THE PITTED WARE CULTURE ON DJURSLAND

Supra-regional significance and contacts in the Middle Neolithic of southern Scandinavia

Edited by Lutz Klassen

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Preface

This book presents results of the international research project "CONTACT. The Pitted Ware Phenomenon on Djursland and Maritime Contacts across the Kattegat in the Third Millennium BC". The VELUX Foundation is thanked for the generous financial support that enabled East Jutland Museum to undertake this project in 2014-2019.

The VELUX Foundation, Dronning Margrethe II's Arkæologiske Fond, Farumgaard-Fonden, Den Hielmstierne-Rosencroneske Stiftelse and Elisabeth Munksgaard Fonden have graciously provided the financial means necessary for printing this volume.

As a local museum, East Jutland Museum could not stand alone in conducting an ambitious research project like CONTACT and thanks are therefore due to all collaborating colleagues and their institutions. The list of project participants includes Per Persson (University of Oslo), Karl-Göran Sjögren and Malou Blank (University of Gothenburg), Robert Hernek, Imelda Bakunic Fridén and Niklas Ytterberg (Bohusläns Museum), Torbjörn Brorsson (Kontoret för Keramiska Studier, Höganäs), Rune Iversen and Morten Allentoft (University of Copenhagen), Uffe Rasmussen and Marianne H. Andreasen (Moesgaard Museum), Bente Philippsen and Niels Nørkjær Johannsen (Aarhus University), Cheryl A. Makarewicz and Sarah Pleuger (University of Kiel) and T. Douglas Price (University of Wisconsin – Madison). Lisbeth Wincentz, Ole B. Poulsen and Lutz Klassen participated from East Jutland Museum

The present volume only presents results of those parts of the CONTACT project that take their main point of departure in the finds from the Pitted Ware culture (PWC) on Djursland. Several studies that employ the Djursland evidence from the PWC in a wider perspective have either already been published in separate journal articles, are under review or are still in preparation. These include a study and interpretation of the characteristic tanged arrowheads of the PWC by Rune Iversen (published in *Journal of Anthropological Archaeology*, 2016), an investigation of PWC pottery from both sides of the Kattegat by Torbjörn Brorsson, Malou Blank and Imelda Bakunic Friden (published in *Journal of Archaeological Science: Reports*, 2018), a study of the absolute chronology of the PWC in its entire area of distribution by Rune Iversen and Bente Philippsen (in preparation), a comparison of decorative elements on PWC pottery from Djursland and western Sweden (Robert Hernek, in preparation) and isotopic studies on faunal remains from PWC sites on Djursland by Cheryl A. Makarewicz (*Journal of Archaeological Science*, forthcoming). Furthermore, the CONTACT project served as a case study in Niklas Ytterberg's analysis of the use of archaeological museum collections in research in three Scandinavian countries (published in *Museum Worlds: Advances in Research*, 2016).

Many colleagues have contributed with valuable comments and constructive criticism, practical help and unpublished material. Thanks are therefore due to Casper Skaaning Andersen, Niels H. Andersen, Søren H. Andersen, Rasmus Andreasen, Jens Bjørn Riis Andresen, Niels Axel Boas, Serge Cassen, Palle Eriksen, Anne Birgitte Gebauer, Kristian Murphy Gregersen, Lotte Hedeager, Elisabeth Iregren, Jacob Kveiborg, Åsa M. Larsson, Torsten

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Special thanks go to East Jutland Museum's longtime partners in the production of our scientific publications: Series editor Sanne Lind Hansen, Aarhus University Press, for her practical help, patience and flexibility as well as David Earle Robinson and Anne Bloch for their translation and revision of manuscripts.

As principle investigator of the CONTACT project, and editor of the present volume, I wish to express my sincere thanks to the VELUX Foundation, not only for their financial support, but also for their flexibility and patience, which were crucial to the success of the project and production of the present volume.

Grenaa, January 2020
Lutz Klassen

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The Pitted Ware Phenomenon on Djursland and Maritime Relations across the Kattegat in the Middle Neolithic

An introduction

Lutz Klassen, Rune Iversen & Lisbeth Wincentz

1 Introduction

Since the introduction of cereal cultivation and animal husbandry to southern Scandinavia approximately 6000 years ago, arable and pastoral agriculture have generally been on a progressive path towards modern industrial production. In the course of this development, ever-larger parts of the landscape have been taken under the plough or transformed into pasture, and exploitation of existing cultivated areas has been intensified. There is, however, one period in the (pre-)history of the area, when agricultural developments apparently took a different course.

Approximately 1000 years after neolithisation, and for about the next c. 500 years (later part of the Middle Neolithic, c. 3000-2500 BC), major regionalisation took place within southern Scandinavia as a result of both social reorganisation and ritual and economic innovation. During this period some areas saw a massive intensification of agriculture, especially in animal husbandry (most evident within the distribution area of the Single Grave culture (SGC), in central and western Jutland, as revealed indirectly by pollen analysis (cf. Andersen 1993), but also in the Late Funnel Beaker culture (TRB) in more easterly parts of Denmark (Madsen 1982)). In other areas, agriculture was apparently at least partly abandoned in favour of a return to hunting and gathering, as witnessed by the emergence of local Pitted Ware culture (PWC) groups in the Limfjord and Kattegat areas (for Denmark: Becker 1951; Iversen 2010). Subsistence during this period was obviously as much a cultural choice as it was dictated by environment and climate. Large-scale communication networks extending across major parts of Europe, regionally differentiated reception of the information relayed via these networks and possibly also immigration played key roles in these developments.

The aim of the present publication is to contribute to an understanding of this historically unique situation by investigating one of the regional developments in southern Scandinavia mentioned above: the emergence of the PWC in Denmark. Ar-

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chaeology today makes use, to an ever-increasing degree, of analytical methods from a wide variety of natural sciences. A precondition for the application of many of these methods is the preservation of organic remains, not least bones and teeth. Within the total distribution area of the PWC in Denmark, northern Jutland (the Limfjord region – Marseen 1953; 1963), and especially the Djursland peninsula in eastern Jutland (Wincentz Rasmussen 1984; 1986a; 1986b; 1991; 1993; 2000; Wincentz Rasmussen/Boas 1982; Richter 1986a; 1986b; 1989; 1991), are the only regions where this precondition is fulfilled. While the finds from northern Jutland are sparse and derive from earlier, less well documented excavations, a wide range of sites of all sizes have been excavated in recent decades on Djursland (see references above; several sites are hitherto unpublished). These sites, and not least the abundant organic remains recovered from some of them, are the topic of the present volume. Its chapters reflect the results of the investigations undertaken by members of the CONTACT research project, which was funded by the VELUX Foundation and conducted at East Jutland Museum and several collaborating museums and universities between 2014 and 2018.

In addition to investigations of the PWC sites and finds from Djursland published in this book, the CONTACT project also included several supra-regional and specialised studies. These were aimed at gaining a better understanding of the Djursland group of the PWC within its much larger overall distribution area and/or the specialised investigation of specific aspects of supra-regional interest and significance. These studies have already been published in a number of separate papers (Iversen 2016a; Iversen/Klassen 2016; Iversen et al. in prep.; Brorsson et al. 2018; Hernek in prep.), but their results are also integrated here into the final, synthetic chapter.

In the following, a short research history of the PWC in Denmark is presented, together with a brief description of the Djursland peninsula. These serve as points of departure for a description of the actual research questions addressed in the subsequent chapters.

2 The Pitted Ware tradition in Denmark: status of research, research questions and hypotheses

The history of research into the PWC in Denmark is rather short, especially when compared to that in neighbouring regions of Sweden and Norway, where relevant finds were recognised much earlier as belonging to a distinct cultural entity. Hence, the PWC was already defined in the early 1900s in east-central Sweden as the "East Swedish settlement culture", based on O. Almgren's excavations at Åloppe in Uppland (Almgren 1906). Later investigations of some very large and finds-rich sites, such as Säter and Fagervik, led to the establishment of an East Swedish Pitted Ware pottery chronology, demonstrating the PWC's origins in the Early Neolithic TRB (Bagge 1952). It was the characteristic pit-decorated pottery that at an early stage defined, and later also gave its name to, the PWC. With O. Lidén's excavations of the Jonstorp settlements in northwestern Scania, which began about 10 years after Almgren's initial discoveries at Åloppe, the PWC was also recognised in southern Scandinavia (Kjær 1920, 36ff.; Lidén 1940).

The Danish research history on the PWC begins in 1951 with the classic publication by C.J. Becker. In this, Becker recognises for the first time the presence of the PWC in Denmark and addresses a broad range of topics. In its scope and importance, this contribution remained unique for many decades and it still sets the agenda for many research questions discussed today (Becker 1951).

The reason for the late recognition of the PWC in Denmark was not the absence of relevant finds, as Becker's 1951 catalogue already includes 34 sites with relevant material that had been collected during excavations and field surveys in course of the second half of the 19th and first half of the 20th century. These finds appeared, however, geographically somewhat isolated from the Swedish sites located primarily in east-central Sweden, including the island of Gotland, and southern and eastern Scania and Blekinge, and from the Norwegian localities. Furthermore, the characteristic tanged arrowheads, one of the two lithic type artefacts for the PWC,

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were often found in the megalithic graves of the TRB. Becker (1951, 259ff.) lists no less than 90 instances of this, and by 2010 this number had risen to 113 (Iversen 2010, 15). Due to their finds contexts, these artefacts were not immediately recognisable as indicators of the presence of a different cultural group. Furthermore, apart from a few sherds at only a few sites, pottery was practically absent from the localities known at that time. It was the publication of the important PWC sites at Jonstorp (Lidén 1940), geographically very close to Denmark, that prompted Becker to undertake a survey of all potential Danish finds and to reach the conclusion that the PWC was in fact also present in Denmark.

Becker's contribution has had a profound impact on research into the PWC in subsequent decades and some of his hypotheses are still relevant today. The work of Lidén on the Scanian Jonstorp sites played an important role in this further research. It was Lidén who first proposed that the bipolar cylindrical blade cores were characteristic PWC artefacts, a theory that Becker (1951, 156f., 184f.) could confirm based on his survey of Danish finds, which consisted almost exclusively of flint artefacts.

Together with S. Müller's early classification of Danish Stone Age artefacts (1888), Lidén's work formed the point of departure for Becker's detailed typology of the second characteristic lithic type artefact for the PWC: the tanged arrowheads (Fig. 1). Becker divided these arrowheads into types A-C, with several subtypes, while singling out type D as belonging to the late SGC (Becker 1951, 188ff.). His assumption that types A, B and C not only formed a typological, but also a chronological succession was based on Müller's earlier deduction that simple arrowheads (type A) were succeeded by more elaborate types (types B and then C; Müller 1888, nos. 174-176), as well as on Lidén's work on the Jonstorp material. The idea that the tanged arrowheads constituted a typo-chronological sequence was, until very recently, of crucial importance to all work on the PWC chronology (cf. Becker 1955, 83ff., Fig. 36; 1982, 24ff.; Wincentz Rasmussen 1986a; Hübner 2005, 680ff., Fig. 496). It is only recently that the validity of the tanged arrowhead chronology has been questioned and a functional interpretation of the observed typological variation proposed instead (Iversen 2010; 2016a).

Despite the lack of finds from sealed contexts, Becker also managed to recognise a certain type of harpoons and fishhooks as characteristic PWC artefacts by comparing the modest number of possible Danish finds with Swedish material. His assumptions have subsequently been confirmed, at least with regard to the harpoon type (Wincentz Rasmussen 1991, 56).

For reasons mentioned above, pottery was the only major artefact group not dealt with by Becker (1951). However, he correctly identified the Jonstorp material as representing a model for what could be expected in Danish PWC contexts, as later demonstrated by the hitherto only publication of an extensive PWC assemblage (from Kainsbakke in Djursland) by L. Wincentz Rasmussen (1986a, 166; 1991, 50ff.). Becker's comments regarding the typological relationship between Danish and western Swedish pottery assemblages were later augmented by the work of O. Marseen (1963, 126), who remarked on similarities between the limited amount of pottery recovered from the Smedegårde settlement in the Limfjord region of northern Jutland and PWC pottery from Bohuslän in western Sweden.

Among Becker's most important observations was the limitation of the PWC distribution area to coastal locations in the northeastern parts of Denmark (Fig. 2), with a clear relationship to the Kattegat, Øresund and Limfjord (Becker 1951, 232f.). In a study published 30 years later, Becker (1982, 14) was able to confirm this region as the distribution area of the PWC in Denmark, based on a much-expanded record of finds and sites (see also Iversen (2010, 13 Fig. 5) for the most recent total distribution map). According to Becker, this specific distribution area, which has no parallels in any other Stone Age culture in Denmark, reflects visits by groups of hunters and gatherers from Norway and western Sweden. Becker argues that these groups travelled to Danish coasts on hunting expeditions and to procure high-quality flint. In fact, he went as far as postulating that all the finds are reflections

Fig. 1 | *Classification of Stone Age artefacts by S. Müller. As early as the late 19th century, long before the PWC was recognised as an archaeological culture present in Denmark, Müller singled out several kinds of pointed arrowheads from Denmark as distinctive types. Number 174 is a PWC A-type arrowhead, according to present-day nomenclature, while 175 is a C-type arrowhead. The D-type arrowhead shown as number 176 is from the Late SGC. From Müller (1888).*

of such temporary visits and that no permanent PWC settlement took place in Denmark (Becker 1951, 241ff.). His argument was founded on the difference in character between Danish and especially eastern Swedish PWC assemblages. While the Danish finds almost exclusively consist of (a few) flint artefacts, the Swedish assemblages are much larger and contain huge amounts of pottery, thereby indicating permanent habitation.

In Becker's view, largely reflecting the theoretical framework of the time, all PWC artefacts represent the products of a single ethnic group of people. He cautiously places the origin of this (intrusive) group in the east, specifically in Russia (Becker 1951, 251ff.). His assumption has recently gained renewed relevance in the light of modern aDNA analyses (see below).

Due to his interpretation of the PWC finds in Denmark as a reflection of temporary visits by foreigners, Becker has some difficulty in explaining the occurrence in PWC contexts of several artefact types that have their origins in other cultures (Becker 1951, 250f.). While we now know that some of the artefacts mentioned by Becker cannot be regarded as part of the PWC inventory, others definitely can. This is especially true of the thick-butted flint axes, which are identical to those of the Late TRB. While Becker is unable to offer any satisfac-

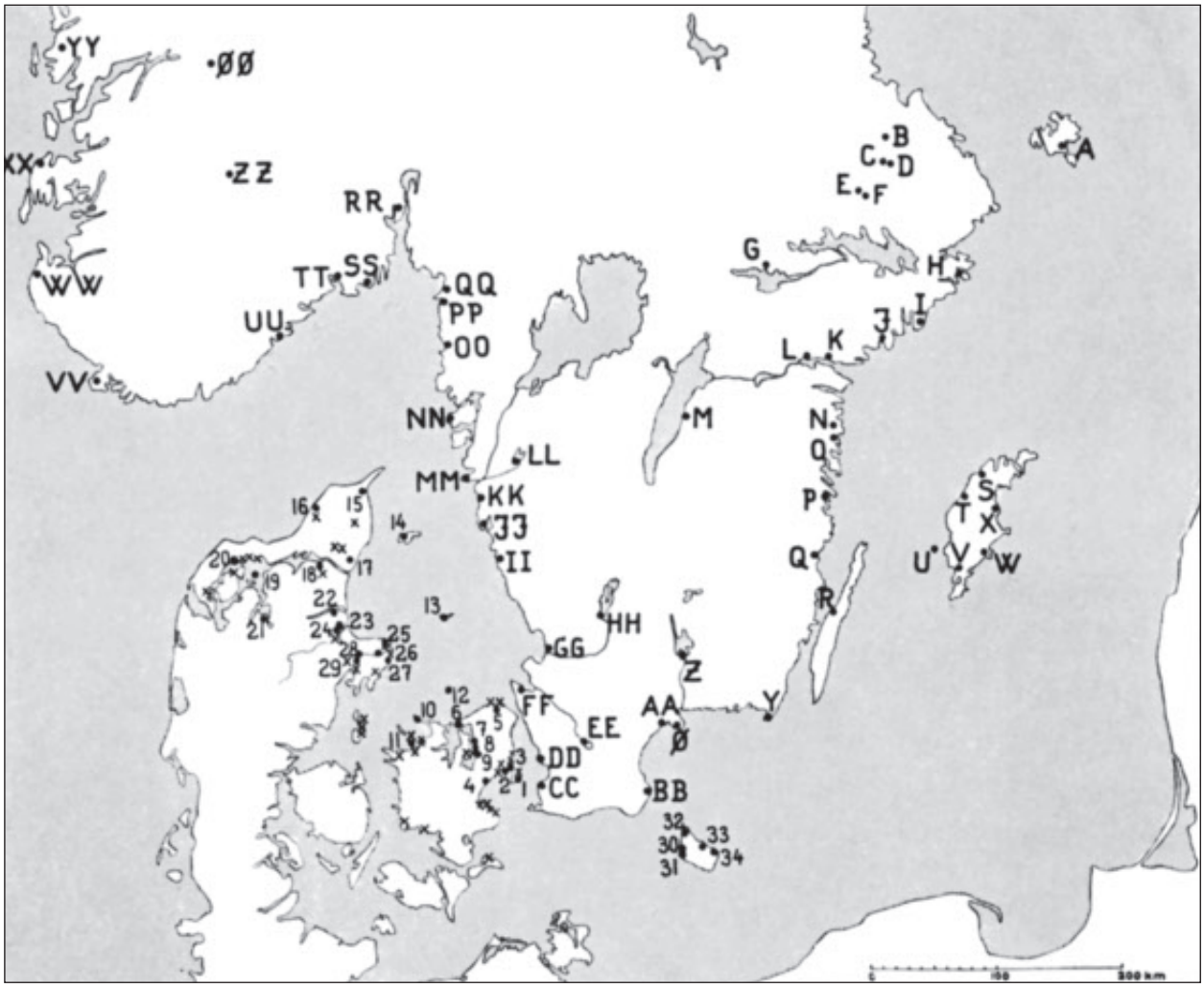

Fig. 2 | *Distribution map for the PWC settlements and stray finds of cylindrical blade cores in Denmark and important PWC settlements in Scandinavia, from Becker (1951). The singular and very specific distribution in the northeastern part of Denmark, with coastal relations for all the sites, is already apparent from this map, and has not changed since despite a marked increase in the number of recorded sites.*

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tory explanation, his observation of the appearance of these artefacts continues to be of the utmost importance for an understanding of the PWC.

Based on his discussion of (apparently) sealed-context finds of PWC artefacts with remains from both the TRB and SGC, Becker (1951, 208ff.) assumes that the PWC in Denmark existed in the later part of the Middle Neolithic (MN A II-IV at the time – later (Becker 1955) augmented by the newly defined final Middle Neolithic TRB phase V). The SGC was assumed to have existed contemporaneously, during almost exactly the same period (MN A III-IV/V). The chronology of the Middle Neolithic has undergone a major revision since then, and the finds discussed by Becker played a crucial role in this revision – see below.

The PWC material presented by Becker in 1951 is characterised by the absence of sealed-context settlement finds or sites with associated preserved organic material. Becker had therefore to base his assessment of the subsistence economy of the PWC on circumstantial evidence, information derived from Swedish sites (in Scania, Blekinge and on the island of Gotland) and his assumption that PWC sites in Denmark reflect the remains of hunting expeditions. The Swedish evidence pointed in the direction of the PWC people being marine-oriented hunters with a special focus on hunting seals. This observation fitted well with the coast-bound location of the Danish sites and, not least, the large number of finds from islands in the Kattegat well known for their seal colonies (Anholt, Læsø and Hesselø; seal bones also have been found in case of the latter, but only in relation to a TRB settlement (Becker 1951, 164ff.)). The sparse finds of harpoons and fishhooks ascribed to the PWC by Becker corroborated this view. In the light of the Swedish evidence, Becker assumed pig husbandry to be the only potential Neolithic component of the PWC economy (Becker 1951, 241ff.). The picture of the PWC in Denmark as a seal-hunting culture he thereby established still dominates the literature today (e.g., Jensen 2001, 47off.), even though the (limited) direct evidence now available (Marseen 1953, 113ff.; Richter 1989; 1991) reveals a more nuanced picture. Arable agriculture has still not been directly demonstrated. There are, however, indirect indications of cereal cultivation both from Denmark and the nearby Jonstorp sites in Scania (see Iversen 2010, 14 for a summary of the available evidence).

A final topic addressed by Becker in his 1951 paper is still under discussion: Whether it is justified to use the common term "Pitted Ware culture" for the diverse groups distributed between the Atlantic façade in southwestern Norway, all along the coast of the Skagerrak and Kattegat to the Baltic coast of southern and eastern Sweden and then as far north as the Åland Islands (Becker 1951, 245ff.). Becker answers this question in the affirmative (cf. his discussion in response to Egil Bakka's presentation at XIII Nordiske Arkeologmøte in Tromsø (Simonsen/Munch 1973, 82f.)), but his conclusion is based on a number of rather weak arguments, because typological observations normally used to define archaeological cultures could easily be employed to justify separation into a large number of regional groups or cultures. A crucial aspect of Becker's argument is that, in his opinion, all the regional groups in question represent people who totally, or to a very great degree, lived on (seal) hunting. When compared with the various agro-pastoralist groups of southern Scandinavia, they therefore possessed a strong unifying component, which Becker judged important enough to justify the uniform denomination "Pitted Ware culture". Of course, Becker's view is strongly influenced by his assumption that a single ethnic group was responsible for all sites/finds.

This view has been criticized in subsequent years – not only with reference to typological differences, but also economic diversity between the various groups (see summary in Nielsen, S. 1979, 34ff.). Nevertheless, the term "Pitted Ware culture" is still used today in reference to a very large part of the region in question. The theoretical concept of what an archaeological culture represents has, however, been altered in the meantime, and the term culture has partly been abandoned. In its place, concepts such as identity and phenomenon, which demand neither uniform material culture nor economy, have been introduced (Iversen 2010).

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Only two years after the paper by Becker discussed above, Marseen published the results of an investigation of a PWC site at Selbjerg in the Limfjord region of northern Jutland (Marseen 1953). This site is important, both because it yielded the otherwise rare PWC pottery, and especially because it takes the form of a shallow kitchen midden in which bone is preserved. The bone assemblage contains remains, in considerable numbers, of a several domesticated animals– not only pigs, which had already been recorded at PWC sites in Sweden, but also cattle and sheep/goats (Marseen 1953, 113ff.). Furthermore, the presence of different species of seabirds indicates both summer and winter occupation of the site. Marseen therefore arrived at two important conclusions which directly contradict Becker's view. Firstly, the presence of domesticated animals indicates that the PWC cannot generally be characterised as a hunter culture. Secondly, Selbjerg is an example of year-round, permanent occupation and not the result of temporary visits by hunters from the opposite side of the Kattegat or Skagerrak. As already mentioned, these observations have not been incorporated to a sufficient degree into subsequent research into the PWC, and the Selbjerg excavation, and the stratigraphy it revealed, has been described differently (Becker 1955, 85ff.) or directly questioned (Sterum 1978, 66f.), as TRB sherds (presumably MN A II-III), SGC pottery and Late Neolithic flint artefacts have been recovered from the shell midden.

From the early 1970s onwards (e.g., Tauber 1971, 128; Davidsen 1975; 1977; Malmros/Tauber 1977), an increasing number of ^{14}C dates and stratigraphical observations indicated deficiencies in the Middle Neolithic chronology as established by Becker (1955). As already mentioned, this chronology implied a long period of contemporaneity between the TRB and SGC. In contrast, the ^{14}C dates showed only a minor, if any, overlap between the two. This led not only to adjustments to chronological tables, but also to an intense debate on processes of cultural change. The latter was encouraged by a new generation of Danish archaeologists who, at least in part, also introduced the theoretical principles of processual archaeology into their work (Davidsen 1977; 1982; Sterum 1978; Nielsen, P.O. 1979, 54ff.; Nielsen, S. 1979; 1982; Malmros 1980; Ebbesen 1982; Becker 1982; Adamsen/Ebbesen 1986). The PWC had previously played an important role in the chronological discussion (Becker 1955, 108ff.), because there was a lack of finds that could indicate directly the relative chronological positions of the TRB and SGC (Fig. 3). Finds in which materials of the PWC and each of the two other cultures appear together (as listed by Becker (1951)), in combination with the arrowhead-based internal chronology of the PWC, were therefore instrumental in establishing the chronological relationship between the TRB and SGC. The PWC lost this role as the number of ^{14}C dates increased for both Late TRB and SGC finds.

At the same time, the very first ^{14}C dates for the PWC became available – from the sites of Kainsbakke and Kirial Bro on Djursland (Wincentz Rasmussen/Boas 1982; Wincentz Rasmussen 1986b; Tauber 1986). Subsequently, three dates from a third site, Ajstrup Krat (Rasmussen 1999, 314), were added to these. The suite of dates available today indicates a lifespan for the PWC extending from about 2910 to 2450 BC (Hübner 2005, 668.; Iversen 2010, 7f.) corresponding to the Late TRB (MN A V) and Early and Middle SGC (Under and Ground Grave periods). It is not clear, however, whether these dates cover the entire temporal extent of the PWC. Evidence from contact finds may indicate a somewhat earlier start date for the Danish PWC, as far back as 3100 BC (MN A II; Iversen 2010, 9).

The (partial) publication of the Kainsbakke and Kirial Bro sites (Wincentz Rasmussen 1984; 1991; 1993; 2000; Wincentz Rasmussen/Boas 1982) represented a crucial step forward in the understanding of the PWC in Denmark. Information from reliably sealed and uncontaminated PWC sites/contexts, including a variety of finds categories, became available for the first time. The large finds assemblages, combined with excellent preservation conditions for bones, not only enabled the first ^{14}C dates to be obtained, as well as the first investigations of economic aspects (see above and Richter 1989; 1991), but also contributed a number of hitherto unknown artefact types. At the same

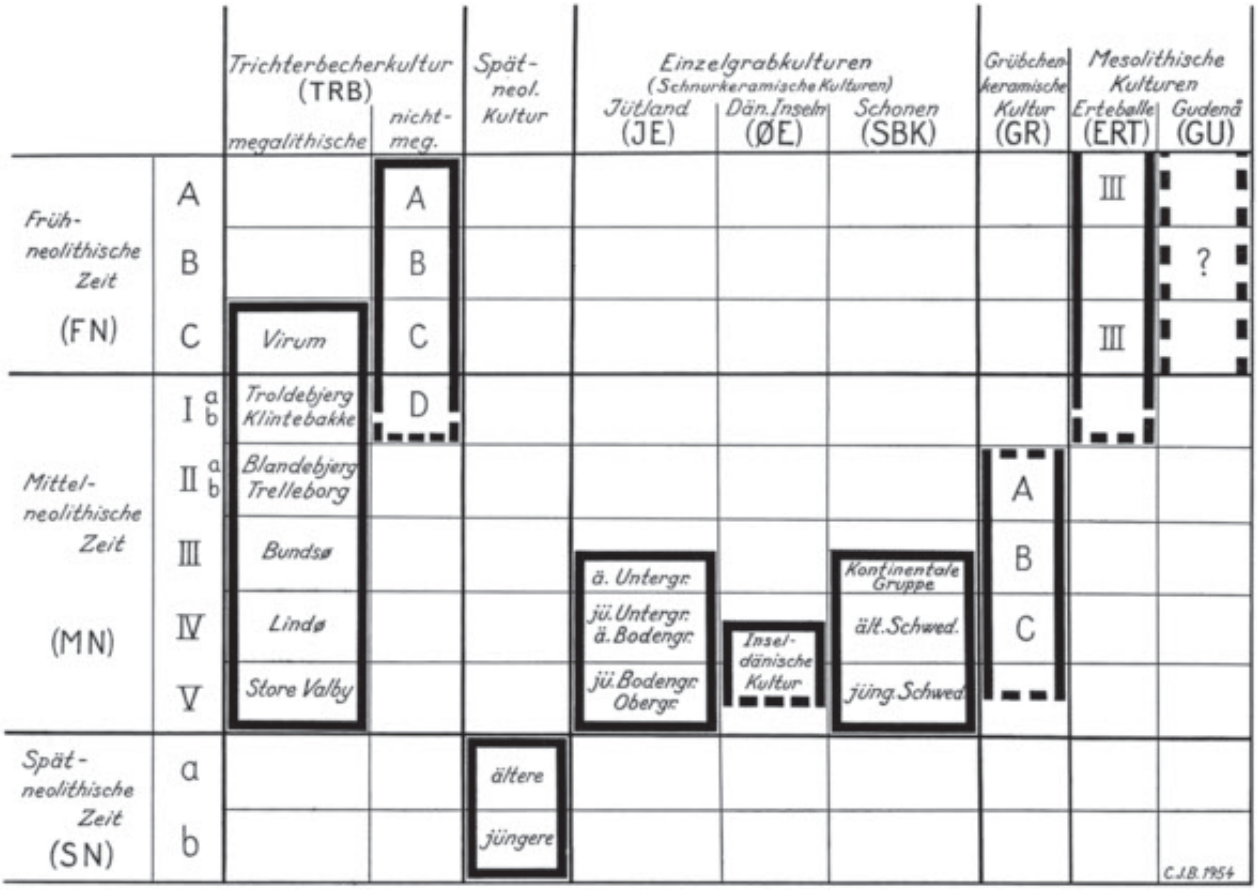

Fig. 3 | *Neolithic chronology according to Becker (1955). The PWC (Grübchenkeramische Kultur) phases A and B/C, as defined by the arrowhead chronology, were instrumental in establishing the relative positions of the Middle Neolithic part of the TRB (Trichterbecherkultur) and the different phases of the SGC (Einzelgrabkultur) in the chronological table. ^{14}C-dates and an increasing body of stratigraphical evidence proved the presumed major overlap between the TRB and SGC to be wrong in the late 1970s. Furthermore, the typological succession of PWC arrowhead types does not, as Becker assumed, reflect a chronological succession of PWC phases.*

time, the remains of Eurasian elk (*Alces alces*) and brown bear (*Ursus arctos*) found at the Kainsbakke site are important with regard to the faunal history of Denmark, as they represent the latest finds of both species and, in case of the brown bear, also the largest settlement assemblage yet recorded in Denmark (Richter 1986a).

With publication of, first and foremost, the Kainsbakke site during the 1980s and early 1990s, as cited above, research into the Danish PWC came to an almost complete halt for the following 20 years. It was R. Iversen, in 2010, who revived interest in the PWC in Denmark by looking at the available evidence with fresh eyes and in the light of an updated theoretical framework (Iversen 2010). Iversen's work was the first since Becker's study 60 years earlier to take into account all the available evidence in a comprehensive review, with the aim of understanding the entire phenomenon, and not only selected parts such as individual settlements, or chronological or typological aspects. Based on revised absolute (3000-2450 BC) and relative chronologies (the tanged-arrowhead typology does not reflect chronological phases), Iversen used all the available evidence to define three types of PWC settlement (Iversen 2010, 11ff.): Base camps (recognised as year-round, permanent settlement sites), camp sites and temporary camps. The camp sites

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were of longer duration (e.g., seasonal camps) than the temporary sites, which may reflect specialised, short-term activities. Iversen's map of the various sites reveals clear differences in the distribution of the three site types, especially the important base camps. These are only evident in eastern and northern Jutland, and not in the northern half of Zealand, which has frequent camp and temporary sites. Iversen compared and contrasted these observations with the presence of contemporaneous TRB sites and, not least, the distribution of PWC finds in megalithic graves of the TRB (graves with more than one tanged arrowhead): The latter resembles very closely the total distribution of PWC sites in Denmark. These incidences are, however, clearly unevenly spread, with the great majority of graves in the northern half of Zealand and only a few in Jutland and other parts of Denmark (apart from notable, minor concentrations on the Stevns peninsula in eastern Zealand, the northeastern part of Funen and the southern coast of Bornholm). By combining all the evidence, Iversen was able to identify several PWC activity zones in Denmark (Fig. 4). These obviously have rather different characters: The PWC identity is strongly expressed in Jutland, where actual permanent settlements exist, no TRB settlements are present within the PWC activity zones and the re-use of earlier megalithic tombs is very restricted. In the activity zones on Zealand, on the other hand, no permanent PWC

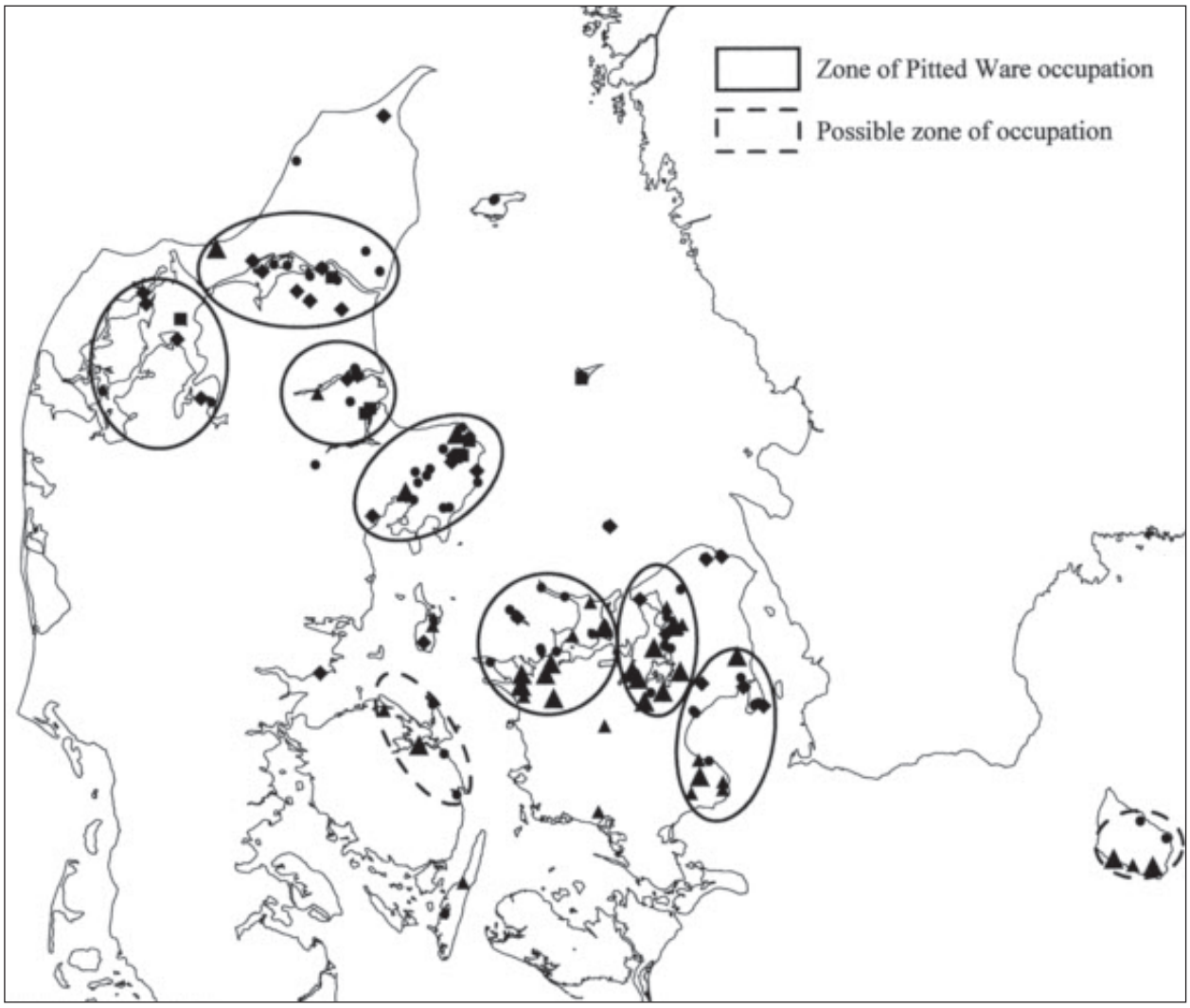

Fig. 4 | *PWC activity zones as identified by Iversen (2010). There are marked differences in character between the PWC activity zones in Jutland and those in eastern Denmark.*

sites are known, contemporaneous (Late) TRB settlements do exist within the PWC activity zones and the re-use of earlier megalithic graves is widespread and extensive. The PWC in northeastern Jutland has a very different expression from that on Zealand. As is evident from the continuity of several types of TRB artefacts (especially thick-butted flint axes and clay discs), the PWC in both areas had its origins in earlier TRB societies. However, groups in Jutland adopted a "Pitted Ware identity" to a much greater degree than those in Zealand. The persistence of TRB elements in the PWC on Zealand led Iversen to describe these groups as having creolized identities, an approach he has expanded upon in later works (Iversen 2013; 2015a; 2015b; 2016b).

Based on his insight into settlement types, the chronology and the identity of local groups, Iversen (2010, 18ff.) addressed the question of what exactly is reflected by PWC finds in Denmark. He convincingly refutes Becker's (1951), original idea of PWC finds being an expression of visiting hunters from the opposite side of the Kattegat. This scenario not only conflicts with the observed continuity of certain artefact types from the preceding TRB, but also with the continued use of megalithic tombs. Furthermore, no pioneering colonisation phase can be identified. When a foreign people migrates, then settles in a new region, a pioneering phase of landscape familiarisation undertaken by a limited number of scouts is to be expected, but the archaeological record does not support such a scenario. Furthermore, the base camps singled out by Iversen indicate permanent, year-round occupation and not just short-term visits, as envisaged by Becker.

S. Nielsen (1979) saw the PWC as an adaption by TRB societies to climate change, which had reduced the agricultural potential during this period and necessitated increased hunting activities to meet requirements for fat- and protein-rich food. This view is rejected by Iversen (2010, 20f.), who points out that there is nothing to indicate the existence of such a necessity. This is apparent from contemporaneous TRB settlements, which even suggest an intensification of food production at this time (Madsen 1982). The emergence of the SGC in the hitherto sparsely settled areas of central and western Jutland, and the observed massive grazing activities associated with this, can, as already outlined above, be seen as a clear indicator of the coeval intensification of animal husbandry, especially cattle breeding.

In his 2010 study, Iversen was able to show that the arrowhead-based PWC chronology was no longer valid, because the tanged arrowhead types A, B and C must be seen as coeval. However, the scope of that study did not permit further investigation of the explanations for the observed stylistic variation. This first became possible with establishment of the CONTACT project in 2014 (Iversen 2016a). One possible explanation for the contemporaneous existence of different arrowhead-types could be that these reflect different PWC groups who used the arrowheads as "ethnic markers" signifiers. A quick look at the distribution map, however, clearly refutes this suggestion. Instead, the stylistic variation can be explained as being functionally determined. The PWC arrowheads fall into two main categories: relatively short, broad hunting arrowheads (type A) and long, slender war arrowheads (type C). Type B would then represent a multifunctional group of arrowheads, which combines features from types A and C. Due to its coarsely denticulate edges, subtype B2 is, however, seen as being affiliated with the group of war arrowheads. In this respect, the new excavations undertaken in 2016 at the Helgeshøj palisaded enclosure in eastern Zealand (Giersing 2004) are of particular interest as they reveal new, and potentially violent, aspects of the PWC. More than 150 tanged arrowheads, several of which show impact fractures, were recovered from a restricted area of the palisade: This is consequently the greatest combined concentration of tanged arrowheads in Denmark, not including the large number of stray finds recorded from Kainsbakke. The Helgeshøj arrowheads are mainly of type B (61%), with the ferocious type B2, with coarsely- denticulate edges, forming a major proportion (44% of the B-arrowheads). Type C constitutes 30%, whereas type A only makes up 9% of the assemblage. (Information about the site

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was kindly provided by L. Sparrevohn, Kroppedal Museum, 1 February 2017. Helgeshøj area 2, archive no. TAK 1726. Typological classification of the arrowheads by R. Iversen.) The site has not yet been published or considered in depth, which of course restricts the current interpretation and its possible violent implications.

In addition to exciting new sites and discoveries such as that at Helgeshøj, the increasing number of archaeogenetic studies of human ancient DNA (aDNA) in recent years has provided important insights into the PWC. As PWC inhumations are known first and foremost from east-central Sweden (in particular Gotland and Öland), these studies have not directly contributed to clarifying the origins of the Danish PWC population. Nonetheless, aDNA studies of the eastern Swedish PWC skeletons have yielded significant results that are largely in line with Becker's early conclusion. The eastern Swedish PWC individuals appear to be genetically related to a larger complex of European Mesolithic hunter-gatherers from Scandinavia, central Europe, Iberia and Russia. In comparison, the hitherto analysed TRB individuals show genetic affiliation with contemporaneous central European Middle Neolithic and Chalcolithic farmers and the preceding Early Neolithic Linear Pottery Culture (Malmström et al. 2009; 2015; Skoglund et al. 2012; 2014; Mittnik et al. 2018). As there is no evidence for the survival of Mesolithic populations into the Middle Neolithic in east-central Sweden and neighbouring regions with Neolithic settlement, the genetic evidence now available for eastern Swedish PWC populations may well indicate migration of people from regions where hunter-gatherer traditions still persisted at the time, i.e. most likely located to the east of Sweden (the eastern Baltic).

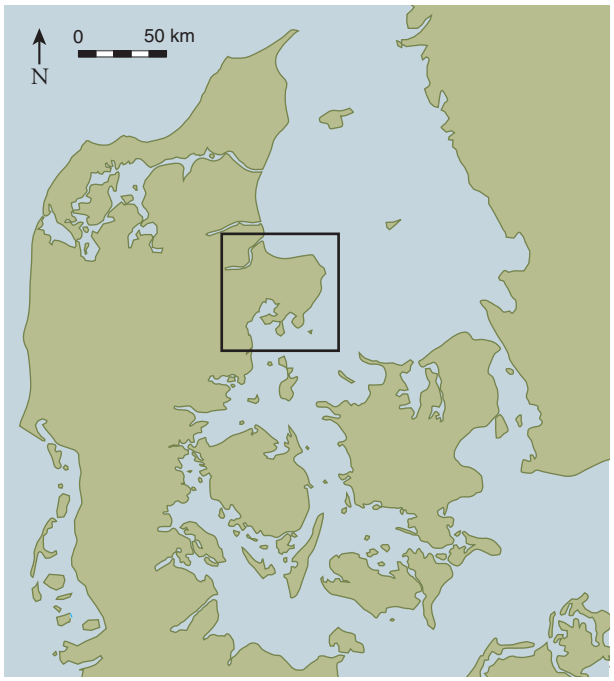

Fig. 5 | *The geographical location of the Djursland peninsula in Denmark.*

3 The Djursland peninsula

The Djursland Peninsula extends out from the east coast of Jutland, between the present-day cities of Aarhus to the south and Randers to the north (Fig. 5). There is no geographically defined western border for the area. In this book, the term Djursland is used to designate the land east of a line extending from the coastline of eastern Jutland, south of Djursland, to the coastline of northern Jutland, north of Djursland. The resulting area has a maximum E-W extent of c. 48 km and a maximum N-S extent of c. 50 km.

Since the end of the last ice age, Djursland (like all of southern Scandinavia) has undergone dramatic changes with regard to the relationship between land and sea due to land uplift following deglaciation and a series of transgressions and regressions. In the Late Atlantic and Early Subboreal, a complex comprised of one major fjord and numerous minor ones extended far into areas that are currently used as agricultural land (Fig. 6). Coastal cliffs and slopes associated with the so-called Littorina Sea of that time are therefore now found inland (Schack Pedersen/Strand Petersen 1997, 18).

The maximum level of the Littorina Sea was reached in eastern Denmark, and consequently also on Djursland, in conjunction with the Late Atlantic and the Subboreal transgression, between the end of the 5th and the beginning of the 3rd millennium BC. In northeast Djursland, the sea level was c. 5 m higher than that of today (Fig. 6). When

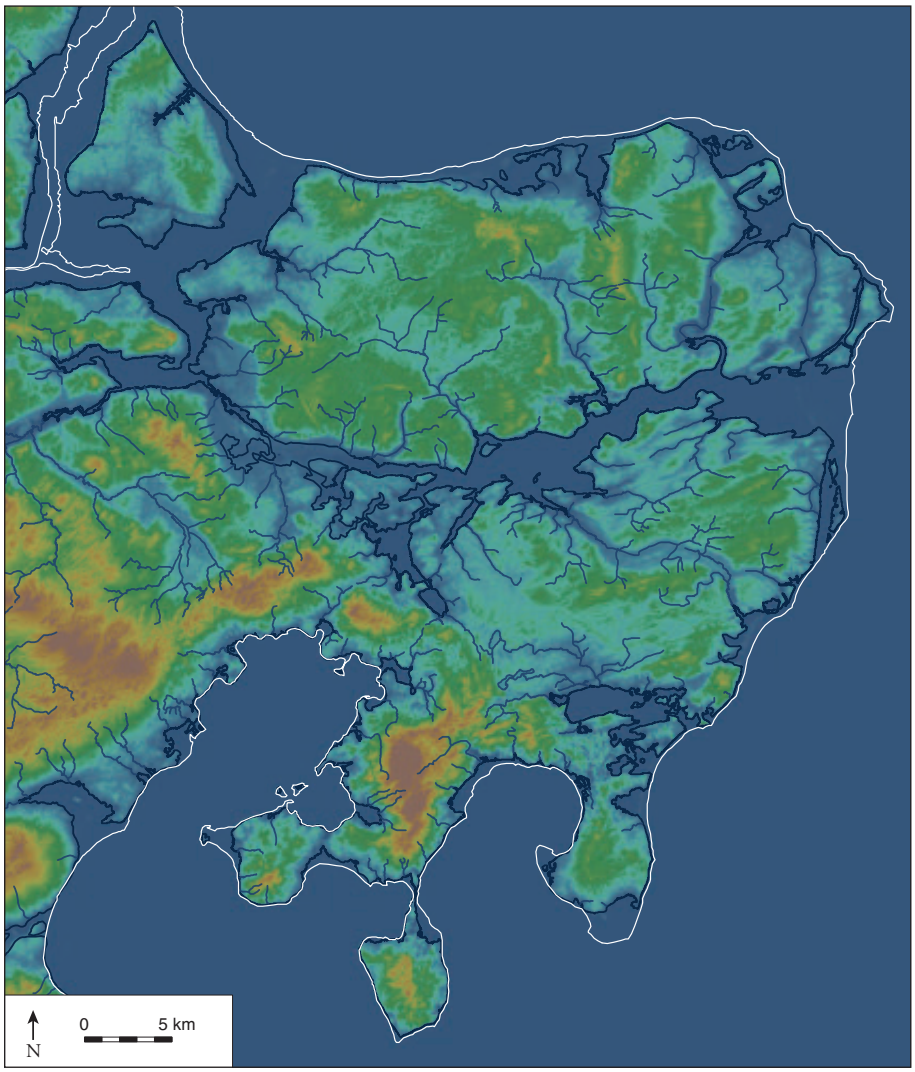

Fig. 6 | *Land-sea relationship on Djursland in the Late Atlantic and Early Subboreal. The present-day coastline is indicated by a white line.*

the water level was at its highest, Kolindsund took the form of a c. 50 km long fjord-like strait running through Djursland. This prevailed at least until the end of the Neolithic, in the early 2nd millennium BC, but precisely how long it existed is unknown (Lewis 2011, 70). Due to falling sea level and continuing land uplift, this sound eventually became a c. 20 km long freshwater lake. It is thought that formation of the major beach ridges at its outlet into the Kattegat, which hindered free passage and resulted in Kolindsund becoming a freshwater body, first took place late in Subboreal times or even later (Schack Pedersen/Strand Petersen 1997, 83). In the narrow western parts, intensive growth of peat gradually transformed the lake into a bog. The wider and deeper eastern part remained a lake (Denmark's largest) until the late 19th century. Prompted by increasing problems with flooding, reclamation of the Kolindsund lake became one of the major Danish drainage projects being undertaken in the 1870s. This resulted in the creation of 24 km² of arable land. The large lake is now dry land, drained by a system of canals (Schack Pedersen/Strand Petersen 1997, 87).

The shift from sound to lake naturally had major consequences for life in and around Kolindsund: It was not a gradual development and periods with fluctuations in for example salinity were of crucial significance for the populations of various molluscs (Strand Petersen 1993). Investigations in Korup Sø, a lake in central Djursland that was originally linked to Kolindsund from the north, have demonstrated major fluctuations in the salinity during the Neolithic. Around 2800-2700 BC, i.e. largely

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contemporaneous with the PWC settlements at Kainsbakke and Kirial Bro, there is evidence of a stable, fully marine environment with a salinity on a par with that in Atlantic times. Synchronous with this, there was a massive increase in the abundance of salt-demanding molluscs, including oysters, in this southern branch of the Kolindsund system. This fully marine environment continued until the Late Neolithic, at the end of the 3rd millennium BC (Lewis 2011, 211-257).

Marine molluscs were a natural part of the diet of people living on the settlements along the sound up until the Early Iron Age. Oysters, which are most sensitive to changes in salinity, disappeared first, as the salt content declined. The latest known settlements with associated oyster shells are from the Late Neolithic, c. 2400-1700 BC, for example Ballegården near Koed (East Jutland Museum archive no. DJM 2196) (Hougaard Rasmussen 1989; Wincentz Rasmussen 1994; Boas 2001, 8). A pit from the Late Bronze Age, which did not contain oysters, only cockles and mussels, was encountered at the same site (DJM 2371). Settlements from the Pre-Roman Iron Age are found to contain primarily shells of mussels, for example incorporated into layers in refuse pits at sites in the eastern part of the area closest to the Kattegat (Wincentz/Boas 1995). Gathering of oysters and other molluscs can, of course, be taken as an indirect indicator that marine resources, which also included fish, featured in the diet (Løkkegård Poulsen 1978).

North of Kolindsund, northern Djursland formed the largest of the Neolithic islands and included almost all the land north of the fjord. It measured c. 35 km E-W and 15 km N-S. Northern Djursland is a moraine plateau with smooth, rolling hills situated between c. 40 and 60 m a.m.s.l.. Several large peat bogs (which may, to some degree, have been lakes in the Neolithic) are found in this area. The predominant soil type is sand, although more clayey soils are found to the northwest and northeast. This kind of landscape is also found south of Kolindsund Fjord in the eastern part of Djursland. Due to the presence of some minor fjords and inlets which penetrated up to about 4 km inland, the northern and northeastern coasts of Djursland were much more irregular than they are today.

From the central part of Djursland, a branch of Kolindsund extended as much as 8 km to the south. In its northern parts, this body of water was up to 9 km wide and hosted a number of large and small islands characterised by low elevation and a complex coastline.

In the western part of Djursland, a flat, sandy, area called Tirstrup Hedeslette (2-5 km wide) follows the southern shore of the Kolindsund Fjord. In the eastern part of Djursland, these meltwater deposits from the end of the last ice age border the southern edge of the moraine plateau immediately south of Kolindsund. The area is characterised by very poor, sandy and gravelly soils.

Finally, south of Tirstrup Hedeslette, the peninsulas of Tved, Helgenæs and (to a lesser degree) Hasnæs are characterised by undulating moraine terrain. The coastal areas around the Kalø Vig bay and the eastern parts of the Hasnæs peninsula are covered by clayey soils; the remainder is characterised by better-drained soils. The Mols hills (which reach a maximum height of 137 m a.m.s.l.) are the highest in Djursland. They were pushed up by the final advance of glaciers from the south during the last ice age, these also carved out the comparatively deeper bay of Kalø Vig, near to the coast.

Investigations in the bog Fuglsø Mose, located c. 15 km northwest of the major PWC sites of Kainsbakke and Kirial Bro in northern Djursland, have demonstrated that at the time of the PWC the woodland suddenly became dense and adopted the character of primeval forest, as seen in the Mesolithic. This shows that it was subjected to very little cultural impact from arable agriculture and livestock grazing at this time (Aaby 1985).

A detailed description of the landscape and its history has been presented by S.A. Schack Pedersen and K. Strand Petersen (1997). The geology of Djursland is described in more detail in Chapter 10 of this volume, dealing with strontium isotope analysis, while more detailed descriptions of the land-sea relationship in the environs of the archaeological sites are given in Chapters 2 and 3.

4 The CONTACT project

As mentioned earlier, Djursland was one of the most prominent PWC areas in southern Scandinavia but it also saw extensive Early Neolithic and early Middle Neolithic TRB presences. This leads directly on to questions about the nature of contact between early farming communities of the TRB in Denmark and early PWC communities in the east-central Swedish parts of the Baltic. These communities predate the Danish PWC by about 300 years (Iversen et al. in prep.). Stable isotope analyses have demonstrated that these early eastern Scandinavian PWC communities lived largely on seals (Eriksson 2004; Lidén/Eriksson 2007; Eriksson et al. 2008; Fornander et al. 2008) and could therefore be nicknamed "the Inuit of the Baltic". The partial adoption of these seal-hunters' way of life by Danish TRB communities, as apparent from the transformation to several local variants of PWC or creolised PWC-TRB societies (*sensu* Iversen 2010), testifies to the huge impact this contact must have had. In this regard, it is worth noting that, in Denmark, true PWC communities only evolved in regions that lay at a greater distance from the early eastern Swedish PWC communities than those in which a creolised TRB-PWC identity emerged. There are two possible explanations for this situation. (1) The existence of direct contacts between east-central Sweden and areas such as Djursland, as indicated by southern Scandinavian objects found in PWC graves on Gotland (Davidsen 1982, 39; Iversen 2010, 24), several large flint axe hoards recorded along the coast of Norrland (Becker 1953) and the Swedish PWC-type objects recovered at Kainsbakke (Wincentz this vol.). The northeastern Swedish hoards each contain up to 175 unpolished, semi-finished thick-butted adzes and chisels of mainly Zealand Senonian flint and might be the result of PWC contacts as originally proposed by Becker (1953; Malmer 1962, 506ff.; Knutsson 1986; Olausson et al. 2012). (2) It was contact with western and not eastern Swedish PWC groups that led to the emergence of Danish PWC communities. PWC finds are very abundant on the islands of Læsø and Anholt (Becker 1951, 166ff.), which are located in the middle of the Kattegat and consequently occupy a central position between the western Swedish and northeastern Danish distribution areas of the PWC. Both host large populations of seals and were therefore of major interest to PWC people. Furthermore, flint could be collected on Anholt, which made the island attractive to the western Swedish PWC communities that lacked high-quality flint. A distinct interest in the island by Swedish groups can be identified at least from the Early Neolithic onwards (Vang Petersen 2004). The islands could therefore have served as steppingstones for contacts between coastal groups on each side of the Kattegat. These two hypotheses have formed the foundations for a range of investigations into the maritime contacts of the PWC communities on Djursland presented in the present volume.

As shown primarily by Kainsbakke, but also by Jonstorp, the southern Scandinavian PWC economy, and probably also its identity, differed markedly from the sealing economy of eastern Sweden. Kainsbakke is the only Danish PWC site from which detailed archaeozoological studies have been presented (Richter 1986a; 1986b; 1989; 1991). Almost all the animal bones derive, however, from a single pit (A47). This was originally interpreted as a settlement pit but should rather be seen as a ritual feature (Malmer 2002, 122). This raises serious doubts about the reliability of our present understanding of the PWC in Denmark. A fraction of the content of a single ritual pit is not necessarily representative of the entire PWC phenomenon. It is the aim of this project to improve this situation substantially by continuing the analyses of the Kainsbakke site and finds, and by investigating additional sites both with and without preserved bones – archaeologically, archeozoologically and archeobotanically. As all of the sites in question are located within a short distance of Kainsbakke, the settlement system and perception of the landscape by the local PWC community can be analysed and compared to that of the preceding TRB groups.

Ritual features and structures are by no means unknown in the PWC (Larsson 2006; 2007), but pit A47 at Kainsbakke is a very special case. As already mentioned above, it contained the largest assem-

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blage of brown bear remains ever found in Denmark (Richter 1986a) and the bones of at least one Eurasian elk. These bones represent some of the latest finds of these species from Denmark. The astonishing quantity of material, the predominance of cranial parts in the bear remains, and the combination with Eurasian elk begs the question of whether these animals originated in Jutland or might possibly have been brought to Kainsbakke from Sweden, where they are still found to the present day. Pit A47 also contained a number of artefact types that are not encountered on other Danish PWC sites but typical of the PWC in east-central Sweden (Wincentz Rasmussen 1986a, 166; Wincentz this vol.). These significant finds make it reasonable, as a working hypothesis, to consider Kainsbakke as a ritual site of super-regional importance, to which people travelled a great distance by sailing across the Kattegat to engage in shared ritual activities. These would have included the deposition of bear heads and specific artefacts (cf. evidence from Neolithic ritual sites of super-regional importance in other parts of Europe, e.g., Stonehenge and Herxheim: Parker Pearson 2012; Turck et al. 2012; Zeeb-Lanz 2010; 2012; 2016). Pit A47 also contained the only uncharred human skeletal remains recorded from the entire Kattegat province of the PWC. These extraordinary depositions may represent the acts of foreigners who came from Swedish PWC communities, because depositions of non-local origin are also known from other super-regional ritual sites (e.g., Herxheim, referred to above). The ritual feature pit A47 is without parallel in the entire distribution area of the PWC. It is therefore of great interest to investigate why such a site came into existence on Djursland.

A precondition for addressing the large-scale research questions outlined above is detailed knowledge of the available archaeological record for the PWC on Djursland. The first chapters of this book, following this introduction, therefore contain a detailed presentation and analysis of six excavated PWC sites on Djursland. Only two of these – Kainsbakke and Kirial Bro – have hitherto been mentioned to any significant degree in the literature. These earlier publications have, however, only dealt with parts of the available evidence from these two sites. In her contribution to the present volume (Ch. 2), the excavator of both sites, L. Wincentz, presents all the available evidence on the structural and material remains from these two key localities, which have seen the largest excavations of PWC sites, not only on Djursland, but in Denmark as a whole.

The subsequent Chapter 3, by U.L. Rasmussen, deals with a further four PWC sites on Djursland: Ginnerup, Skærvad, Neden Skiden Enge and Musefælden. Excavations have been undertaken at all of these, albeit of a rather restricted and somewhat divergent character. Structural evidence and, not least, a detailed analysis of the finds from these localities is presented. The results are of the utmost importance for an understanding of the PWC activity zone on Djursland and the functioning of the PWC settlement system in the region. The latter is described in the next chapter, 4, co-authored by U.L. Rasmussen, L. Wincentz, L. Klassen and O.B. Poulsen. This concludes the primary archaeological analysis of the available PWC evidence from Djursland and is instrumental in characterising the PWC activity zone in the northeastern part of the peninsula.

The following section is dedicated to a series of scientific investigations of both organic and inorganic remains, recovered primarily from the Kainsbakke and Kirial Bro sites. Organic remains, in particular, are almost exclusively known from these two localities.

Faunal remains are addressed in two separate chapters dealing with the mammal and bird remains (Makarewicz/Pleuger this vol., Ch. 6) and fish remains (Pleuger/Makarewicz this vol., Ch. 7) respectively. These contributions are crucial, not only to research into the Djursland PWC group, but also to investigations of the PWC across its entire area of distribution, most parts of which are characterised by unsuitable preservation conditions for organic remains. The aim of these analyses is to trace developments in animal exploitation practices which contributed to shifts in the economic and social organisation of PWC communities on Djursland. In addition to basic information gained from

faunal analyses (species, age, sex, frequency, metric data), several specific research problems are addressed by stable isotope analysis ($\delta^{13}C$, $\delta^{15}N$, $\delta^{18}O$). The focus of this section is on questions regarding the relative exploitation of wild species, including fishes, and domestic animals. Did PWC groups on Djursland pursue animal exploitation strategies for domestic animals consistent with those of the earlier TRB? Did PWC communities on Djursland exploit marine resources on a seasonal basis? And, if so, did these groups alter their management strategies for animal domesticates, perhaps in ways that were not optimal for herd maintenance, in order to pursue the culturally important exploitation of seals? Did PWC herders adapt local grazing strategies to the different animal species? Were cattle and caprines (sheep/goats) grazed on separate pastures, and were pigs free-ranging or maintained in enclosures? Did herders exploit coastal pastures to buffer against potential grazing shortages in inland pastures during the winter months? To what extent were animal mobility patterns dictated by grazing availability or other factors, such as seal hunting? Were fishing grounds located in the direct vicinity of the site or more distant?

The archaeobotanical investigations presented by M. Andreasen in Chapter 8 are focused on the question of cereal cultivation during the PWC on Djursland, and in Denmark as a whole. Only indirect evidence for this practice has hitherto been presented in the literature, while actual macroremains of cereals have never been recorded. Andreasen bases her contribution on investigations of the abundant soil samples recovered from Kainsbakke and Kirial Bro, in combination with a number of AMS ^{14}C-dates (see below), and also presents an up-to-date survey of all available indirect evidence for PWC cereal cultivation.

The CONTACT project also includes a dating module focused on the production of a large number of new AMS ^{14}C-dates, as well as an assessment of these, in conjunction with dates obtained previously. Clarification of chronological issues is pertinent to many research questions. Samples have therefore been dated not only from Djursland, but also from Norway and western Sweden, and older dates from these regions, and from eastern Sweden, have been reassessed. Dating the western Swedish PWC is essential to an evaluation of maritime contacts across the Kattegat and thereby the potential role of western Swedish PWC groups in the emergence of PWC communities on Djursland. It is also important for the discussion of the relationship between PWC and TRB groups in the Kattegat area and, with that, a general understanding of the PWC phenomenon. Chapter 5, by B. Philippsen, R. Iversen and L. Klassen, concentrates on the evidence from Djursland, while the superregional analysis of the PWC chronology is published in a separate paper (Iversen et al. in prep.). From a methodological point of view, re-evaluation of older dates for food crusts, is particularly essential. For dates obtained for sample material of this kind, research has been undertaken into potential reservoir effects and their correction; by dating food crusts and terrestrial material from the same context where available, by investigating the chemical and isotopic compositions of food crusts, by dating different fractions of food-crust material, by dating soot and other charcoal in the clay of pottery and by dating marine and terrestrial material from the same context to assess the marine reservoir effect.

Archaeogenetic investigations have proved to be of great importance in research into the PWC of eastern Sweden and the recognition of genetic differences between PWC and TRB populations.

As mentioned above, pit A47 at Kainsbakke has yielded the only human remains found in a sealed PWC context in Denmark. Undertaking aDNA research on this material was therefore a logical step, not least in relation to the question of whether immigration of Swedish PWC people could have been instrumental in the creation of PWC communities in Denmark. In Chapter 11, M. Allentoft presents the initial results of an aDNA analysis of a single human individual from Kainsbakke.

A further chapter dealing with scientific analyses of organic remains from Kainsbakke and Kirial Bro is devoted to Sr-isotope and, to a minor degree, experimental Pb-isotope analysis (Klassen et al. this vol., Ch. 10). The aim of this chapter is to iden-

tify possible translocation of humans and animals across the Kattegat. As described above, the abundant finds of brown bears and Eurasian elk from Kainsbakke, not least, are of considerable interest in this respect. A broad range of species, including red deer, cattle, pigs and sheep/goat have, however, also been subjected to analysis. A precondition for meaningful interpretation of the results of these isotope measurements on PWC faunal remains is the availability of baselines for their potential regions of origin. Very different geological origins and ages, and rock and sediment types, characterise the two main regions of interest in this investigation, Djursland and western Sweden: Tertiary/Quaternary on Djursland, Precambrian in western Sweden. Markedly different $^{86}Sr/^{87}Sr$ ratios should therefore be expected and enable distinction of humans and animals originating on each side of the Kattegat. These differences are also reflected in existing data (Sjögren/Price 2013; Sjögren et al. 2009; Frei/Price 2012; Frei/Frei 2011), which are though by no means adequate. A substantial number of Sr-isotope analyses have therefore been used to create new baselines and improve existing ones.

The final chapter in this section deals with scientific analyses (both chemical and technological) of PWC pottery (Blank et al., Ch. 9). As with the investigations into the absolute chronology of the PWC, this work includes one study focusing on the finds from Djursland and another dealing with a much larger geographical region. The latter has already been published separately by Brorsson et al. (2018). This chapter scrutinises the origin of the clay and the techniques used in pottery production by the PWC on Djursland. It includes thin-section analysis and the application of various types of elemental analysis (pXRF, ICP-MS). The results are compared with data from analyses of TRB pottery, with the aim of identifying any potential culture-specific traits. In addition to characterising PWC craft traditions on Djursland with regard to chemistry and technology, the identification of possible imports from Swedish PWC groups constituted one of the main goals of this sub-project.

The final section of the publication is exclusively devoted to a synthesis and overall interpretation of the results presented in previous chapters of the book and in the papers previously published in several journals (Klassen et al., Ch. 12). The scope of this work extends far beyond the PWC on Djursland and aims to exploit the potential of the research on a much broader scale. It includes reflections on the effect of contacts between ethnically and culturally different groups, as well as the role of large-scale European contact networks in shaping local identities.

5 References

Adamsen/Ebbesen 1986
Ch. Adamsen/K. Ebbesen (eds.), Stridsøksetid i Sydskandinavien. Beretning fra et symposium 28.-30.X.1985 i Vejle. Arkæologiske Skrifter 1 (København 1986).

Almgren 1906
O. Almgren, Uppländska stenåldersboplatser. Fornvännen 1, 1-19, 101-118.

Andersen 1993
S.T. Andersen, Det tidlige landbrug. In: S. Hvass/B. Storgaard (eds.), Da Klinger I Muld…25 års arkæologi i Danmark (København/Århus 1993), 88-91.

Bagge 1952
A. Bagge, Fagervik. Ein Rückgrat für die Periodeneinteilung der Ostschwedischen Wohnplatz- und Bootaxtkulturen aus dem Mittelneolithikum. Acta Archaeologica XXII, 1951, 57-118.

Becker 1951
C.J. Becker, Den grubekeramiske kultur i Danmark. Aarbøger for Nordisk Oldkyndighed og Historie 1950, 153-274.

Becker 1953
C. J. Becker, Die Nordschwedischen Flintdepots. Ein Beitrag zur Geschichte des Neolithischen Fernhandels in Skandinavien. Acta Archaeologica XXIII, 1952, 31-79.

Becker 1955
C.J. Becker, Die Mittelneolithischen Kulturen in Südskandinavien. Acta Archaeologica XXV, 1954, 49-150.

Becker 1982
C.J. Becker, Om grubekeramisk kultur i Danmark. Korte bidrag til en lang diskussion (1950-1980). Aarbøger for Nordisk Oldkyndighed og Historie 1980, 13-33.

Boas 2001
N.A. Boas, Blakbjerg. En befæstet plads fra tragtbægerkulturen i yngre stenalder ca. 3.500 f.Kr. In: En by og dens mennesker. Marie Magdelene før og nu (Ryomgård 2001), 4-8.

Brorsson et al. 2018
T. Brorsson/M. Blank/I.B. Fridén, Mobility and Exchange in the Middle Neolithic: Provenance studies of Pitted Ware and Funnel Beaker pottery from Jutland, Denmark and the west coast of Sweden. Journal of Archaeological Science: Reports 20, 2018, 662-674.

Davidsen 1975
K. Davidsen, Tragtbægerkulturens slutfase. Nye C 14 dateringer. KUML 1973/74, 165-178.

Davidsen 1977
K. Davidsen, Relativ kronologi i mellemneolitisk tid. En diskussion af C.J. Beckers kronologisystem på baggrund af nye og gamle stratigrafiske fund. Aarbøger for Nordisk Oldkyndighed og Historie 1975, 42-77.

Davidsen 1982
K. Davidsen, Undergravstid på de danske øer. Aarbøger for Nordisk Oldkyndighed og Historie 1980, 38-51.

Ebbesen 1982
K. Ebbesen, Enkeltgravskulturen – 100 år efter opdagelsen. Aarbøger for Nordisk Oldkyndighed og Historie 1980, 52-72

Eriksson 2004
G. Eriksson, Part-time farmers or hard-core sealers? Västerbjers studied by means of stable isotope analysis. Journal of Anthropological Archaeology 23, 2004, 135-162.

Eriksson et al. 2008
G. Eriksson/A. Linderholm/E. Fornander/M. Kanstrup/P. Schoultz/H. Olofsson/K. Lidén, Same island, different diet: Cultural evolution of food practice on Öland, Sweden, from the Mesolithic to the Roman Period. Journal of Anthropological Archaeology 27, 2008, 520-543.

Fornander et al. 2008
E. Fornander/G. Eriksson/K. Lidén, Wild at heart: Approaching Pitted Ware identity, economy and cosmology through stable isotopes in skeletal material from the Neolithic site Korsnäs in eastern Central Sweden. Journal of Anthropological Archaeology 27, 2008, 281-297.

Frei/Frei 2011
K.M. Frei/R. Frei, The geographic distribution of strontium isotopes in Danish surface waters – A base for provenance studies in archaeology, hydrology and agriculture. Applied Geochemistry 26, 2011, 326-340.

Frei/Price 2012
K.M. Frei/T. Douglas Price, Strontium isotopes and human mobility in prehistoric Denmark. Archaeological and Anthropological Sciences 2012, 103-114.

Giersing 2004
T. Giersing, Et mellemneolitisk palisadeanlæg ved Helgeshøj, Østsjælland. Aarbøger for Nordisk Oldkyndighed og Historie 2001, 7-34.

Hernek in preparation
R. Hernek, Keramiska grupper inom gropkeramisk kultur i Kattegat-området. En jämförande studie avseende dekorerad keramik.

Hougaard Rasmussen 1989
G. Hougaard Rasmussen, Ballegård. Arkæologiske udgravninger i Danmark 1988 (København 1989), nr. 307.

Hübner 2005
E. Hübner, jungneolithische Gräber auf der jütischen Halbinsel. Typologische und chronologische Studien zur Einzelgrabkultur. Nordiske Fortidsminder Serie B, Band 24 (København 2005).

Iversen 2010
R. Iversen, In a World of Worlds. The Pitted Ware Complex in a large-scale Perspective. Acta Archaeologica 81, 2010, 5-43.

Iversen 2013
R. Iversen, Beyond the Neolithic transition – the 'de-Neolithisation' of South Scandinavia. In: M. Larsson/J. Debert (eds.), NW Europe in Transition. The Early Neolithic in Britain and South Sweden. BAR International Series, Vol. 2575 (Oxford 2013), 21-27.

Iversen 2015a
R. Iversen, Creolisation processes in the later South Scandinavian Neolithic. An approach to cultural heterogeneity. In: K. Brink/S. Hydén/K. Jennbert/L. Larsson/D. Olausson (eds.), Neolithic Diversities. Perspectives from a conference in Lund, Sweden. Acta Archaeologica Lundensia Series in 8º, No. 65 (Lund 2015), 58-65.

Iversen 2015b
R. Iversen, The Transformation of Neolithic Societies. An Eastern Danish Perspective on the 3rd Millennium BC. Jutland Archaeological Society Publications, Vol. 88 (Højbjerg 2015).

Iversen 2016a
R. Iversen, Arrowheads as indicators of interpersonal violence and group identity among the Neolithic Pitted Ware hunters of southwestern Scandinavia. Journal of Anthropological Archaeology 44, 2016, 69-86.

Iversen 2016b
R. Iversen, Was There Ever a Single Grave Culture in East Denmark? Traditions and Transformations in the 3rd Millennium BC. In: M. Furholt/R. Grossmann /M. Szmyt (eds.), Transitional Landscapes? The 3rd Millennium BC in Europe. Universitätsforschungen zur prähistorischen Archäologie, Band 292 (Bonn 2016), 159-170.

Iversen/Klassen 2016
R. Iversen/L. Klassen, "CONTACT" – et forskningsprojekt om grubekeramisk kultur. Fund & Fortid 2016 (1), 16-20.

Iversen et al. in prep.
R. Iversen/B. Philippsen/P. Persson, Reconsidering the Pitted Ware Chronology. A temporal fixation of the Scandinavian Neolithic hunters, fishers and gatherers.

Jensen 2001
J. Jensen, Danmarks Oldtid. Stenalder 13.000-2.000 f.Kr. (København 2001).

Kjær 1920
H. Kjær, Nordisk Archæologmøde i Kjøbenhavn 1919. Aarbøger for nordisk Oldkyndighed og Historie 1920, 1-62.

Knutsson 1986
K. Knutsson, Några arbetsidéer i samband med bearbetningen av Bjurselet-fynden, in: Ch. Adamsen/K. Ebbesen (eds.), Stridsøksetid i Sydskandinavien. Arkæologiske Skrifter 1 (København 1986), 253-265.

Larsson, M. 2006
M. Larsson, A tale of a Strange People. The Pitted Ware Culture in Southern Sweden. Kalmar Studies in Archaeology 2/University of Lund, Institute of Archaeology Report Series 96 (Kalmar 1996).

Larsson, M. 2007
M. Larsson, The guardians and protectors of mind: ritual structures in the Middle Neolithic of southern Sweden. In: M. Larsson/M.P. Pearson (eds.), From Stonehenge to the Baltic: Living with cultural diversity in the third millennium. BAR International Series. vol. 1692 (Oxford 2007), 17-23.

Lewis 2011
J.P. Lewis, Holocene environmental change in coastal Denmark: interaction between land, sea and society. Doctoral Thesis Loughborough University 2011.

Lidén 1940
O. Lidén, Sydsvensk Stenålder Belyst Av Fynden På Boplatserna I Jonstorp. II Gropkeramikskulturen (Lund 1940).

Lidén/Eriksson 2007
K. Lidén/G. Eriksson, Walking on the wild side: on cultural diversity and the Pitted Ware Culture along the Swedish east coast during the Middle Neolithic. In: M. Larsson/M.P. Pearson (eds.), From Stonehenge to the Baltic: Living with cultural diversity in the third millennium. BAR International Series. vol. 1692 (Oxford 2007), 1-9.

Løkkegård Poulsen 1978
K. Løkkegård Poulsen, Eisenzeitliche Muschelhaufen in Dänemark. Offa 35, 64-85.

Madsen 1982
T. Madsen, Settlement Systems of Early Agricultural Societies in East Jutland, Denmark: A regional Study of Change. Journal of Anthropological Archaeology 1, 1982, 197-236.

Malmer 1962
M.P. Malmer, Jungneolithische Studien, Acta Archaeologica Lundensia, Series in 8° (Lund 1962).

Malmer 2002
M.P. Malmer, The Neolithic of South Sweden. TRB, GRK, and STR (Stockholm 2002).

Malmros 1980
C. Malmros, Den tidlige enkeltgravskultur og stridsøksekultur. Oplæg til en diskussion. Aarbøger for Nordisk Oldkyndighed og Historie 1979, 62-68.

Malmros/Tauber 1977
C. Malmros/H. Tauber, Kulstof-14 dateringer af dansk enkeltgravskultur. Aarbøger for Nordisk Oldkyndighed og Historie 1975, 78-95.

Malmström et al. 2009
H. Malmström/M. T. P. Gilbert/M. G. Thomas/M. Brandström/J. Storå/P. Molnar/P. K. Andersen/C. Bendixen/G. Holmlund/A. Götherström/E. Willerslev, Ancient DNA Reveals Lack of Continuity between Neolithic Hunter-Gatherers and Contemporary Scandinavians. Current Biology 19(20), 2009, 1758-1762.

Malmström et al. 2015
H. Malmström/A. Linderholm/P. Skogslund/J. Storå/P. Sjödin/M. Thomas/P. Gilbert/G. Holmlund/E. Willerslev/M. Jakobsson/K. Lidén/A. Götherström, Ancient mitochondrial DNA from the northern fringe of Neolithic farming expansion in Europe sheds light on the dispersion process. Philosophical Transactions of The Royal Society B 370: 20130373. http://dx.doi.org/10.1098/rstb.2013.0373

Marseen 1953
O. Marseen, Fangstfolk på Selbjerg. Kuml 1953, 102-120.

Marseen 1963
O. Marseen, Smedegårde og Livø. Grubekeramiske bopladser ved Limfjorden. Kuml 1962, 123-143.

Mittnik et al. 2018
A. Mittnik/C.-C. Wang/S. Pfrengle/M. Daubaras/G. Zariņa/F. Hallgren/R. Allmäe/V. Khartanovich/V. Moiseyev/M. Tõrv/A. Furtwängler/A. Andrades Valtueña/M. Feldman/C. Economou/M. Oinonen/A. Vasks/ E. Balanovska/D. Reich/R. Jankauskas/W. Haak/S. Schiffels/J. Krause, The genetic prehistory of the Baltic Sea region. Nature Communications 9 (442), 2018, doi: 10.1038/s41467-018-02825-9.

Müller 1888
S. Müller, Stenalderen. Ordning af Danmarks Oldsager. Vol. I (Paris, Kjøbenhavn, London, Leipzig 1888).

Nielsen, P.O. 1979
P.O. Nielsen, De tyknakkede flintøksers kronologi. Aarbøger for Nordisk Oldkyndighed og Historie 1977, 5-71.

Nielsen, S. 1979
S. Nielsen, Den grubekeramiske kultur i Norden samt nogle bemærkninger om flækkepilespidserne fra Hesselø. Antikvariske Studier 3, 23-48.

Nielsen, S. 1982
S. Nielsen, Den grubekeramiske kultur og stridsøksekulturen. Aarbøger for Nordisk Oldkyndighed og Historie 1980, 34-37.

Olausson et al. 2012
D. Olausson/R. E. Hughes/A. Högberg, A New Look at Bjurselet. The Neolithic flint axe caches from Västerbotten, Sweden: Using non-destructive energy dispersive x-ray fluorescence analysis for provenance determination. Acta Archaeologica 83, 2012, 83-103.

Parker Pearson 2012
M. Parker Pearson, Stonehenge: exploring the greatest Stone Age mystery (London 2012).

Rasmussen 1999
K.L. Rasmussen, ^{14}C-dateringer, København 1998. Arkæologiske Udgravninger I Danmark 1998, 310-328.

Richter 1986a
J. Richter, Brown Bear (Ursus arctos) from Kainsbakke, East Jutland. Journal of Danish Archaeology 5, 1986, 125-134.

Richter 1986b
J. Richter, Evidence for a natural deposition of fish in the Middle Neolithic site, Kainsbakke, Djursland. Journal of Danish Archaeology 5, 1986, 116-124.

Richter 1989
J. Richter, Animal husbandry in a Danish Pitted ware Culture site. In: E. Iregren/R. Liljekvist (eds.), Faunahistoriska studier tillägnade Johannes Lepikpsaar. Institute of Archaeology Report Series 33 (Lund 1989), 43-56.

Richter 1991
J. Richter, Kainsbakke. Aspects of the paleoecology of Neolithic man. In: L.W. Rasmussen/J. Richter (eds.), Kainsbakke (Grenå 1991), 71-127.

Simonsen/Munch 1973
P. Simonsen/G.S. Munch (eds.), Bonde – Veidemann. Bofast – ikke bofast i nordisk forhistorie. Foredrag og Diskusjoner fra XIII. Nordisk Arkeologmøte i Tromsø 1970. Tromsø Museums Skrifter XIV (Tromsø 1973).

Sjögren/Price 2013
K.-G. Sjögren/T.D. Price, A complex Neolithic economy: isotope evidence for the circulation of cattle and sheep in the TRB of western Sweden. Journal of Archaeological Science 40, 2013, 690-704.

Sjögren et al. 2009
K.-G. Sjögren/T.D. Price/T. Ahlström, Megaliths and mobility in south-western Sweden. Investigating relationships between a local society and its neighbours using strontium isotopes. Journal of Anthropological Archaeology 28, 2009, 85-101.

Skoglund et al. 2012
P. Skogslund/H. Malmström/M. Raghavan/J. Storå/P. Hall/E. Willerslev/M.T.P. Gilbert/A. Götherström/M. Jakobsson, Origins and Genetic Legacy of Neolithic Farmers and Hunter-Gatherers in Europe. Science 336(6080), 2012, 466-469.

Skoglund et al. 2014
P. Skoglund/H. Malmstrom/A. Omrak/M. Raghavan/C. Valdiosera/T. Gunther/P. Hall/K. Tambets/J. Parik/K.-G. Sjögren/J. Apel/E. Willerslev/J. Stora, A. Gotherstrom/M. Jakobsson, Genomic Diversity and Admixture Differs for Stone-Age Scandinavian Foragers and Farmers. Science 344 (6185), 2014, 747-750. doi: 10.1126/science.1253448.

Schack Pedersen/Strand Petersen 1997
S.A. Schack Pedersen/K. Strand Petersen, Djurslands Geologi (København 1997).

Sterum 1978
N. Sterum, Nogle C-14-frie synspunkter på den Beckerske kontakthypotese. Hikuin 4, 1978, 61-76.

Strand Petersen 1993
K. Strand Petersen, Environmental changes recorded in the Holocene molluscan faunas from Djursland, Denmark. Scripta Geologica, Special Issue 2 (Leiden 1993), 359-369.

Tauber 1971
H. Tauber, Danske Kulstof-14 Dateringer Af Arkæologiske Prøver III. Aarbøger for Nordisk Oldkyndighed og Historie 1970, 120-142.

Tauber 1986
H. Tauber, C14 dateringer af enkeltgravskultur og grubekeramisk kultur i Danmark. In: Ch. Adamsen/K. Ebbesen (eds.), Stridsøksetid i Sydskandinavien. Arkæologiske Skrifter 1 (København 1986), 196-204.

Turck et al. 2012
R. Turck/B. Kober/J. Kontny/F. Haack/A. Zeeb-Lanz, "Widely travelled people" at Herxheim? Sr isotopes as indicators of mobility. In: E. Kaiser/J. Burger/W.Schier (Hrsg.), Population Dynamics in Prehistory and Early History. New Approaches Using Stable Isotopes and Genetics. TOPOI. Berlin Studies of the ancient World 5 (Berlin 2012), 149-163.

Vang Petersen 2004
P. Vang Petersen, Jagten på Anholts ukendte ørkenfolk. Aktuel Arkæologi 2, 2004 (6), 22-26.

Wincentz Rasmussen 1984
L. Wincentz Rasmussen, Kainsbakke A 47. A Settlement Structure from the Pitted ware Culture. Journal of Danish Archaeology 3, 1984, 83-98.

Wincentz Rasmussen 1986a
L. Wincentz Rasmussen, Forholdet mellem grubekeramisk kultur og enkeltgravskulturen i Danmark. In: Ch. Adamsen/K. Ebbesen (eds.), Stridsøksetid i Sydskandinavien. Arkæologiske Skrifter 1 (København 1986), 165-168.

Wincentz Rasmussen 1986b
L. Wincentz Rasmussen, Nye C14 dateringer for grubekeramisk kultur i Danmark. In: Ch. Adamsen/K. Ebbesen (eds.), Stridsøksetid i Sydskandinavien. Arkæologiske Skrifter 1 (København 1986), 211-212.

Wincentz Rasmussen 1991
L. Wincentz Rasmussen, Kainsbakke, en kystboplads fra yngre stenalder. In: L. Wincentz Rasmussen/J. Richter (eds.), Kainsbakke (Grenå 1991), 1-69.

Wincentz Rasmussen 1993
L. Wincentz Rasmussen, Grubekeramiske bopladser. In: S. Hvass/B. Storgaard (eds.), Da Klinger I Muld…25 års arkæologi i Danmark (København/Århus 1993), 114-115.

Wincentz Rasmussen 1994
L. Wincentz Rasmussen, Ballegård. Arkæologiske Udgravninger i Danmark 1993 (København 1994), nr. 341.

Wincentz Rasmussen 2000
L.W. Rasmussen, Kirial Bro – mellem fangere og bønder, in: S. Hvass (ed.), Vor skjulte kulturarv. Arkæologien under jordoverfladen. Til Hendes Majestæt Dronning Margrethe II. 16. april 2000 (Esbjerg 2000), 52-53.

Wincentz Rasmussen/Boas 1982
L. Wincentz Rasmussen/N.A. Boas, Kainsbakke og Kirial Bro. To bopladser fra den grubekeramiske kultur ved Grenå. Antikvariske Studier 5, 1982, 104-114.

Wincentz/Boas 1995
L. Wincentz/N.A. Boas, Jernaldersamfundet ved Askhøj i Albøge. Grenaa og Omegn Før og Nu 1995, 87-92.

Zeeb-Lanz 2010
A. Zeeb-Lanz, Die bandkeramische Grubenanlage von Herxheim (Südpfalz) – ein überörtlicher Ritualort und sein Umfeld. In: I. Matuschik/Ch. Strahm (Hrsg.), Vernetzungen. Festschrift für Helmut Schlichterle (Freiburg 2010), 63-73.

Zeeb-Lanz 2012
A. Zeeb-Lanz, Das "Isotopen-Netzwerk" stellt sich vor: Bericht vom Workshop am 6. Februar 2010 in Speyer. Archäologisches Nachrichtenblatt 17-2, 2012, 165-174.

Zeeb-Lanz 2016
A. Zeeb-Lanz (ed.), Ritualised Destruction in the Early Neolithic – The Exceptional Site of Herxheim (Palatinate, Germany), Vol. 1. Forschungen zur Pfälzischen Archäologie 8.1 (Speyer 2016).

Aaby 1985
B. Aaby, Norddjurslands landskabsudvikling gennem 7000 år. Belyst ved pollenanalyse og bestemmelse af støvindhold i højmosetørv. Fortidsminder 1985, Antikvariske Studier 7, 60-84.

Kainsbakke and Kirial Bro

The two main sites of the Pitted Ware culture on Djursland

Lisbeth Wincentz

1 Introduction

In the 1980s, archaeological investigations were undertaken at two previously known prehistoric sites, Kainsbakke and Kirial Bro, near the village of Kirial in northeast Djursland, eastern Jutland (Fig. 1). These sites proved to encompass cultural deposits and features in the form of shell layers, settlement pits and at least one ritual feature. The excavations yielded large finds assemblages of flint, pottery and faunal remains (mostly bones) from the Pitted Ware culture (PWC). Together with the results of preliminary scientific investigations, these have already been partially presented in a number of publications (Wincentz Rasmussen/Boas 1982; Wincentz Rasmussen 1984; 1986a; 1986b; 1991; Richter 1986; 1987; 1989; 1991). The finds bear witness to more permanent PWC settlement in the area than that perceived previously, which was seen as representing the short-duration activities of itinerant bands of Scandinavian hunters who were possibly looking for flint (Becker 1951, 243, 255). Further excavations were subsequently undertaken at both Kainsbakke and Kirial Bro, the findings of which have not previously been published. These excavations also gave rise to several scientific analyses, now supplemented by more recent ones (various contributions to this vol.), the archaeological contexts for which are described and documented here.

2 Kainsbakke

2.1 Landscape and topography

Kainsbakke and Kirial Bro (see below) are located only 1 km apart in northeastern Djursland (Fig. 1). The area is characterised by deeply-cut valley systems, which follow underlying tectonic faults in the bedrock and have in some places been eroded down to the underlying chalk (Schack Pedersen/Strand Petersen 1997, 15-20). Late Glacial meltwater and subsequent marine erosion, together with actions of watercourses and wetlands, have further contributed to the formation of these valley systems. The Kainsbakke locality (site no. 140105-118 in the Danish national Sites and Monuments database; East Jutland Museum archive numbers DJM 2000 (surface finds from fieldwalking) and DJM 1900 (archaeological

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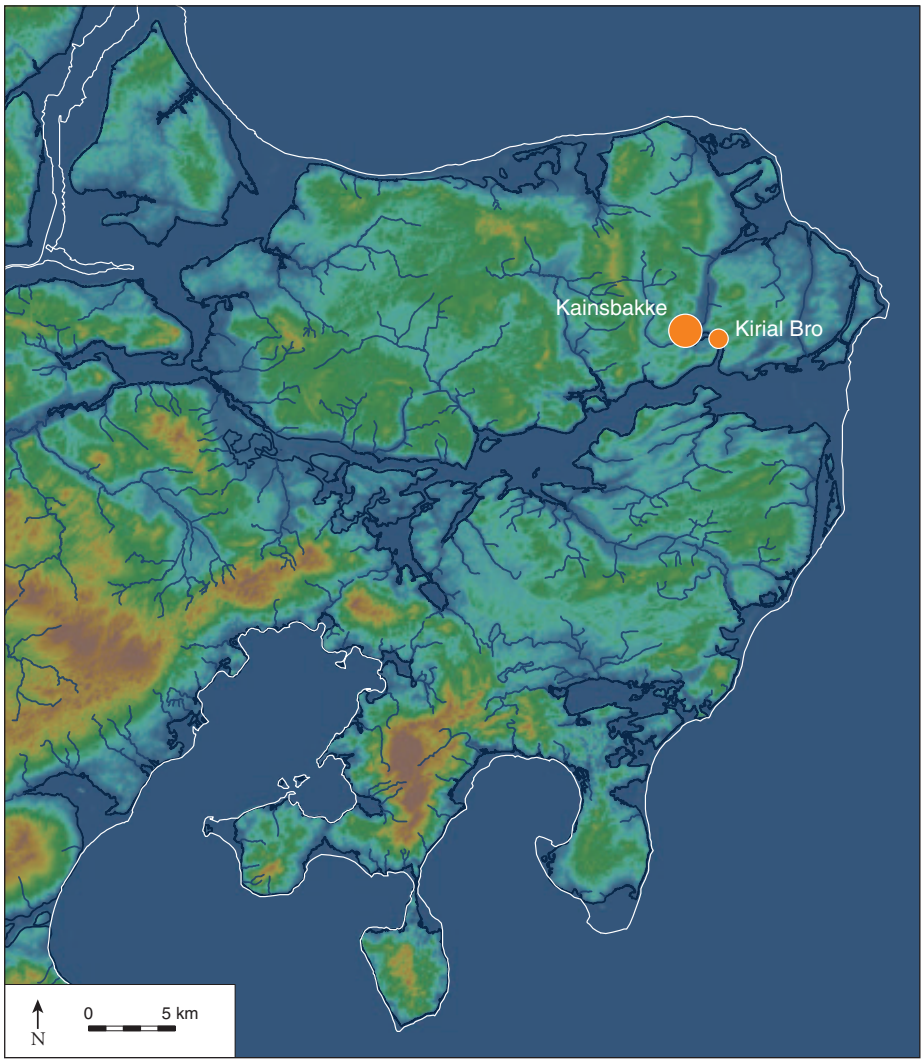

Fig. 1 | *The modern coastline (white) and the coastline in the early part of the Subboreal (black). Due to isostatic and eustatic movements since the end of the ice age, the fossil coastline now lies between c. 2.8 m (southwestern part) and 5.5 m (northeastern part) above sea level. Kainsbakke and Kirial Bro, which were coastal settlements in the Middle Neolithic, now lie between 8 and 10 km inland. Map background after Klassen (2014).*

excavations – referred to as Kainsbakke II)) is situated on a low, delimited plateau, referred to on old maps as "Holmen", with an area of about 35-40 ha (Fig. 2). The plateau, the highest point of which lies around 11 m a.m.s.l., is surrounded by a 200-400 m wide wetland area. To the southwest, west and north, this wetland area is bounded by hills rising to 30 m a.m.s.l. To the northeast, the ridge Kainsbakke (or Kains Banke) extends out as a promontory, separated from the plateau by a watercourse (known today as Holme Rende). Road cuttings and aggregate extraction precisely here have unfortunately disturbed the original topography. From the range of hills along Skærvad Å, both to the east and west of Kainsbakke, there are records of at least ten dolmens or passage graves (Vedsted 1986, finds list B), and a demolished long dolmen was demonstrated during the excavation on the eastern part of the "holm" itself (see Ch. 2.3.1.4).

At the time of its occupation, the Kainsbakke settlement lay at the head of a narrow fjord, which cut inland from Kolindsund to the south, following a deep valley formed by ice age meltwater and bordered by high slopes (Fig. 3; cf. the general description of the landscape in Djursland in Ch. 1 of this book). The head of the fjord lay directly to the south of the site, where marine sediments have been demonstrated at 5 m a.m.s.l. (unpublished investigations by Claus Malmros during the excavation of Kainsbakke). The northern and western sides of the holm, or islet, were bordered by wetlands, now the bogs of Svinekær and Havdal which, in turn, are bounded by rela-

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Fig. 2 | *First edition 1:20,000 map (1842-99) for northeast Djursland. Wetland areas are marked in bluish-green. The recently drained Kolindsund and the boggy valley extending north of Kainsbakke are clearly shown.*

tively steep slopes. A valley system extends out to the north, hosting Skindbjerg, Villersø, Dalstrup, Emmelev and Veggerslev bogs, as well as watercourses which empty into Gjerrild Bay. In Middle Neolithic times this valley system was already a boggy wetland area, and it is known for its many votive finds from the Early Funnel Beaker culture (TRB) in the form of numerous thin-butted axes and pottery vessels (i.e. bog pots) (Becker 1947, 53-60; Vedsted 1986, finds list C, 110f.; Klassen et al. this vol.). Consequently, there is unlikely to have been direct access by water from Kainsbakke to the Kattegat to the northeast, or to the flint occurrences in the Gjerrild and Karlby cliffs. To reach the Kattegat by water it was necessary to sail south to Kolindsund and from here towards the east and north. There may have been a track or path along the margins of the bog. This path would have linked Kainsbakke with the flint occurrences in the coastal cliffs.

2.2 *Investigation history and settlement size*

Amateur archaeologists have been aware of the Kainsbakke locality for at least a century, as a favourite site for collecting flint, especially from the PWC. Initially, collection was rather random, but in the 1970s, in collaboration with the then Djursland Museum, amateur archaeologists' fieldwalking became more systematic. In addition to the collection areas on the actual holm (Kainsbakke I-III), fieldwalking was also undertaken in the immediate vicinity. This led to the discovery of the locality Kainsbakke IV, located 100-150 m NNE of the scheduled burial mound Fuglhøj on the actual Kainsbakke hill crest. Elongate features containing dark-coloured cultural deposits with a little PWC flint were observed here which possibly represent segmented ditches from a causewayed enclosure (see Rasmussen et al. this vol. for a more comprehensive account of the PWC settlement around the Kainsbakke locality).

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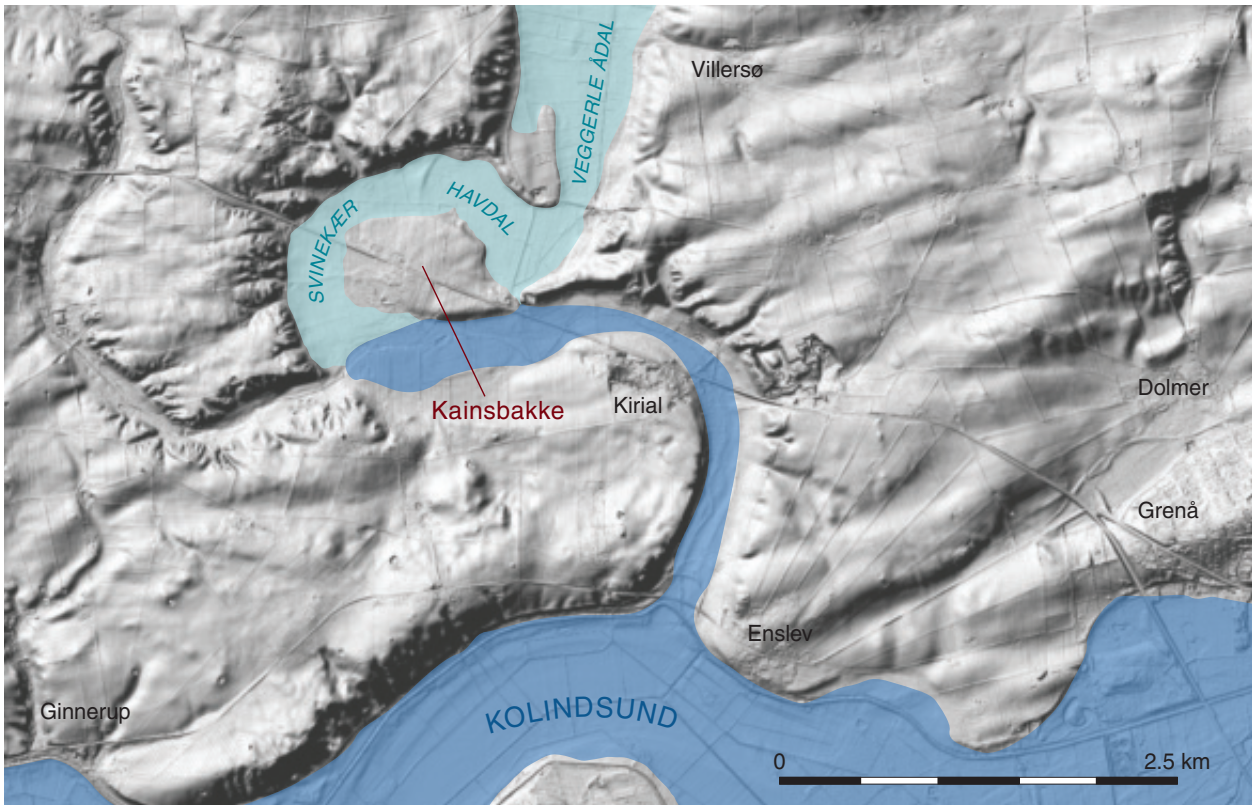

Fig. 3 | *Lidar map of Kainsbakke ("Holmen") and surroundings. The extent of the Littorina Sea and wetlands is marked in blue and green, respectively. The Kainsbakke holm was surrounded by the fjord and wetlands and consequently had an island-like character.*

Two large private collections, amassed by N.O. Boas and E. Øbom, are now held at East Jutland Museum (DJM 2000). These collections contain no less than c. 6000 scrapers, 300 tanged arrowheads and 300 cylindrical blade cores. Based on the presently available information, an area of around 7 ha with a very high density of finds can be identified, extending out to both sides of the modern highway on the eastern side of the holm. The finds density decreases towards the west, while the situation in the area further to the north and northwest on the holm is currently not fully known, because modern usage of the area does not permit fieldwalking. However, there are reports from here of finds of PWC character. It can therefore be established, that the core area of the PWC settlement extended over at least 7 ha but that its total areal extent was significantly greater than this (Fig. 4). The total activity area in the Neolithic extended over about 15 ha. Kainsbakke is therefore one of Denmark's largest Neolithic localities, and settlements of comparable size are often located on the sites of earlier causewayed enclosures.

2.3 Archaeological investigations

The first archaeological investigation, a small trial trench on the southeastern part of the holm, was launched in 1979, when dark patches, both with and without shells, were ploughed up. In the next couple of years an area of c. 526 m² was uncovered, extending out from this first trench and across the visible features. The latter included a 5 x 6 m pit, A47, the southern half of which was excavated in 1982 with financial support from the Danish Research Council for the Humanities. In 1998-99, 480 m² of cultural deposits were investigated on the far eastern part of the holm. These deposits proved to have accumulated around the stone pavement in

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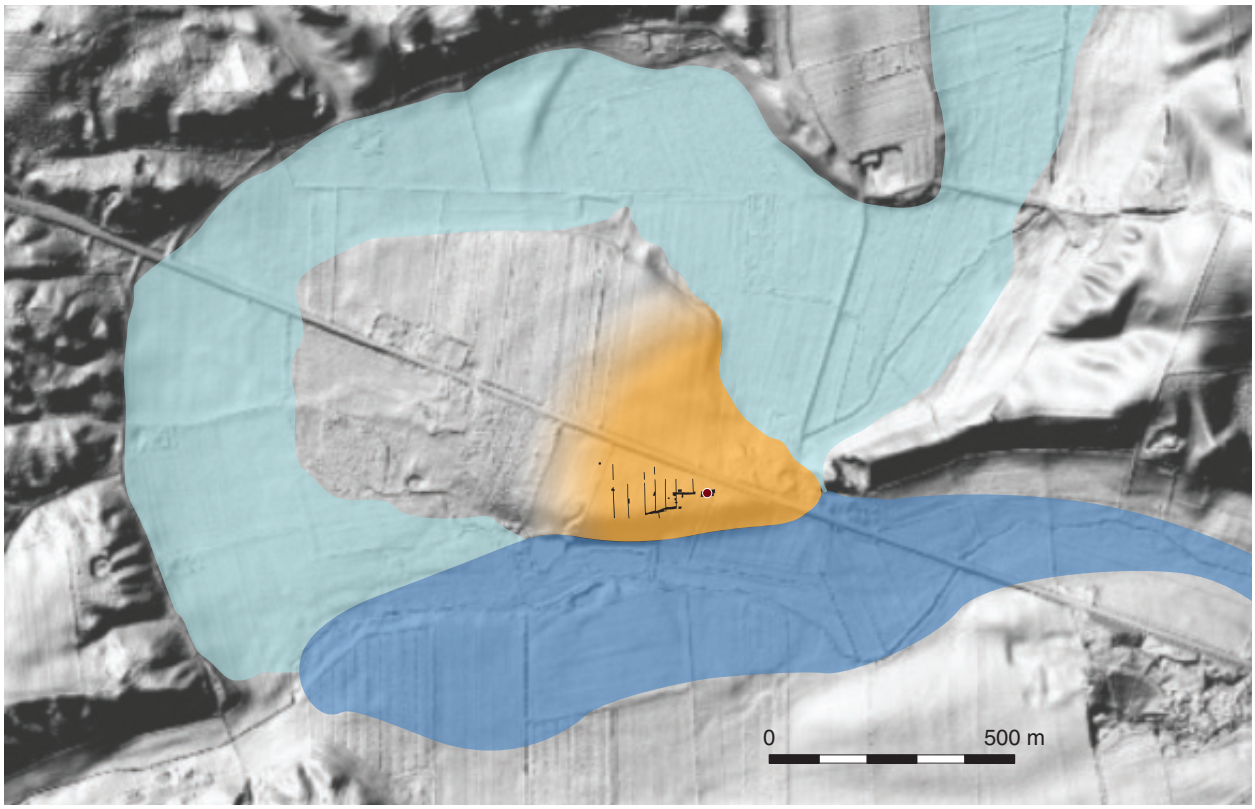

Fig. 4 | *Lidar map of the Kainsbakke holm showing the c. 15 ha area with PWC surface finds and the location of the excavation trenches. The highest density of surface finds occurred in the easternmost c. 7 ha of the area. The location of the demolished long dolmen is also marked.*

the kerbstone area of a demolished long barrow (see Ch. 2.3.1.4), which must therefore have stood on the actual settlement (Fig. 4).

In 2001, in a collaboration between the then Djursland Museum and the National Museum of Denmark, a systematic trial excavation was undertaken to the west of the area in the southeast where the sporadic investigations had been carried out previously (Fig. 5). The aim was, in particular, to investigate whether pit A47 could be part of a Neolithic causewayed enclosure. A total area of 1675 m² was uncovered, revealing what proved to be four large pits in a row, extending out from A47, and no more than 60 m to the southwest: Like pit A47, these lay around 8-9 m a.m.s.l. Further to this pit row, several smaller pits and features were recorded on the surface of the trial trenches (Østergård Sørensen/Boas 2002). In 2002-3, the northern part of pit A47 was excavated with support from the Danish Research Council for the Humanities and Djursland Museum. Finally, in connection with the laying of a sewage pipe in 2009, 20 test pits were investigated along its route, which ran along the foot of the holm to the south of the site. A thick sequence of cultural deposits was encountered here which contained abundant flint material.

The subsoil in the study area consists mostly of gravel and partly of clay, with major portions mixed with hand-sized and larger stones, including many of chalk and flint. To the far west, the subsoil is pure yellowish sand.

In total, c. 2700 m² of the Kainsbakke settlement was excavated, which corresponds to less than 4% of the settlement's core area, as indicated by the massive amount of material picked up from the field surface. Within the excavated area, 18 pits of varying size, and sporadic remains of cultural deposits containing finds from the PWC, were investigated. Further to these, there were undated minor features, numerous postholes and

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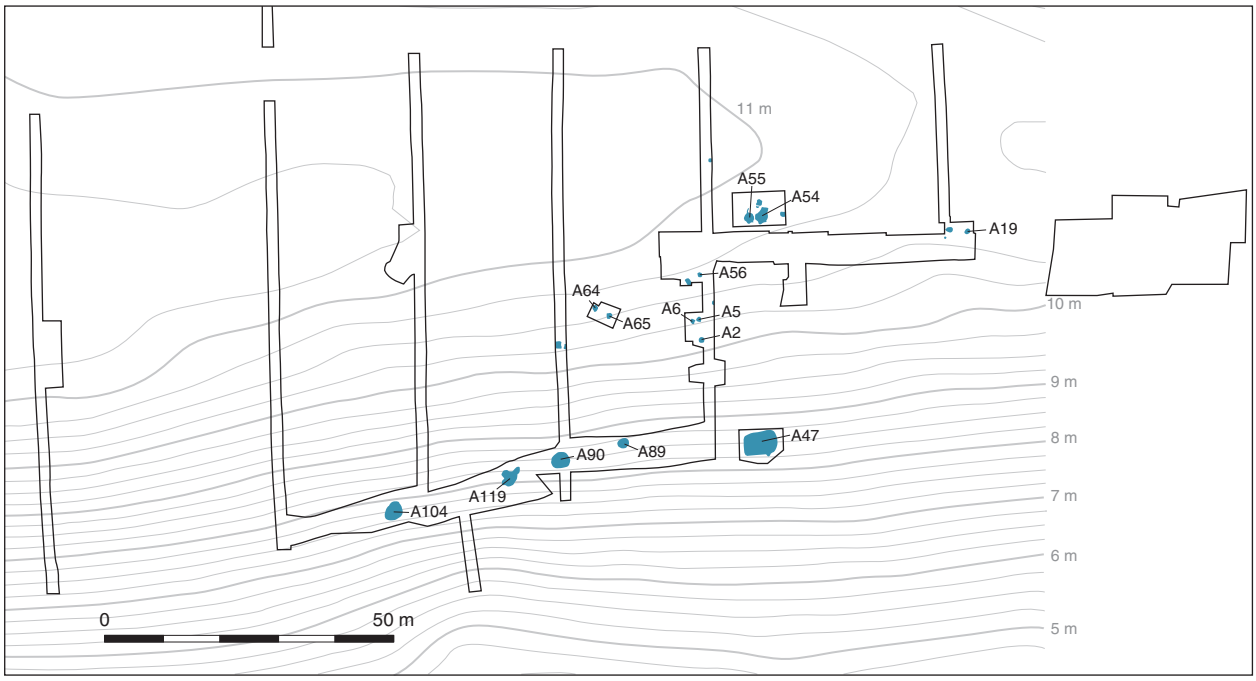

Fig. 5 | *The location of the excavation trenches on the southeastern part of the Kainsbakke holm. Secure PWC features are highlighted in blue.*

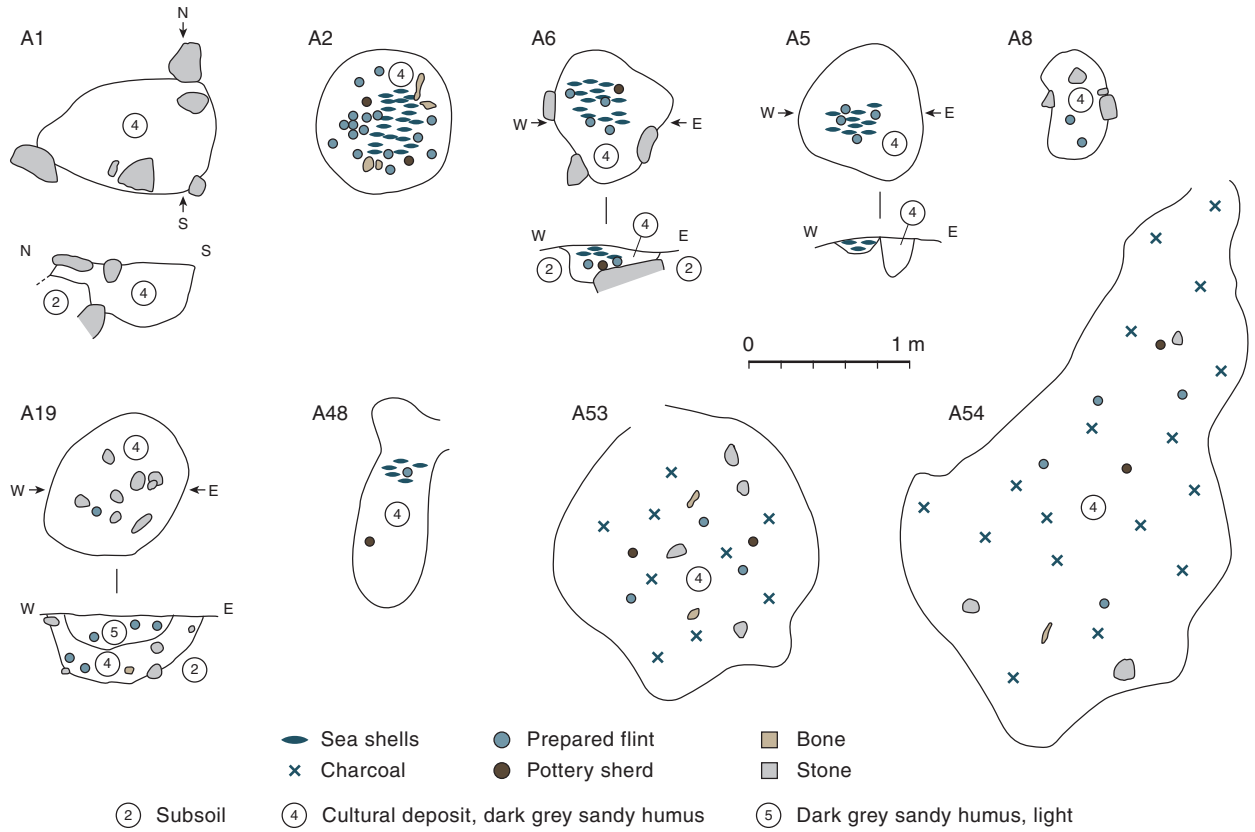

Fig. 6 | *Outline and section drawings for small and less complex pits at Kainsbakke, and an outline drawing of pit A2.*

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parts of fence ditches from the Early Iron Age. These were concentrated in the eastern part of the plateau where, in the Pre-Roman Iron Age, several solitary farms apparently lay close together out towards the southern edge of the hill (Østergård Sørensen/Boas 2002). Finds from the TRB on the holm are, on the other hand, conspicuous by their absence. Apart from two sherds found during the excavation of the demolished long dolmen (Ch. 2.3.1.4) and probably also a fragment of a greenstone/diabase axe found in pit A47 (Ch. 2.4.3.1), not a single find from the TRB was recovered during the excavations. The entire extensive body of material collected from the field surface includes only three possible, but uncertain, flakes from thin-butted axes as potential testimony to TRB activity on the holm.

2.3.1 Features from the Neolithic

Only the eastern part of the holm to the south of highway 16 has been subjected to investigation as it is here that the greatest number of visible features and artefacts have been recorded on the field surface. Remains from the Neolithic are found c. 7-11 m a.m.s.l. The highest part of the holm, south of the highway, forms a flat plateau, before the terrain again falls relatively sharply down towards the surrounding wetland area to both the south and east, which was a branch of the fjord during the Neolithic. There are traces of Iron Age occupation everywhere across this plateau, and this has disturbed the Neolithic remains. A few Iron Age potsherds were found at the surface of one or two of the Neolithic features, whereas there was Neolithic material in almost all the Iron Age features. These finds are considered to derive from the general cultural deposits at the site, as it was only rarely possible to distinguish definitively between cultural deposits from the Neolithic and the Iron Age. Areas of preserved cultural deposits on the plateau had a maximum thickness of 0.3 m. One of these to the northwest extended over about 100 x 40 m and contained finds from both the Iron Age and the Neolithic (PWC). Moreover, two features appeared below the Iron Age deposits that could be from the Neolithic. These were only recorded at the surface in plan and were not investigated further. They probably represent two small pits. No hearths or features other than pits were recorded as being of Neolithic date. Cultural deposits rich in flint, pottery and bones that had accumulated at the margin of the southern foot of the hill were though considerably more massive, with a thickness of up to 1.3 m. Several investigations revealed that these deposits were not obviously stratified and overlay beach sand. They must therefore be seen as secondary, i.e. formed by the deposition of material eroded down from parts of the site located higher up.

In addition to the thin, partially disturbed cultural deposits from the Neolithic, 13 circular, rounded or oval pits of varying size were investigated; these had an average diameter of 1.2 m and a depth of rather more than 0.3 m. Pit A47, and three of the four pits in a row to the west of it, were though generally larger. In addition, a number of small pits and minor features were recorded in plan but not excavated during a trial excavation in 2001. These remnants of cultural deposits were found to contain artefacts of the same character as those in the pits though, in the case of the pottery and the bones, in smaller quantities (Tab. 1, page 60-61). Finds of typical flint artefacts or pottery from the early Middle Neolithic were completely absent from the cultural deposits, and this was also the case for the surface finds and – with the aforementioned exceptions – the material from the excavated features.

2.3.1.1 Small pits

A total of 13 small pits, which lay randomly scattered across the excavated area at Kainsbakke, were investigated. Nine of these were of relatively simple character, while four displayed a complex stratigraphy. The outlines and cross-sections of the less complex pits are shown in Figure 6, while Figure 7 shows the complex sections through three of the four remaining pits. There is only an outline drawing of complex pit A2, as it was taken up intact in a block of soil and excavated at the museum without a section being recorded separately.

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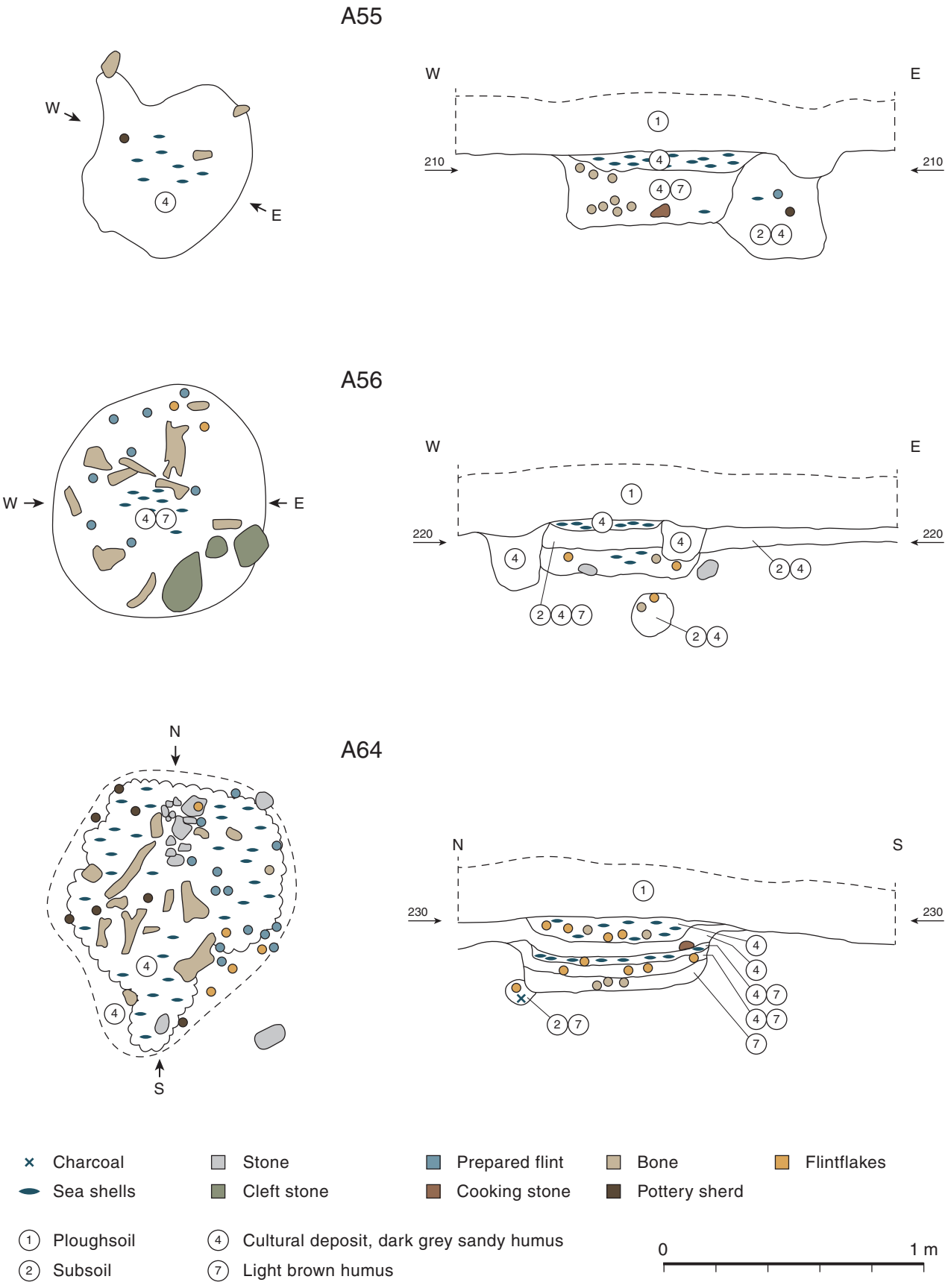

Fig. 7 | *Outline and section drawings for the more complex small pits A55, A56 and A64.*

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The 13 pits can be described as follows:

A1: Oval, bathtub-shaped pit. Surface dimensions: 1.1 m E-W and 0.4 m N-S; depth 0.4 m. The pit contained a fill of blackish-grey, sandy soil mixed with numerous flint flakes and potsherds. The pit was located immediately next to a stone of more than 0.5 m in diameter.

A2: Circular pit with evenly rounded base and straight sides. Diameter 0.9 m, depth 0.3 m. The pit was taken up intact in a block of soil in 1980 and excavated indoors. In its upper, central part lay a 0.05 m thick layer of mollusc shells. Other mollusc shells were scattered throughout the remainder of the pit fill, which was greyish-black in colour and rich in humus. Bones, pottery, flint, charcoal fragments and charred hazelnut shells were also found scattered, together with a few concentrations, everywhere in the pit fill. The finds included more than 100 scrapers and 92 blades (Tab. 1). From 0.05-0.1 m above the base of the pit, across its entire extent, there was a greyish-black, humus-rich layer containing a particularly large number of fishbones, including several examples of articulated sections of vertebrae.

A3: Circular pit with a slightly conical cross-section, a diameter of 0.4 m and a depth of 0.3 m. It had a uniform, greyish-black fill which contained large parts of two pottery vessels, a little flint and a fragment of a polissoir.

A5: Circular pit with a diameter of 0.8 m, a depth of 0.1 m and a greyish-black, humus-rich fill. In the middle of the pit there was a darker area of 0.4 x 0.3 m containing shells of oysters, cockles and mussels, as well as snail shells. It also contained a little flint debitage, a scraper and a few bones.

A6: Rounded pit measuring 0.7 x 0.8 m and with a depth of 0.3 m. The pit had a fill of greyish-black sandy soil with a darker part in the middle containing shells of oysters, cockles and mussels. Mixed between the shells were flint, pottery and bones. The pit had a flat, rounded base, and its southeastern part lay over a large stone in the subsoil. The shell-rich part was concentrated in the upper 0.1 m. Around the edge of the pit lay a few hand-sized stones. The frequency of large fragments of mammal and bird bones increased in its lower part, and a collection of 16 scrapers was encountered.

A8: Oval pit with a rounded base, measuring 0.7 x 0.4 m, with a depth of 0.4 m. The pit fill comprised sandy soil containing a little flint, including a scraper.

A19: Circular pit with straight-cut sides and a flat base. Diameter 0.9 m, depth 0.5 m. Dark-brown fill, darker in the central 0.25 m through the pit's total depth. Contained a good quantity of flint, including 44 blades. Seven stone (non-flint) crushing-/hammerstones and numerous potsherds can also be highlighted.

A48: An irregular, elongate feature measuring 1.3 x 0.55 m and 0.2 m in depth. It possibly represents a feature associated with the Iron Age settlement at the site, established over a Neolithic pit, which was evident as an accumulation of mollusc shells and a concentration of Neolithic finds in redeposited soil.

A53: Rounded pit measuring 1.8 x 1.7 m and with a depth of 0.2 m. The pit's fill comprised uniform, slightly soot-blackened soil containing flint and pottery.

A54: Irregular pit measuring 3.8 m NE-SW and 2 m E-W, and with a depth pf 0.3 m. Fill of homogeneous, slightly soot-blackened soil containing flint, pottery and bones.

A55: Circular pit with a diameter of 1 m and a depth of 0.35 m. It had straight-cut sides and a flat base. At the surface of the pit fill was a shell-rich area, 0.6 m in diameter. The upper 0.09 m of the pit fill consisted of dark-grey, shell-rich sandy soil containing a number of

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artefacts. Below this, and partly out towards the sides of the pit, was a brownish-grey sandy deposit containing fewer flint and pottery finds but a greater number of bones. At the eastern side of the pit there was a lighter, diffuse layer containing a few bone fragments.

A56: Circular pit with a diameter of 0.8 m and a depth of 0.25 m with straight-cut sides and a flat base. The pit had been disturbed at one side by a fence ditch from the Iron Age and at the other by a posthole from the same time. Uppermost in the pit was a 0.05 m thick layer of shells mixed with soil and artefacts. Below this was a 0.1 m thick layer that consisted of sandy soil, light-brown humic material and subsoil. The lowermost 0.1 m comprised subsoil material and light-brown humic material in which were scattered oyster shells, flint, pottery and bones.

A64: Rounded pit with straight-cut sides and a rounded to flat base, measuring 1 x 0.9 m and a depth of 0.35 m. Uppermost in the pit was a 0.12 m thick layer of shells and cultural deposit, and below this a 0.06 m thick cultural deposit without shells or artefacts. This was followed by a 0.05 m thick layer of shells mixed with lighter-coloured soil than in the uppermost layer, and then a 0.06 m thick layer of light-brown humus-rich cultural material. The lowermost 0.06 m comprised light-brown humic material. The pit contained numerous blades and scrapers but few other artefacts.

In summary, it can be concluded that rather more than half of the excavated smaller pits had a fill containing mollusc shells, while these were absent from the remainder. Bones were, however, preserved in both categories of pits due to the chalk-rich subsoil. The pits typically had straight-cut sides and a flat or slightly rounded base. Most contained flint tools and waste flakes, potsherds, bones and bone/antler tools in varying quantities and varying relative frequencies. Pit 64 was very clearly stratified into layers, with and without shells, and rich in flint, pottery and animal bones, especially fragments of jaws and feet (Fig. 8). Given the remarkable concentrations of selected skeletal parts in this pit, it is possible that it, and some of the other smaller pits, had a ritual function, perhaps during a secondary phase of use. In general, however, the pits appeared to be ordinary settlement pits with an unremarkable fill and artefact content.

2.3.1.2 Pit A47

Pit A47 occupies a central place in the account of the Kainsbakke locality due to its special character and the large finds assemblage it yielded (Tab. 1).

Fig. 8 | *Pit A64 under excavation showing exposed bones. Photo: Lisbeth Wincentz.*

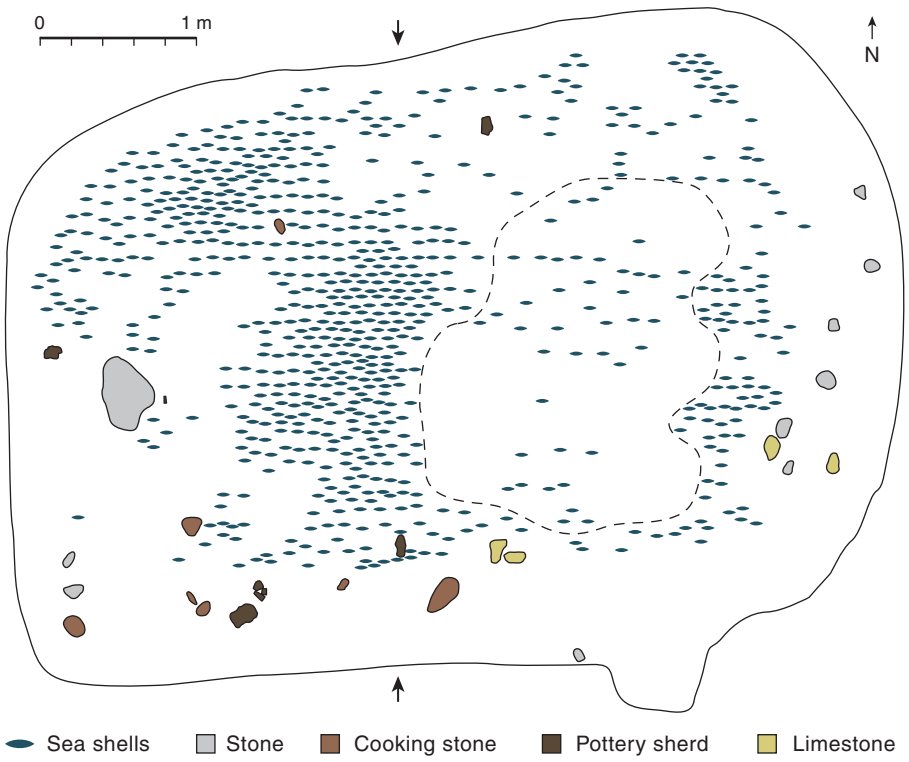

Fig. 9 | *Outline drawing for pit A47.*

The pit was located on sloping terrain to the south of the site, between 8 and 9 m a.m.s.l. It was, like many other features at the site, discovered due to finds of ploughed-up material on the surface, where it measured 5.7 m in diameter W-E, and 4.5 m N-S (Fig. 9). Even at the surface, the artefact distribution was dense and extensive, and organic material was preserved due to the presence of mollusc shells.

Finds from the pit were recorded in 0.25 m² squares of 10-30 cm in thickness, i.e. the excavation was undertaken in artificial layers, termed excavation phases. The top of each excavation phase was drawn and recorded, as considered necessary. Apart from scrapers, the tools and a few intact pots or larger pot fragments were recorded individually, being plotted both horizontally and vertically. The northern part of the pit was recorded by excavated layer, termed excavation phases I-IX, with levels taken for each phase. The southern part, on the other hand, was excavated by archaeological layer, with the nature and composition of the deposit and the depth being recorded for each find. Phases (northern part) and archaeological layers (southern part) can therefore easily be matched. The excavated soil was wet-sieved through a 1 mm mesh. Soil samples were taken from each excavation phase in the central part of the pit, and otherwise as considered necessary. A longitudinal section through pit A47 shows that its sides were slightly sloping (Figs. 10-11). The original pit sides are estimated to have had a slope of 120-140° relative to the fairly flat base, the length of which, i.e. 5 m, is only 0.7 m less than the length of the pit at the surface. In cross-section, the south side of the pit was seen to be steeper, with a slope of 100-110° (Fig. 12). The original pit was therefore rounded rectangular in plan with steep sides and a relatively flat base at a depth of at least 1.1 m below the surface. The pit's stratigraphy, comprised of a series of clearly distinguishable layers, is evident from the sections. Layer 6, which consisted of light-coloured sand with a slight admixture of topsoil/humic material, is interpreted as subsoil that collapsed from the sides and upper edge of the pit during its primary phase. Layer 5 may represent backfill following a recut that extended slightly below the original base of the pit. This layer consisted of sand mixed with topsoil/humic material, in which there were a very few finds of pottery, flint, bones, cooking

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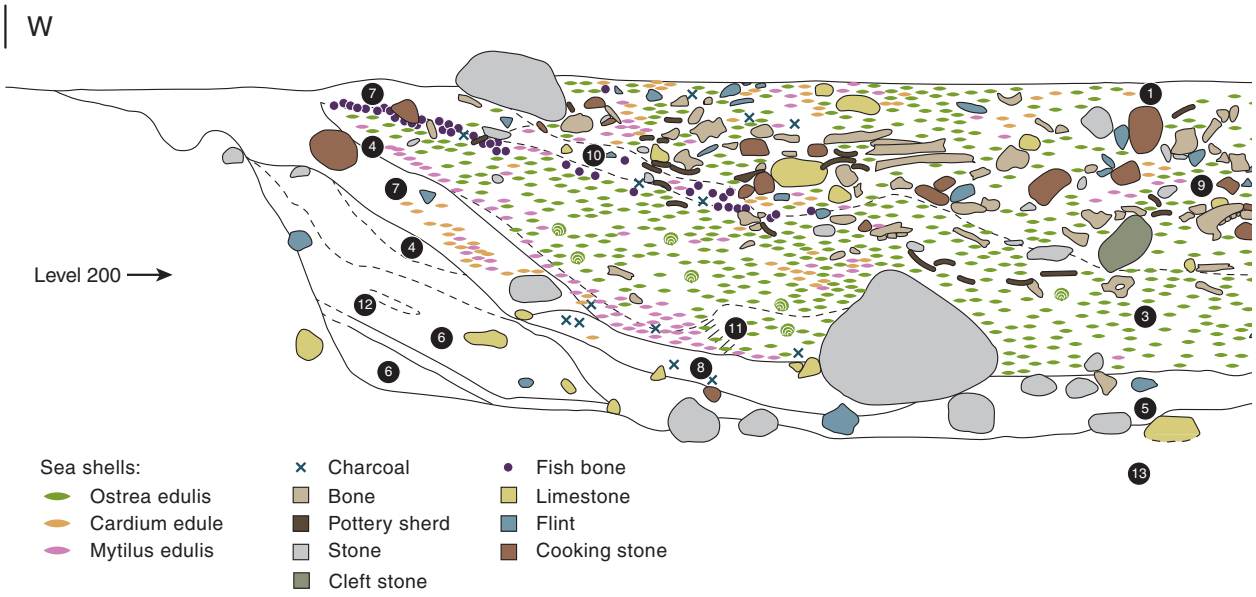

▲► **Fig. 10** | *Longitudinal section (W-E) through pit A47.*

Fig. 11 | *Longitudinal section through pit A47, seen from the south. Excavation in 1982. Photo: Lisbeth Wincentz.*

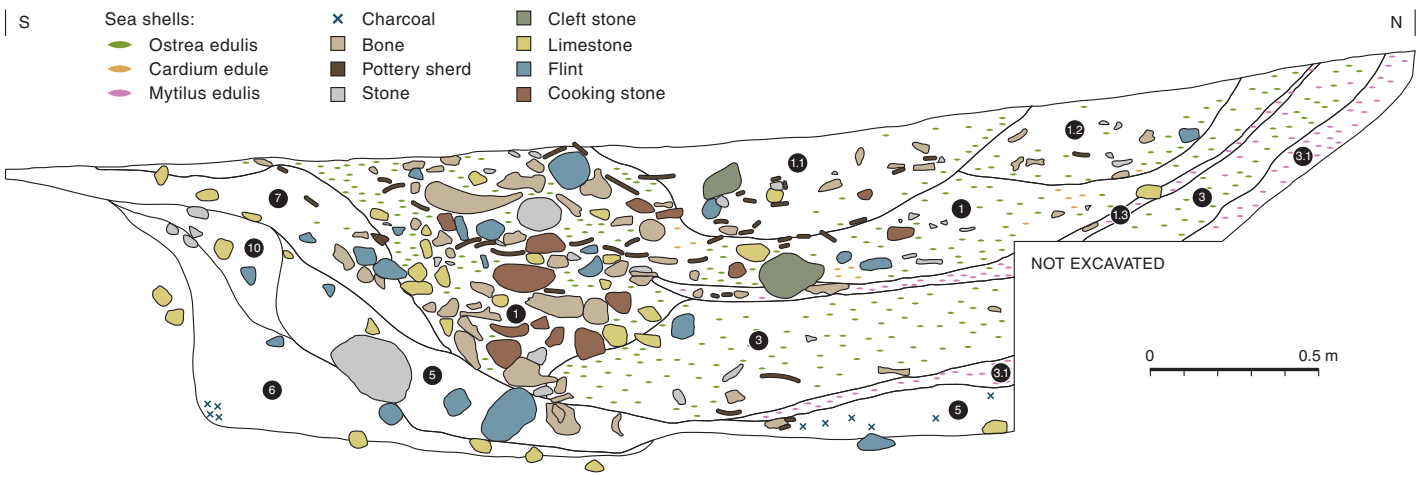

Fig. 12 | *Cross-section (S-N) through pit A47.*

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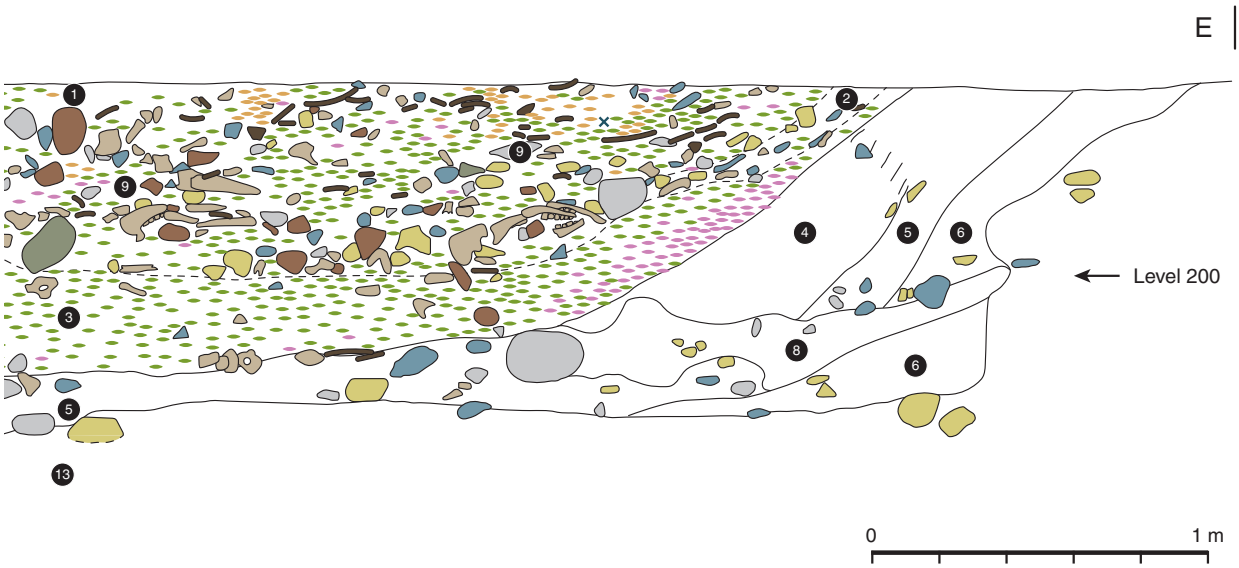

stones and shells. It was partially covered by the dark, soot-blackened layer 8, which extended symmetrically out to all sides. Both layer 5 and layer 8 contained several large stones, some up to 1 m in diameter, one of which was the lower stone for a saddle quern. In the eastern side of the pit, layer 8 was irregularly delimited, probably due to disturbance by animals. On excavation in plan, a 10-15 cm wide charcoal border, which also contained red-burnt clay, was observed lowermost in layers 5-8 at the western side of the pit (Fig. 13). It could not be securely determined whether burning had taken place in the pit, or this material had been added to it. The pit had apparently subsequently stood open long enough for a new, almost humus-free sand layer, layer 4, to slip down or be added around the sides. At the western side of the pit, over the humus-rich cultural deposit, layer 7, which contained a few mussel shells, there was a thin stripe of sand, resembling layer 4, which also

Fig. 13 | *Layers 5-8 in pit A47, showing traces of burning. Photo: Lisbeth Wincentz.*

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Fig. 14 | *In situ oyster shells in pit A47. Photo: Lisbeth Wincentz.*

contained a layer of mussel shells. A concentration of mussel shells was also found over layer 4 along the eastern side of the pit. A recut through layer 4 possibly took place before layers 3 and 1 were deposited in the pit. Layers 1 and 3 were characterised by a substantial content of oyster shells and shells of molluscs and snails; among the shells were major deposits of bones, flint and pottery. Layer 1 contained a substantial proportion of tools, pottery, bones etc., while layer 3 comprised a more compact shell deposit with fewer tools, pottery and bones. The ordered, horizontal deposition of mollusc shells gave this layer the character of a coating. Due to their substantial mixing with artefacts and bones, the shells in layer 1 had, at least in parts, a less horizontal orientation than those in layer 3. The transition between the two shell layers was very even without any intervening soil. There were no signs of disturbance or later digging activities that had led to crushing of the shells or modified their horizontal positions (Fig. 14). Oysters were the dominant species, but mussels and cockles were also numerous. Further to these were a number of marine/brackish-water gastropods (Richter 1987).

Layer 1 had a particular abundance of large bones, including at least five collections of specially selected skeletal elements which reflect structured depositions (Figs. 15-17). In most cases these took the form of three to seven intact or partial lower jaws (mandibles) laid in a row. The jaws are of elk, red deer, ox and pig (Fig. 15.1-3). Similar collections of in particular pig lower jaws are known from PWC graves on Gotland (Janzon 1974, 282). Horn cores, of domesticated cattle judging from their size, were found in a heap, which also suggests a structured deposition (Fig. 16.1). A complete set of horn cores of enormous dimensions (i.e. of aurochs) must be interpreted similarly (Fig. 16.2). In another case, the skull of a brown bear

Fig. 15 | *Pit A47: Three in situ heaps of lower jaws. Photos: Lisbeth Wincentz.*

1

2

3

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1

2

Fig. 16 | *Pit A47: 1. Heap of ox horn cores. 2. Set of aurochs horn cores in situ. Photos: Lisbeth Wincentz.*

Fig. 17 | *Pit A47: Deposition of a brown bear skull on an ox horn core in layer 1. Photo: Lisbeth Wincentz.*

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