

# 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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East Jutland Museum

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Aarhus University Press 

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# Preface

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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 Hielmstjerne-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, pa-

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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



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

An introduction

*Lutz Klassen, Rune Iversen & Lisbeth Wincentz*

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## 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-

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,

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.

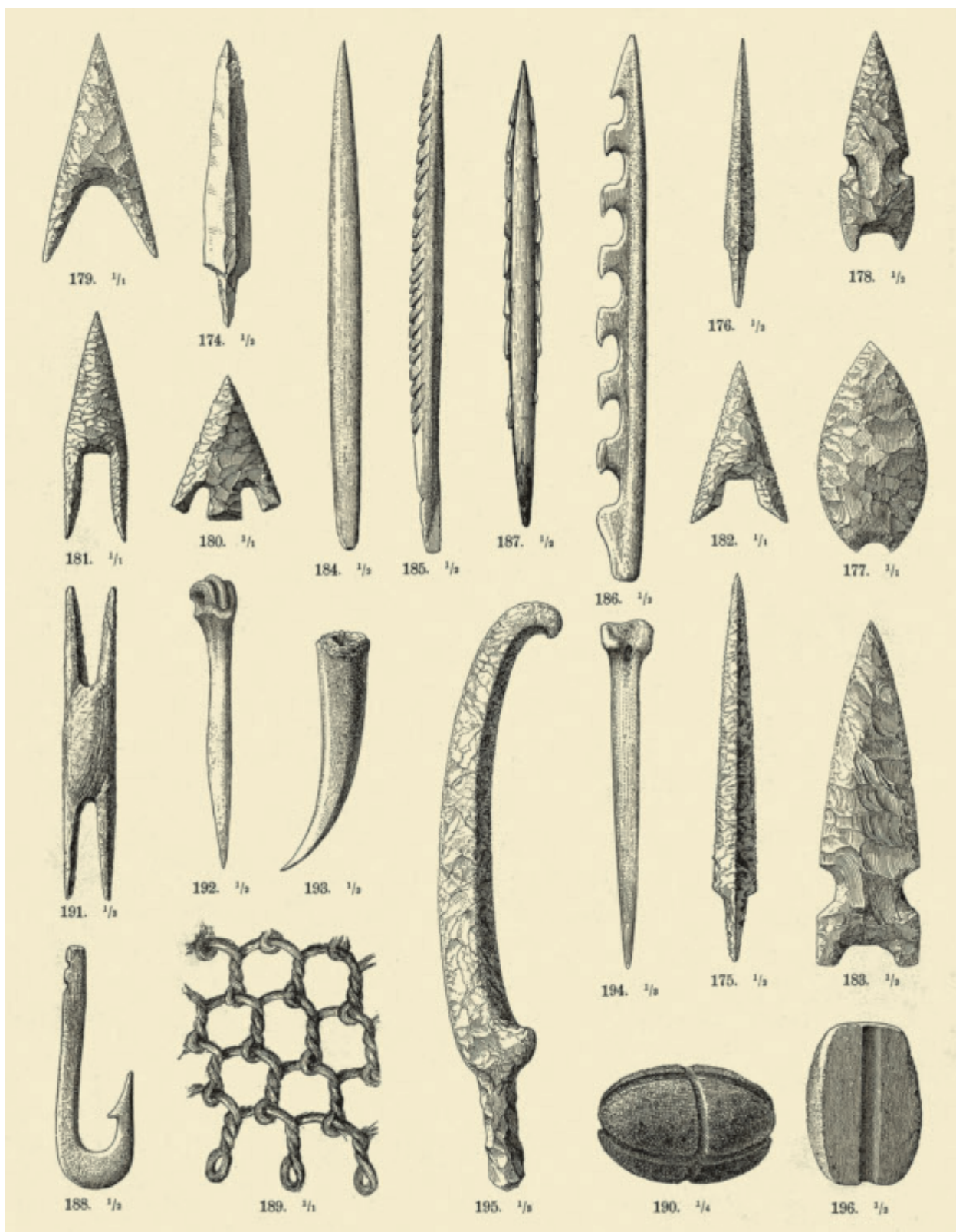
Together with S. Müller's early classification of Danish Stone Age artefacts (1888), Lidén's work formed the point of departure for Becker's detailed typology of the second characteristic lithic type artefact for the PWC: the tanged arrowheads (Fig. 1). Becker divided these arrowheads into types A-C, 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, 68off., 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).

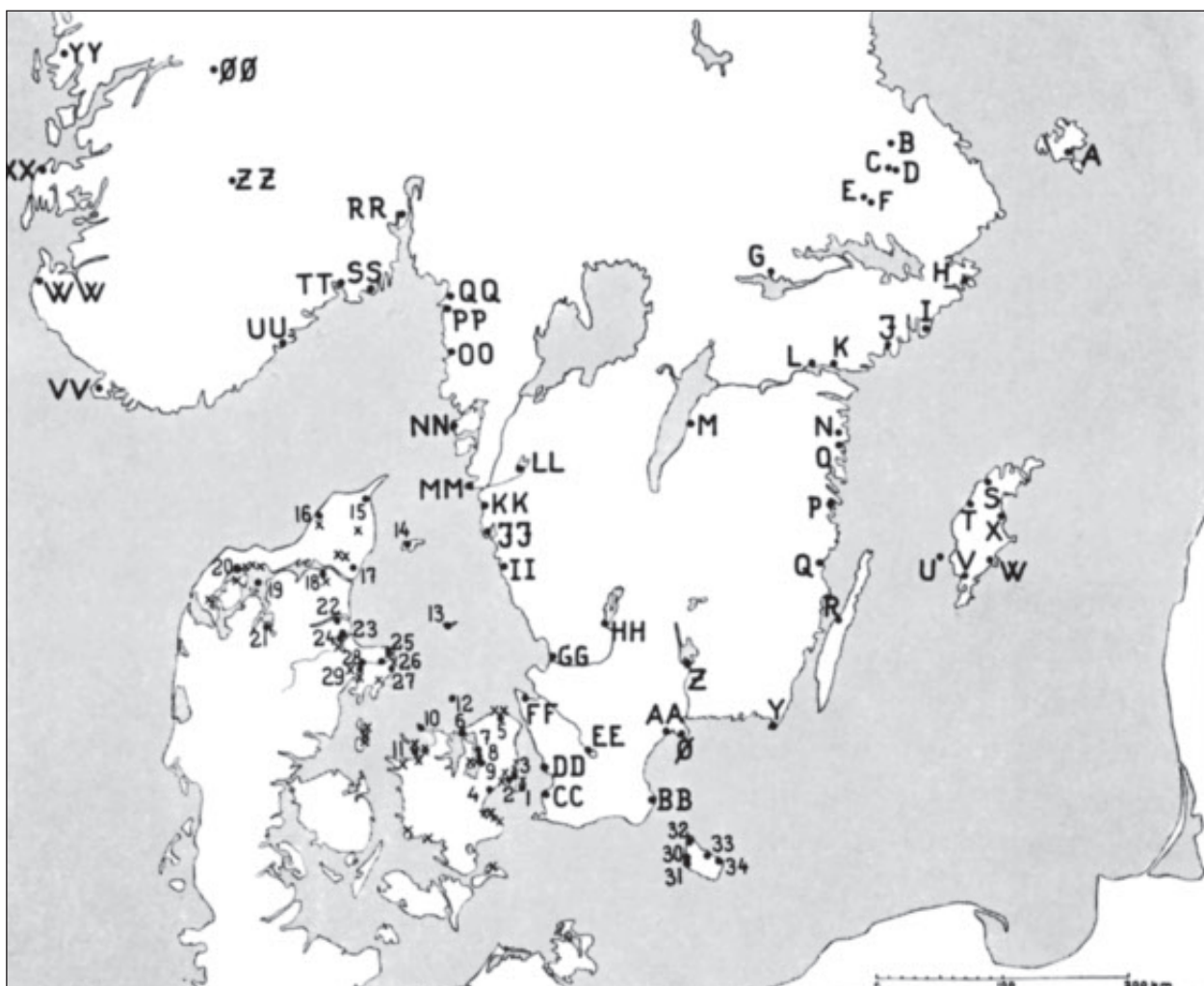


of such temporary visits and that no permanent PWC settlement took place in Denmark (Becker 1951, 241ff.). His argument was founded on the difference in character between Danish and especially eastern Swedish PWC assemblages. While the Danish finds almost exclusively consist of (a few) flint artefacts,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

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, 470ff.), even though the (limited) direct evidence now available (Marseen 1953, 113ff.; Richter 1989; 1991) reveals a more nuanced picture. Arable ag-

riculture 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 agropastoralist 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).

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 <sup>14</sup>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 <sup>14</sup>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 <sup>14</sup>C dates increased for both Late TRB and SGC finds.

At the same time, the very first <sup>14</sup>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 <sup>14</sup>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

		Trichterbecherkultur (TRB)		Spät-neol. Kultur	Einzelgrabkulturen (Schnurkeramische Kulturen)			Grübchenkeramische Kultur (GR)	Mesolithische Kulturen	
		Trichterbecherkultur (TRB)	nicht-megalithische		Jütland (JE)	Dän. Inseln (ØE)	Schonen (SBK)		Erteballe (ERT)	Gudenå (GU)
Früh-neolithische Zeit (FN)	A		A					III		
	B		B						?	
	C	Virum	C					III		
Mittel-neolithische Zeit (MN)	I <sup>a</sup> <sub>b</sub>	Troldebjerg Klintebakke	D							
	II <sup>a</sup> <sub>b</sub>	Blandebjerg Trelleborg					A			
	III	Bundsø			ä. Unterggr.	Kontinentale Gruppe	B			
	IV	Lindø			jü. Unterggr. ä. Bodengr.	äit. Schwed.	C			
	V	Store Valby			jü. Bodengr. Obergr.	Insel-dänische Kultur jüng. Schwed.				
Spät-neolithische Zeit (SN)	a			ältere						
	b			jüngere						

**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. <sup>14</sup>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.

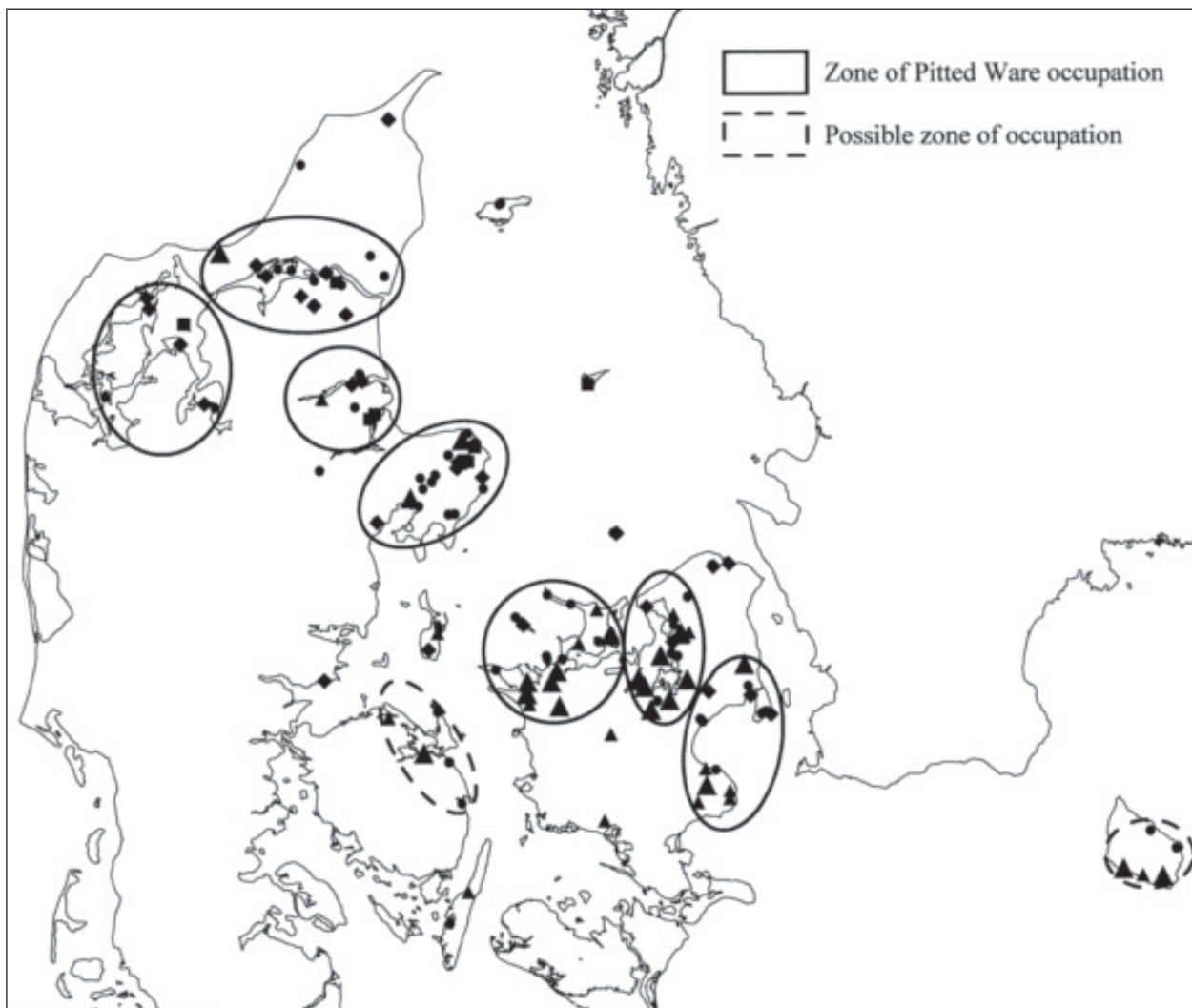
time, the remains of Eurasian elk (*Alces alces*) and brown bear (*Ursus arctos*) found at the Kainsbakke site are important with regard to the faunal history of Denmark, as they represent the latest finds of both species and, in case of the brown bear, also the largest settlement assemblage yet recorded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

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 adaptation 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

was kindly provided by L. Sparrevojn, 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).

### 3 The Djursland peninsula

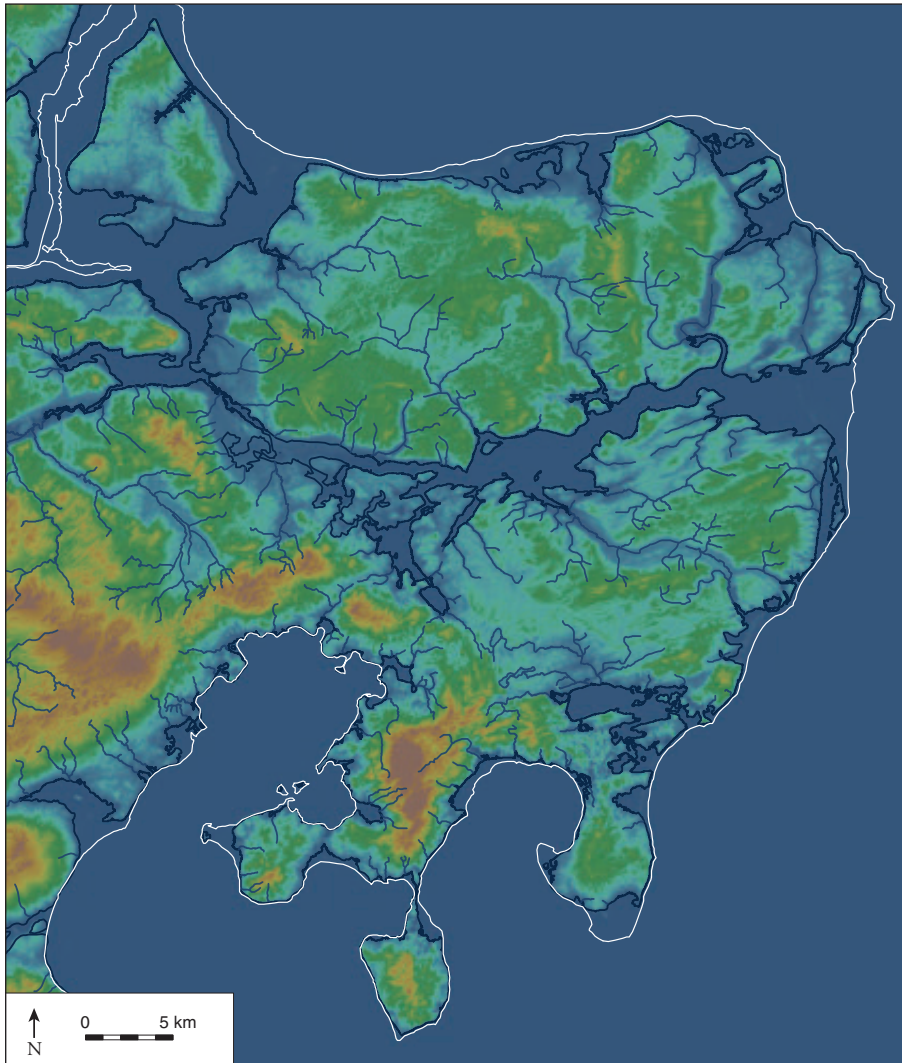
The Djursland Peninsula extends out from the east coast of Jutland, between the present-day cities of Aarhus to the south and Randers to the north (Fig. 5). There is no geographically defined western border for the area. In this book, the term Djursland is used to designate the land east of a line extending 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 Pedersen 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. 5** | *The geographical location of the Djursland peninsula in Denmark.*



**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 cen-

tury. 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 km<sup>2</sup> 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



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.