired the 10-12 km long eighth-century wall of Dannevirke that controlled the entrance from Holstein and Saxony in the south up into the Danish duchy of Slesvig and on into Jutland. The latter achievements he deemed so important that he had them mentioned on the leaden funeral plaque that followed him into the grave in 1182: "murum quoque ad totius regni presidium qui vulgo Danewerch dicitur ex lateribus coctis primus construxit et castellum in Sproga edificavit"[11].

All these castles have been explained as part of a defence system against heathen pirates, and that was certainly an important function. Some of the castles were not only strongholds in themselves, but controlling or blocking access to them was attempted by various means. The most common was by underwater poles hammered into the bottom of the fiord or river leading up to the castle, so that only sailors with good local knowledge could navigate there[11] [12]. Such underwater blockades are known from a number of places in Denmark - and many other countries - and are much older than the Middle Ages, but they were still an effective part of defence in the twelfth and thirteenth centuries. During the Danish siege of pagan stronghold of Wolgast near Rügen, the crusaders had first laboriously to clear the waters of large stones and a great number of underwater poles. When this was done, they waited for the right wind and then set fire to an old ship that slowly drove towards the wooden palisades of Wolgast. But halfway it got stuck on a pole that had been overlooked and burned out to no avail - and to the great joy of the pagan defenders[13].

Other defences became more elaborate. Duke Canute Lavard protected his castle in the city of Slesvig by blockading the mouth of the Slien fiord leading up to the city. He built two fortifications on each side of the fiord that were permanently manned with a garrison that could operate the big beam construction that would raise the iron chains and close the fiord for any ships that had not put in at one of the fortifications and paid toll - and been checked for weapons[14].

[11] On http: / / www.crusades.dk/images/ gravplade.jpg.
[12] Rieck 1991.
[13] Saxo, 16,6.
[14] Knytlingesaga, cap. 86.

The castles also had, however, an important aggressive function as starting points for expeditions or as strongholds in newly conquered territory in the continuous Danish crusades against the Wends in the twelfth century and the Prussians and Estonians in the thirteenth. An example is the royal castle of Vordingborg in the southernmost part of Zealand, which may actually have been held by Wends up into the twelfth century[15]. This is uncertain and disputed, but around 1160 Vordingborg was conquered or taken over by King Valdemar who fortified it with a large tower. But the area within the walls is too big for the tower and the few other buildings that they protect. An obvious explanation is that every year Vordingborg became the gathering place for crusaders, where they could meet, organise themselves, and give the most unskilled participants an intensive two week fighting course[16], before the whole fleet set out and crossed the Baltic to attack pagan territories.

When an area had been conquered, local fortifications were destroyed, or locations were taken over and sometimes fortified. Duke Canute expanded his territory into the land of the pagan Abodrites and built a new castle with a strong tower at Oldenburg and later further east another castle at Segesberg[17]. They were clearly intended as strongholds from which new land could be ruled, and to which soldiers and colonists could retreat during the frequent pagan rebellions. The traditional Slavic castle in the area was a circular fortress with wooden palisades and towers. The taking of control over these lands in the last half of the twelfth century by Danish crusaders seems to have led to a concentration so that a lot of the local fortresses were demolished, while a few central ones were strengthened and rebuilt in stone - for example Mecklenburg, Schwerin, Wolgast, and Demmin[18]. This pattern continued further east into the thirteenth century, when German and Danish crusaders conquered the small hill fortresses in Livonia and Estonia and replaced some of them with stone fortifications that were totally new to these lands. Henry of Livonia, writing in the first two decades of the twelfth century, relates how the pagan Lithuanians in vain tried to pull down a stone castle with

[15]Wille-Jorgensen 2002; 2004.

[16]Which seems to have been standard procedure, according to Saxo (14.23.3, not specifically about Vordingborg).

[17]Helmold, cap. 53.

[18]Bohrne 1999, vol. 2, p. 111.

their ropes because they did not know that the stones were not just put on top of each other but actually held together with mortar; a technique that was apparently unknown in Livonia(19).

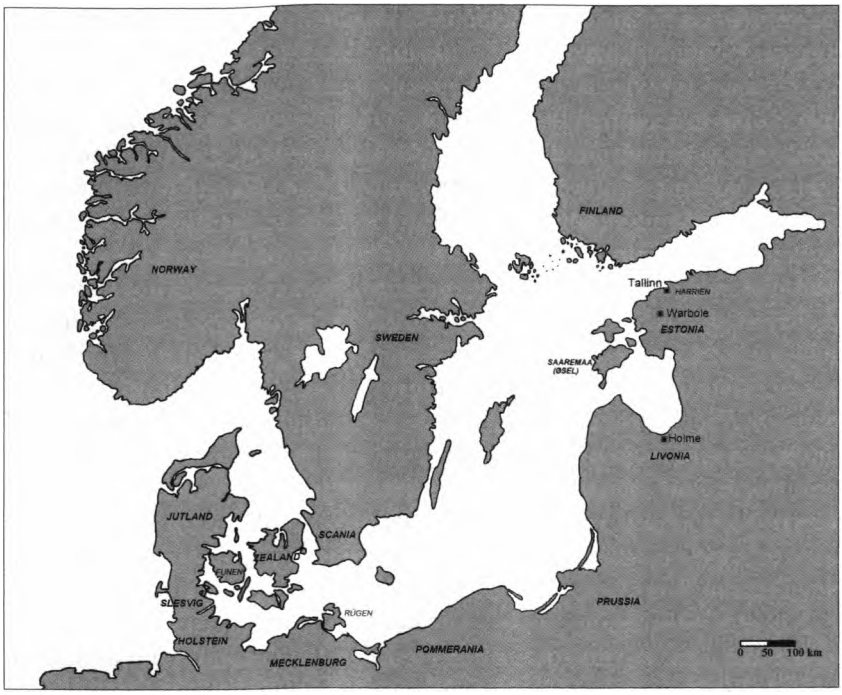
With regards to Danish and Southern Scandinavian castles, it can be argued that the twelfth century was a period with great changes. A rapid *encastellamento* seems to have taken place compared to the eleventh century, both in minor private fortresses and in impressive magnates' or royal castles. Also, there seem to have been a marked tendency to replacing wood with stone at the end of the century. The tower of Bastrup is an exception in being very early, but in general stone buildings began to be common in the 1160's and 1170's, within Denmark, and shortly afterwards also in the areas conquered in crusading.

Large war machines

We must assume that there was some kind of connection between changes in the building of castles and fortifications and changes in the construction of war machines. It is difficult to follow in detail. Archaeological evidence is often very difficult to date with precision, and descriptions in written sources are normally not precise enough to allow us to distinguish different types of war machines from each other. Also, the basic principle behind siege warfare remained the same for hundreds of years: to bombard the castle walls with large and heavy stones, until they broke down. In spite of these difficulties, it is possible to argue that a change took place around 1200, also in the construction of war machines.

The oldest known throwing machine is the *onager*, a large frame of beams with an arm attached to it that was propelled by an elastic band of twisted hide or hair. The *onager* was described by the fourth century military theoretician Vegetius whose work was well known throughout

(19)Henry of Livonia, 1, 6: "[...] Semigalli pagani vicini, audita lapidum constructione, ignorantes eos cemento mediante firmari, cum magnis funibus navium venientes, putabant se stulta sua opinione castrum in Dunam trahere,



The Baltic area. Johnny G. G. Jakobsen 2009.

the Middle Ages[20] [21]. It was a very simple construction but with poor range and little precision, because the torsional power of hide is much dependent upon the age of the hides and the local humidity. During one of the sieges of Paris in the middle of the ninth century, the Vikings used a throwing machine which must most probably have been an *onager*[21]. But as far as I know, we have no later evidence of any use of the *onager* in Scandinavian sources.

A much more precise type of throwing machine was the one with a sling on a huge arm mounted on a framework of beams. The machine was operated either by a group of people who pulled ropes at the same time and made the huge arm swing and propel the missile; or by a counterweight, e.g. a box with stones or sand. The first type was smaller

([2°]) Vegetius 4, 22; cf. Monteiro 1998, pp. 346-358.
[21]Aim and Hoffmeyer 1981.

and called *petraria, mangonel*, or *tormenta.* The second type is the trebuchet. It has been vigorously discussed from whence these machines came to Western Europe and when. It has been suggested that it is a Muslim weapon, maybe an independent development of Vegetius' *onager*, which Christians came to know in Sicily or on the Iberian Peninsula in the eleventh century, while others have suggested that the throwing machines originally stem from China and came to Europe through Muslim intermediaries^.

The machines were introduced to the Nordic countries with the crusading movement. Counterweight machines were used during the siege of Nicaea in 1097 and at the conquest of Jerusalem, in which also Nordic crusaders took part, and during the siege of Sidon in 1110 the Norwegian King Sigurd Jorsalfarer saw a *valslongva* - a war sling - and took the principle with him back home[22] [(23)]. It is probable that it was a pulling machine.

The larger throwing machines had been unknown in the Nordic countries earlier, but now they came rapidly into use, and interest in them was great. In 1134, Harald Kesja started a rebellion against his half--brother King Erik Emune to gain his father's throne, and he built a fortress just outside the royal city of Roskilde. To prevent him from attacking, King Erik sought help from some Saxons living in the city, and they helped him to construct a throwing machine and install it "in a proper place" which must have been on the city wall or on some high point inside the city. The first shot fell far too short, and Harald and his men loudly mocked Erik and his strange machine. But the next shot went much higher, fell from a much more vertical angle, and hit directly the top of the wooden tower in Harald's fortress and smashed it to the ground. "In this way, King Erik combined the strength of the Danes with the cunning of the foreigners," the historian Saxo wrote about 1200 when describing the incident[(24)]. Harald had to give up the siege, and the following night he had a hole made in the palisades and had his horses lowered down and fled. When he soon after actually succeeded in taking Roskilde, he conducted a purging of the town especially among the German-speaking inhabitants, and especially among those who knew

[(22)]Hoffmeyer 1988; Chevedden *et al.* 2000; France 1999, p. 119.
[(23)]Alm and Hoffmeyer 1981.
[(24)]Saxo, 13.9.6.

about the new war technique. Anyone involved in the construction of the throwing machine, had his nose cut off.

Saxo calls the machine in Roskilde a *maschinamentum* or a *tormentum.* It may have been a torsion machine, but it is much more likely that it was of the hand-operated kind. Saxo seems to have been fond of the new war utensil. That must be the reason why he also equips the mighty berserkers at the Brâvalla-battle back in mythical times with *tormenta*[25]. That is totally anachronistic, and modern more source-conscious historians have therefore carefully translated *tormenta* at this point in the text with hand--slings. That is certainly a mistake, because in other places Saxo called the one-person hand-sling a *levia tormenta*[26]*.* It is much more probable that Saxo deliberately attempted to give the impression that Danes since time immemorial had had knowledge of the big throwing machines.

Once introduced, the machines very quickly became an indispensable part of all good wars. When the final siege was launched on the strong pagan fortress of Arkona on the northern promontory of Rügen in 1168, King Valdemar the Great's first action was to let his soldiers take control of all roads and bridges that gave access to the place to cut off any attempts at sending help to the pagans in Arkona, and at the same time he ordered the building of large throwing machines.

The machines were also used in the defence of castles or cities. The Norwegian count Erling Skakke protected the entrance to the Viken area near modern Oslo by setting up throwing machines on the mountains along the fiord to bomb attacking ships[25] [26] [27]. When King Valdemar the Great had a war council with his men about how to conquer Viken, some suggested sailing very fast so the stones would not hit them; others that an expedition of knights should be put on land and fight their way over the mountains and kill those who could operate the machines before the main army sailed off; but in the end the majority deemed it too dangerous and cancelled the whole thing - in spite of the fact that Valdemar tried in person to beat them corporally into obeying. This happened in the 1170's.

[25]Saxo, 8.2.2.
[26]E.g. Saxo, 14.4.5.
[27]Saxo, 14.38.2.

From the 1180's onwards, some of the pagan cities in the Wendic areas had been equipped with throwing machines as part of their defence, as was the case with Wolgast. When the Danish crusaders approached the first time, the machines were still being installed and not ready. When the crusader army returned later, the machines were functioning and the crew operating them had been trained, so now they could hit very precisely the narrow channel that the ships had to follow. They had become so accurate in their work that they could point out archbishop Absalon's ship and target that specifically[28]. They did not hit him, but simply the fact that it could be imagined that it was possible shows that we are probably talking about the most modern type of counter--weight machine. With an onager or a hand pulled type, such a precision would have been unthinkable.

From around 1200, throwing machines became even bigger and fitted with voluminous chest shaped counter-weights that could be filled with big stones. They became much heavier and impossible to wind without the help of an ingenious winch with more gears and driven by horses or by men in a treadmill. They could now project stones of 200--300 kilos or half-rotten animals' cadavers hundred of meters. Heads of captured enemies or loads of other body parts had been a traditional and effective means of psychological warfare, but from around 1200, they were supplemented by firebombs that were sent into the cities and were especially effective in the north and in the Baltic area where almost all houses had thatched roofs in contrast to the tiles of Southern Europe. The firebombs consisted of pieces of red hot iron or of clay pots filled with a flammable liquid - sulphur, pitch, or the like - that was let with a fuse and thrown and with a bit of luck exploded at impact and scattered the burning liquids over a larger area. Such firebombs were in use in the Livonian crusades very early in the thirteenth century[29].

Whether Greek fire was known in the North, has been very much debated[30]. Greek fire was an explosive and devastating mixture of most probably sulphur and naphtha, and maybe with saltpetre added. The composition was a well guarded Byzantine secret from the late

[28] Saxo, 16.6.2.

[29] Henry of Livonia, 28, 5.

[30] Summarized in *Kulturhistorisk leksikon for nordisk middelalder,* vol. 5, col. 511-513.

seventh century which was later intercepted by the Muslims. Greek fire was sprayed out from a metal tube that could be shaped like e.g. a lion's head, with an infernal noise and a burning, viscous substance which stuck to all wood and only became worse if one tried to sprinkle water upon it. The best safeguard against Greek fire was to impregnate the woodwork with vinegar or to cover the timber with fresh animal hides with the flesh side outwards, which the burning substance could not stick to[31]. Campaigning in summertime must have been an odorous affair.

The Scandinavians had of course known about Greek fire from all the warriors who had served the Byzantine emperor in the Nordic Varangian guard and from their many journeys to Byzantium[32]. Greek fire was demonstrated to King Sigurd Jorsalfarer in Constantinople in 1110; Nordic sources describe it as "a terrible weapon" and call the metal tubes "shield-devils spewing out poisonous flames". The Nordic production of inflammable substances had been varied and often also quite effective, but it lacked access to the most important ingredient for Greek fire, the raw oil product naphtha.

The Westerners - Scandinavians and Germans - seem to have had a technological advantage compared to peoples in the more Eastern regions, but it was short-lived and had to be utilised immediately. In 1206, the crusaders laid siege to the castle Holme in Livonia to suppress a pagan rebellion, and they succeeded in taking the city precisely through the use of the throwing machines. Later the same year, Holme was attacked by Prince Vladimir of Pskov whose troops had no experience with the big throwing machines but wanted to try the new technique. The first model they built, however, back-fired and killed some of those operating it[33]. Also, in 1222, King Valdemar the Victorious had begun the final annexation of the island of Saaremaa (Õsel) and had a strong stone castle built on the island. But when the king had left, the Osilians made contact with the Estonians on the mainland in Warbole who had surrendered and become allies of the Danish crusaders - and who had been given a throwing machine to defend themselves against attack from their still pagan relatives. The Osilians studied the machine carefully

[31] France 1999, p. 118.

[32] An interesting investigation of the Nordic-Byzantine relations around 1200 is Ciggaar 2000.

[33] Henry of Livonia, 10,12.

and went back to Õsel and started building replicas: "everyone made his own throwing machine". In the end they had built 17 and attacked Valdemar's castle and bombarded it for five days, until the crusaders had to surrender. The Osilians tore down the castle, till there was not left one stone upon another, and then they went to Estonia and "incited the Estonians to make rebellion against the Danes and against Christianity, and promised them that the Danish castles are easy to conquer, and taught them to build small and large throwing machines and other machines of war, and great evil arose on earth"[34]. The technological advantage of the Danes had been lost.

It became possible to construct local adaptations, but the precise operation of the very big throwing machines continued to be the work of well educated specialists whose efforts were decisive for the successful outcome of sieges of big cities, and who were lavishly rewarded for their efforts. In the 1220's King Valdemar the Victorious endowed huge land areas in Northern Estonia, in the province of Harrien, to Ulrik Blidemester - Ulrik the Trebuchet master[35]. It is most likely that this was payment for services Ulrik had rendered during the final and decisive conquest of Tallinn in June 1219 which meant that most of Estonia now came under Danish rule. The land grant to Ulrik was substantial, but as so often with Scandinavian history, the source transmission is fragmentary and it is difficult to put this isolated donation charter into context. Had Ulrik rendered some unusual service, did he have personal connections? Or should we on the contrary conclude, that there must have been more masters of trebuchets in the service of the Danish king, and that they were all rewarded to a similar degree? If so, we should start considering the masters of war machines as on a par with admirals and Marshalls, with commanders of fleets or cavalry. A broader comparative study is needed to understand the Scandinavian sources properly.

The siege warfare was very practical and with very direct and brutal consequences. But it also had an ideological aspect which was expressed by theoreticians of the age, but which also must have been transmitted in sermons and battle-field exhortations and have influenced ordinary soldiers. When Arkona on Rügen finally had been conquered in 1168,

[34] Henry of Livonia, 26, 3.
[35] DD 1:7 nr. 299.

the old pagan temple was dismantled and destroyed together with the pagan idol, and 12 new churches were built on the island. One of the churches was constructed by using the beams from the throwing machines that had played an important role during the preceding siege. Saxo the historian remarked, that "the instrument of war had now been transformed into the house of peace. The instrument that had formerly smashed the bodies of the enemies, now served to save their souls"[36].

Ships

The long coast lines of Norway and Sweden and the many islands of Denmark make it obvious that Scandinavian warfare early became dependent upon the development of war ships and the establishing of a flexible and controlled fleet. The long, narrow Viking war ship - the *snekke* - is known in its final form from the ninth century and continued to be in use far into the thirteenth. Its form made it extremely fast, and the hull was built of very thin boards and with frames divided in two so that the lower and upper part of the hull could move independently of each other, which gave the necessary flexibility so that the long ships did not break on the big waves but could ride on them.

The royal fleet was organised in the so-called *lething* whose origin has been disputed among Scandinavian historians[37]. Most would agree that it is an old organisation stretching back to the Viking age although we know about its more detailed regulations only from written sources from the twelfth and thirteenth century. The territory of the whole country was divided into a number of "ships", *naves*, which should each provide a ship for the king's wars. The nave was subdivided into a number of "ports" or *hafne,* that should each provide a man for the ship, equipped with the normal weapons of shield, helmet, spear, and sword. The free men in each *hafne* formed together a confraternity and should in principle serve on the ships in turn. Each ship was led by a steersman who should keep himself with horse and armour and all weapons - receiving economic compensation from the free men in the *hafne* -

[36] Saxo, 14.39.34.
[37] Malmros 1985; Lund 1996.

and who should also be armed with crossbow. If he could not himself operate the crossbow, he should bring a man with him who could(38).

A qualified estimate is that the *lething* in Denmark could muster about 1000 ships and about 30-40 000 men if all were mobilised at the same time, which of course would be in only very unusual cases(39). To this should be added the private fleets of both king and magnates. The *lething* also provided the king with a force of about 1000 mounted knights who were permanently mobilised, financed by the local free men all over the country, and who were armed with crossbows. This all reflects a country with an unusually high degree of militarization compared to others in Western Europe around 1200. One explanation for this is the continuous crusading in the Baltic which also explains why Danish kings could have an official, juridically regulated and very large contingent of crossbowmen at a time when the use of the crossbow again and again had been banned by church councils - it had namely been allowed in the religious wars against heathens.

An important element in naval warfare was to board the opposing ship after having made an opening in the groups of defenders by bombarding them with stones and arrows and stabbing them with spears. For all this, it was an advantage to stand above the enemy, on a higher ship. This may be one of the reasons that Nordic ships became bigger and bigger in the last half of the twelfth century. The other reason was that crusading after the conquest of Rügen in 1168 became directed against much more remote areas such as Prussia, Livonia, and Estonia. The crossing to Rügen could be made in one day from the southern Danish islands, but an expedition to Estonia could, depending upon the weather, take weeks and necessitated more planning, more provisions, often more men - and therefore bigger ships. A third reason for the change is that Denmark was simply following the general European trend towards bigger ships in the late twelfth century(40).

(38) Law of Jutland chap. Ill; and in other laws from the mid thirteenth century.

(39) The crusade fleet against Rügen, in c. 1136, comprised c. 1100 ships (Saxo, 14.1.7). The crusade fleet that conquered Tallinn in Estonia, in 1219, is the largest recorded from the high middle ages in Denmark and consisted of 1500 ships *(The annals ofRibe*; *The Annals ofRyd,* in DMA, pp. 170, 232, 259).

<40>Cf. Pryor 1988.

A few of the very long *snekke* ships of more than 30 meters have been found from the mid eleventh century, but it is only from c. 1140 that they seem to have become much more common. From the same period come the first few examples of ships of the new *kogge*-type which represents a totally different idea than the Viking war ship(41). The *kogge* is much broader, much slower, but also much bigger and more solid than the *snekke.* The railing on even the largest *snekke* is less than one meter over the sea; the railing on a *kogge* is at least two meters. On the other hand, the *snekke* could be rowed at great speed, while the *kogge* was totally dependent upon sail and wind. The two types of ship existed side by side throughout the thirteenth century, but the *kogge* slowly replaced the *snekke.* At the same time the *kogge* grew bigger and bigger and from the second half of the thirteenth century was equipped with regular towers from which the enemies' ships could be covered with crossbow bolts, and to which the defenders could retreat and continue fighting if their ship was boarded.

The discussion of different ship types can become very technical, but in this context it suffices to observe that a shift took place also within ship building in the decades around 1200. Just as it was the case with castles and throwing machines, the ships became bigger.

Revolution and reordering of society

The idea of a military revolution in the early sixteenth century has been well established for some time now and inspired fruitful new syntheses. A similar revolution around 1200 has been proposed only recently. Even in 1994, Hugh Kennedy in his book about Crusader Castles referred to R. C. Smail's opinion that military techniques changed only little in the crusading period and then added that another opinion had been expressed in an at the time unpublished dissertation by Paul Chevedden(42). According to Chevedden, the end of the twelfth and the beginning of the thirteenth century saw a radical improvement in the capabilities of medieval artillery which in turn led to marked changes in castle building. Chevedden built his arguments on Arabic sources and

(41) Malmros 1985, p. 95; Englert, 2000.
(42)Kennedy 1994, pp. 8-9.

wrote about the crusader states in the Middle East. The present article has been an attempt to contribute to this discussion by offering the thesis that such a technological change actually took place in Denmark and Scandinavia exactly around 1200.

War machines and ships became significantly bigger, the knowledge behind operating them and the whole organisation necessary to utilise them in actual warfare became much more specialised, and this may in its turn have inspired or necessitated an administrative reordering of societies. The *lething* system involved in principle all free men and the ability to muster an impressing force, but they were not all equally effective in actual warfare. It is significant that the *lething* before setting out on expeditions had to give the soldiers the most basic fighting training for two weeks, but also that it could be imagined that the steersmen did not know how to operate a crossbow. The solution was obvious. During the eleventh century we have more examples of individuals or institutions being exempted for actually participating in the *lething* in return for paying a fixed sum, and during the early thirteenth century the *lething* seems more and more to have been replaced by a regular taxation which could then be used to pay for the professional soldier and specialists such as the above mentioned Ulrik the Trebuchet Master, or the tax could finance the building of the still bigger war *kogges* and their permanent contingent of sailors and soldiers.

In Denmark in the period around 1200, a revolution in military technique seems to have taken place which led to a new organisation of society. General conscription among all free men was replaced by a taxation which paid the new class of military specialists.

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