

# DUTCH BEAKER CHRONOLOGY RE-EXAMINED

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**ABSTRACT:** In the Netherlands two competing models are in use for the chronological development of the Single Grave and Bell Beaker Cultures: the unilinear and the two-track model. The unilinear model proposes a continuous development from PF Beakers to AOO Beakers to Bell Beakers, with an overlap between the first two Beaker groups. The two-track model proposes that both half-decorated and fully-decorated beakers were present in the successive phases. Testing the validity of the models is difficult. The  $^{14}\text{C}$  dates suffer from numerous problems such as uncertainty of association and the old-wood effect. Moreover, after calibration the majority of the dates fall into two broad wiggles of the INTCAL09 calibration curve. The chronological sequence from PF to AOO to Bell Beakers with an overlap of the first two groups, as suggested in the unilinear model, seems to be plausible. Dating the start of AOO and Bell Beakers, and ordering the phases and types, remains impossible. The separately evolving group of half-decorated beakers, as suggested in the two-track model, seems not to survive into the BB period. New analyses of the ceramics from a group of as yet insufficiently published SGC settlement sites in the province of Noord-Holland may play a key part in validating either chronology.

**KEYWORDS:** the Netherlands, Single Grave Culture, Bell Beaker Culture, PF Beakers, AOO Beakers, Bell Beakers, typochronology,  $^{14}\text{C}$  dates

## 1. INTRODUCTION

In 2009 a new research project was launched, entitled ‘Unlocking Noord-Holland’s Late Neolithic Treasure Chest: Single Grave Culture Behavioural Variability in a Tidal Environment’.<sup>1</sup> The aim of this project is to simulate models for settlement variability, the use and role of material culture, and landscape use, by means of an integral study of the various excavation data. Ceramics form a major category of finds which can contribute to our knowledge of these settlements, since at these sites various types were found in association. Currently, there are two models in use for the chronological development of the Single Grave Culture and the Bell Beaker Culture in the Netherlands. These models are mutually exclusive, since they propose different cultural developments. The first model envisages a unilinear development from the Single Grave Culture to the Bell Beaker Culture, with consecutive Beaker types as the products of a continuous development. The other model sees two tracks in the development of these cultures and postulates that from the late SGC onwards there is a group of half-decorated Beakers and a group of fully-decorated Beakers. To allow a proper study of the chronology of the ceramics from the SGC-settlement sites in Noord-Holland, it must be established whether one model or parts of both chronological models are indeed correct and useful for analyzing and classifying the ceramics. In this paper the different arguments in favour of the two models will therefore be tested.

## 2. THE TWO MODELS

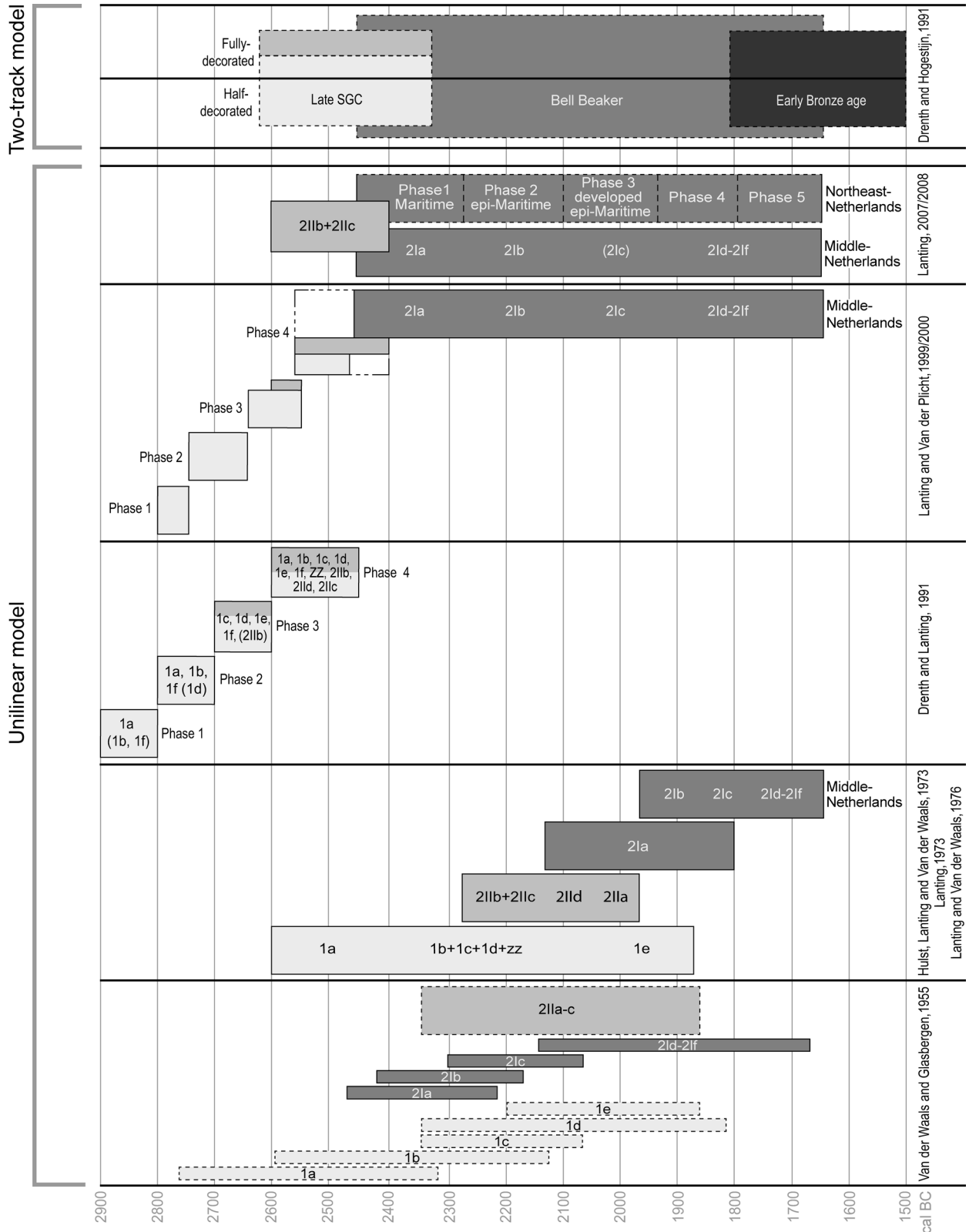
### 2.1. The unilinear model

The key proposition of the unilinear model is that the development from Protruding Foot Beakers via All Over Ornamented Beakers and subsequent Maritime Bell Beakers to Bell Beakers of the Veluwe type was a continuous one. There is, however, not just a single unilinear model but there are several versions, largely based on the same type divisions but with different adjustments and propositions (Van der Waals & Glasbergen, 1955; Lanting, 1973; Drenth & Lanting, 1991; Lanting & Van der Plicht, 1999/2000; and Lanting, 2007/08). An outline of the differing versions will be given below.

#### *Van der Waals and Glasbergen, 1955*

A first typological and chronological seriation of Protruding Foot Beakers, All Over Ornamented Beakers and Bell Beakers was presented in 1955 by Van der Waals and Glasbergen (fig. 1). These scholars presented a scheme in which the ceramics, on the basis of their morphological characteristics and decoration, were divided into Protruding Foot types, Bell Beaker types and All Over Ornamented types, although the designation AOO was then not used (Van der Waals & Glasbergen, 1955).

The beakers with a protruding foot are divided into six sub-types, 1a-1f (*ibid.*: 7–18). Types 1a-1e are distinguished on the basis of their decoration and the alphabetical order was thought to reflect the chronological order



For the Van der Waals and Glasbergen model the dates in the publication were calibrated with Intcal09. For the other models the calibrated dates in the publications were used.

**Legend:**

Boxes with dashed lines: dates are suggested by the authors as indication  
 Boxes with solid lines: dates are suggested by the authors as having some certainty

- = PF Beakers
- = AOO Beakers
- = Bell Beakers
- = Early Bronze age Beakers

Fig. 1. The different chronological models (Illustration S.M. Beckerman, layout S.E. Boersma, RUG/GIA).

(*ibid.*: 8–17). Type 1f is undecorated, but a plastic band or a cordon may occur below the rim (*ibid.*: 12). This type was present throughout the whole sequence (*ibid.*: 12). Beakers with a zig-zag design were not designated as a sub-type but did get special mention (*ibid.*: fig. 3 and p. 16).

Van der Waals and Glasbergen interpreted AOO Beakers (1955: 27) as a hybrid group of beakers, combining characteristics of both groups. The AOO Beakers do not represent a phase, but are said to occur alongside both PF and Bell Beakers (*ibid.*: 30/31). On the basis of their decoration, three different types were distinguished; 2IIa-2IIc (*ibid.*: 27–33).

The earliest Bell Beakers are so-called Maritime Beakers, which are subdivided into types, 2Ia-2Ic (*ibid.*: 19–24). This subdivision was based on the zonation of the decoration. Type 2Ia has zoned decoration, on type 2Ib incipient zone contraction is visible and on type 2Ic the zones are fully contracted (*ibid.*: 19–24). The group of Maritime Beakers also included beakers with paired – alternating decorated and undecorated – zones (*ibid.*: 19–24).

The successors of the Maritime Beakers, the so-called Veluwe Beakers, were divided into three types, 2Id-2If (*ibid.*: 24–7). In this classification the ratio between height and width of the vessel is particularly significant. Type 2Id is higher than broad, type 2Ie is as high as it is broad and in type 2If the height exceeds the width (*ibid.*: 24–7). The variation in decorative arrangements and elements is considerable (*ibid.*: 24–7). A new decorative element on Veluwe Beakers consists of zones filled with decoration with a vertical orientation (*ibid.*: 25). These zones were used as a frieze in which different motifs were applied in triangular boxes, or which were divided into metopes. The undecorated strips between the decorated zones are presumed to show chronological developments; on examples of type 2Ie Beakers these strips stand out in relief, and on some of the type 2If these bands become raised ridges; in the final stage the decoration between the ridges may disappear completely (*ibid.*: 25–6). Furthermore, Van der Waals and Glasbergen (*ibid.*: 25/26) state that the decoration on type 2Id was applied in a regular and clear manner, whereas younger vessels show more carelessly made decoration.

#### *Lanting, 1973; Lanting and Van der Waals, 1976*

In 1973 Lanting and in 1976 Lanting and Van der Waals presented what later came to be known as the ‘Dutch model’. They argued that the development from PF to AOO to Bell Beakers was continuous and a product of local developments rather than large-scale migrations (fig. 1).

Lanting and Van der Waals (1976: 5) recognised three main trends in the development of the Protruding Foot Beakers. These trends relate to: 1. the shape of the vessel base; 2. the techniques of decoration; and 3. the decorative motifs. The earliest beakers have a clearly pinched-out

foot (*ibid.*: 5). Later beakers have a flat or hollow base. The decoration changes from solely consisting of parallel lines of cord impressions to one with grooved lines and lines made with a plain spatula (*ibid.*: 5). The oldest decoration, both with cord-impressed and grooved lines, consists of horizontal lines. The motifs first change into herringbone design and later into horizontal rows of diagonal impressions in one direction. According to Lanting and Van der Waals (1976: 5), type 1a is the oldest and type 1e is the youngest, in line with the initial publication by Van der Waals and Glasbergen (1955: 7–18). Lanting and Van der Waals (1976: 5) do, however, regard the chronological order of types 1b, c and d as unclear, and a considerable temporal overlap must be taken into account. Zigzag Beakers were seen as not fitting into this sequence, yet are considered to be closely related to type 1d (*ibid.*: 5).

AOO Beakers are, in the unilinear model of Lanting and Van der Waals (1976: 3, 5, 13–5) not a hybrid group of beakers, as was suggested by Van der Waals and Glasbergen (1955: 27), but a link in the development from PF Beakers to Bell Beakers (fig. 1). Radiocarbon dates suggest a chronological overlap between PF and AOO Beakers (Lanting & Van der Waals, 1976: 3). An argument for the close relationship between PF and AOO Beakers is that they are found together in graves and settlement pits (*ibid.*: table 1). Moreover, two beakers, one from Merksplas (Belgium) and one from Ulenburg (Germany) combine features of PF and AOO Beakers (*ibid.*: 8). Typical of many AOO Beakers is decoration on the inside of the rim. This kind of decoration is also found on Late PF Beakers and on Bell Beakers of the Maritime type, and continues into stamp-decorated Barbed-Wire pottery (*ibid.*: 6). AOO types 2IIa and 2IIc are sometimes decorated with diagonal notches on the rim. Such decoration is also found on type-1d PF Beakers and Maritime Beakers (type 2Ia). The occurrence of these two decorative patterns on the different beaker groups is regarded as another argument for continuous, unilinear, development (*ibid.*: 6).

The AOO Beakers are said to differ from PF Beakers in three respects (*ibid.*: 5–9). First, the outer surface of the AOO Beakers, as their name reveals, is fully decorated, whereas PF Beakers have an undecorated lower part. Second, the protruding foot has almost completely disappeared on AOO Beakers. The third difference is that grooved lines are absent on AOO Beakers. All the other decorative motifs and techniques known from PF Beakers are also present on AOO Beakers. Lanting and Van der Waals consider types 2IIb en 2IIc (1976: 6) to be the oldest AOO types, because they display traits with a close resemblance to PF Beakers. Type 2IIb is decorated with parallel lines of cord impressions; type 2IIc is decorated with either herringbone motifs or horizontal rows of oblique or vertical spatula impressions (*ibid.*: 5). Type 2IIa is thought to be the youngest AOO type; Lanting and Van der Waals (1976: 6) see it as the direct predecessor of

the Bell Beakers of the Maritime type. These vessels are decorated with more-or-less contiguous horizontal zones with diagonally placed dentated spatula impressions. The zones are delimited by a cord line. The direction of the diagonal impressions alternates by zone. Sometimes a narrow undecorated zone appears between two decorated ones. The last type, 2II<sub>d</sub>, is placed chronologically between the other types (*ibid.*: 6). This type closely resembles type 2II<sub>a</sub>, but the impressions are made with a plain spatula and the direction of the decoration does not always alternate by zone (*ibid.*: 37).

Concerning the chronology of the Maritime Beakers, Lanting and Van der Waals (1976: 9) state that type 2I<sub>a</sub> is the oldest, and AOO type 2II<sub>a</sub> is considered the direct predecessor of this type. The 2I<sub>a</sub> Beakers are decorated with zones filled with impressions made with a dentated spatula. They regard the development from 2II<sub>a</sub> to 2I<sub>c</sub> Beakers as a gradual one. Maritime Beakers with dentated spatula lines delimiting the zones are considered to be younger (*ibid.*: 9). After this, a new development occurred: the zones started to contract. Beakers with incipient zone contraction are labelled type 2I<sub>b</sub> (*ibid.*: 8). Lanting and Van der Waals (1976: 8) argue that the pairing of zones is not the same as zone contraction. The alternation of decorated and undecorated zones of roughly equal width is seen as a basic Maritime-style element. Therefore, the beakers with paired zones are placed with type 2I<sub>a</sub> (*ibid.*: 9). After the incipient zone contraction, zone contraction 'proper' is claimed to form the link between the Maritime Beakers and the beakers of the Veluwe types (2I<sub>d</sub>-2I<sub>f</sub>). Lanting and Van der Waals (1976: 9) see the type with contracted zones, 2I<sub>c</sub>, as essential to comprehending the origins of the Veluwe types. A problematic point, however, is that this type comprises only a few specimens. Lanting and Van der Waals (1976: 9) furthermore stress that the evolution of the Veluwe types out of the Maritime types as described by Van der Waals and Glasbergen (1955) was a phenomenon taking place in the central part of the Netherlands.

The chronology of the Danish SGC is used by Lanting and Van der Waals (1976: 12) to validate their model. Parallel beaker types, and especially battle-axes, daggers of Grand Pressigny flint and daggers of Scandinavian types are said to confirm the established Dutch chronology. The PFB group is seen as contemporaneous with the Danish Undergrave and Groundgrave Periods, the AOO group with the Groundgrave Period, the beginning of the BBC coincides with an advanced phase of this period, and the Late Bell Beakers coincide with the Uppergrave Period and possibly the start of Late Neolithic B (*ibid.*: 12-5).

In order to test their relative chronology based on the variations in the ceramics, Lanting and Van der Waals (1976: 36-67, table III) presented a diagram in which they placed all <sup>14</sup>C dates associated with ceramics in the same order as their proposed type seriation. These <sup>14</sup>C dates were said to largely support the ordering of PF Beakers

as the oldest, AOO Beakers as their immediate successors and Bell Beakers as their ultimate successors (*ibid.*: 37). The <sup>14</sup>C dates seem to indicate that PF and AOO Beakers co-existed for about two centuries. Not just the ordering of the groups, but also the ordering of the various types appears to be supported by the <sup>14</sup>C dates (*ibid.*: 37).

#### *Drenth and Lanting, 1991*

Drenth and Lanting (1991) spotted a number of problems with the chronology of the SGC. First, there are only three stratified sites that might yield information on type sequencing. Second, there are no dendrochronological dates. Third, <sup>14</sup>C dates, after calibration, rarely are unequivocal and can be used only as a *terminus post quem* (Drenth & Lanting, 1991: 42). Drenth and Lanting (1991) therefore propose a revised chronology based on hammer-axe types (fig. 1). These can be related to hammer axes from Jutland, for which a more firmly based chronology is available. Drenth and Lanting (1991: 42/43) divided the SGC into four phases: phase 1, 2900/2850-2800 BC; phase 2, 2800-2700 BC; phase 3, 2700-2600 BC; and phase 4, 2600-2450 BC. The authors warn that their scheme is in part highly hypothetical, because some hammer-axe types are represented by just one specimen (*ibid.*: 46).

#### *Lanting and Van der Plicht, 1999/2000*

Lanting and Van der Plicht (1999/2000) published an extensive overview of the <sup>14</sup>C chronology of the Neolithic. For the SGC they follow the division into phases by Drenth and Lanting (1991), but they date phase 1 between 2800 and 2750 BC; phase 2, 2750-2650 BC; phase 3, 2650-2550 BC; and phase 4, 2550-2400 BC (Lanting & Van der Plicht, 1999/2000: 35 and 74/79, fig. 1). The AOO Beakers are dated to 2600-2400 BC; the two-century overlap with the SGC is thus maintained (*ibid.*: 35, 79-81). The Bell Beaker Culture then starts around 2500 or 2540 BC (*ibid.*: 36-42 and 81-95).

Lanting and Van der Plicht (1999/2000) highlight three main problems affecting the reliability of the <sup>14</sup>C dates. First, they mention that old-wood effect affected many of the datings. Therefore dendrochronological dates from Switzerland and France are used to establish a starting date for the BBC (*ibid.*: 36). Second, insufficient cleaning of the samples might reduce the reliability of dates. Third, many of the dates can only be used as a *terminus post quem*.

#### *Lanting, 2007/2008*

Lanting (2007/08: 13-47) claims that there were two Bell Beaker groups: one group in the central Netherlands and another group in the northeastern Netherlands and northwestern Germany (fig. 1). The developments in the central Netherlands, with some small adjustments, remained as outlined in earlier editions of the unilinear model. But for the northeastern Netherlands and

northwestern Germany, Lanting proposed a new phase division (Lanting, 2007/08).

The adjustments that Lanting (2007/08) presents for the central Netherlands primarily concern the AOO Beakers. Lanting (2007/08: 17) states that the morphological characteristics seem to have no chronological significance. He interprets the AOO (*ibid.*: 16) Beakers as the products of a group of people within the late Single-Grave society, distinguishing themselves by their different ceramics and a different grave orientation. Lanting (2007/08: 35) continues to provide examples illustrating the transition from AOO to Maritime Beakers. The beakers found at Helden-Koningslust and the large beaker found at Hoenderloo are examples of true 2IIa Beakers (according to Lanting, 2007/08: 35). Succeeding these, true type-2IIa Beakers are beakers with narrow undecorated zones between the decorated ones. These beakers must in their turn have given rise to Maritime Beakers with cord impressions delimiting the decorated zones, and with decorated and undecorated zones of equal width. Lanting (2007/08: 35) regards the beakers found at Mol (Belgium), Buinerveld and two at Uddelermeer as examples of beakers with cord-delimited decorated zones of about equal width. Later the cord impressions seem to disappear (*ibid.*: 35).

In earlier versions of the unilinear model, type 2Ic was said to form the bridge in the development from type 2Ia to the Veluwe types (Lanting & Van der Waals, 1976: 9). However, not many examples of beaker type 2Ic have been found (*ibid.*: 9). Lanting (2007/08: 49) therefore believes that there should be other beakers that represent the transition from types 2Ia and 2Ib to 2Id, e and f. In his opinion, it is most likely that, given their profile and decorative scheme, the beakers found at the sites Ede-De Kwekerij, Uddelermeer-ontginning, Westerbeek-van Eersten, Elspeetse Heide and Lisse constitute this link (*ibid.*: 49).

Lanting (2007/08: 49) lists the main characteristics of the Veluwe Beakers from the central Netherlands. The decoration is, as a rule, made with a dentated spatula, sometimes with a plain spatula, or as thin grooved lines. Pots with the typical Veluwe shape but with random fingernail impressions or plastic knobs also occur. Lanting (2007/08: 49) considers it plausible, but hard to prove, that type 2Id is the first type to occur and 2If the last, with a chronological overlap of the different types.

Lanting (2007/08: 55–8) subdivides the Bell Beaker group in the northeastern Netherlands and northwestern into five phases. The first phase is the Maritime phase. The second phase is early epi-Maritime and comparable to type 2Ib of the central Netherlands. This phase also saw handles on some beakers. This is followed by a developed epi-Maritime phase, which has no counterpart in the central Netherlands. The last two phases were not labelled. The fourth phase is exemplified by, among others, the vessels found in Emmen and Oudemolentumulus 13, which Van der Waals and Glasbergen knew

as type 2Ic. The beakers of the fifth phase are the direct predecessors of the stamp-decorated early Barbed-Wire Beakers. Lanting (2007/08: 57) remarks that not all beakers found in this area can be placed in one of the phases. Some beakers are related to the Veluwe types of the central Netherlands. There are five <sup>14</sup>C dates that can be linked to ceramics. According to the author (Lanting, 2007/08: 59), these dates do not argue against the outlined typological development.

## 2.2. The two-track model

In 1999 Drenth and Hogestijn proposed a different sequencing of the beaker cultures. Their model too is based on continuous development, yet these developments run not on one, but on two tracks (fig. 1). They postulate that in the late phase of the SGC and in the Barbed-Wire tradition there is a class of fully-decorated and a class of half-decorated vessels (Drenth & Hogestijn, 1999: 107–112). The authors (*ibid.* 1999: 110) suggest that the same division might be applicable to the Bell Beaker Culture. Thus, the starting point for this model is the late phase of the SGC, when both the half-decorated late PF Beakers and the fully-decorated AOO Beakers were in use. Not just the AOO Beakers, as proposed in the unilinear model, led to the development of Bell Beakers, but pots of both types did (*ibid.*: 108). The half-decorated and fully-decorated Bell Beakers in their turn are seen as the ancestors of the half- and fully-decorated Barbed-Wire stamped pottery. Drenth and Hogestijn do not agree with the centre-periphery hypothesis put forward by Lanting and Van der Waals (1976) and especially Lanting (2007/08), and see a nationwide validation for their model involving regional groups.

Drenth and Hogestijn (1999) not just present a chronological overview of the developments according to their model, but also criticise the propositions underlying the unilinear model. Much attention is given to three aspects of the unilinear model: the existence of a Maritime phase, the zone-contraction hypothesis and the genesis of the Veluwe Beakers. For the sake of clarity, the same sequence will be followed here.

### *Maritime Beakers and a Maritime phase?*

Drenth and Hogestijn (1999: 103–7) state that a Maritime phase did not occur, since such a phase would have produced a dramatic change in the number of different decorated beaker types. Moreover, such a Maritime phase should be visible in the funerary ritual (Drenth & Hogestijn, 1999: 103/104). Beakers of the Maritime type are never associated with high-status grave goods. So if there indeed was a Maritime phase, this would, according to Drenth and Hogestijn (1999: 103/104), have meant a gap in the long-term tradition of prestige grave goods and high social status. A third argument against a Maritime phase is that such a phase would make it impossible to identify regional groups for that particular epoch (*ibid.*:

104). Regional phenomena *are* visible in both the SGC and the later BBC (*ibid.*: 104). At the Bell Beaker site of Vlaardingen only beakers of the Maritime type occur. Drenth and Hogestijn (1999: 105) argue that this site must have had a special function, or the ceramics must have belonged to a specific social group. They stress (*ibid.*: 106) that quantitative differences of ceramic types at settlement sites reflect not only chronological differences but also social differences and different functions of the sites.

In the unilinear model, Maritime Beakers developed out of AOO Beakers, particularly type 2IIa (Lanting & Van der Waals, 1976: 6). During this process, the decoration scheme changed from all-over to zoned. Drenth and Hogestijn (1999: 109) argue that this zoning of the decoration occurred not only on fully-decorated beakers but also on half-decorated beakers. The beakers from the sites Zuid-Esmarke, Ede-De Kweekerij, Anloo-tumulus II and Holten are seen as examples of half-decorated beakers with zone contraction (*ibid.*: 109). These Bell Beakers are thought of as the direct offspring of the half-decorated late PF Beakers rather than derivatives of Maritime Beakers (*ibid.*: 109). Drenth (in prep.) moreover argues that zoned decoration already occurred on ceramics from the SGC. Sherds with zoned decoration were found at the settlement sites of Aartswoud and Zeewijk. Pots from Swalmentumulus 8, Noordborge-Hoge Loo and Eext-Bergakkers are additional examples (*ibid.*: 112). Not only ceramics from late SGC contexts have zoned decoration; even older types show this too (Drenth, in prep.). According to Drenth and Hogestijn (1999: 110), not only the location of the decoration, but also the decorative motifs themselves reveal a two-track development. A significant difference between half-decorated late PF Beakers and half-decorated Bell Beakers lies in the extent of the decoration (Drenth, in prep.). On the PF Beakers it stops just above or on the point of greatest girth (*ibid.*: in prep.), whereas on Bell Beakers it extends below the point of greatest girth.

Beakers of the Maritime type are said to occur together with late PF and AOO Beakers (Drenth & Hogestijn, 1999: 105). Examples of this are found at the settlement site of Sijbekarspel-De Veken. Furthermore, the tumulus of Hoenderloo-Schenkenhul yielded a beaker that, on the basis of its decoration, is to be placed between the AOO and Maritime Beakers (*ibid.*: 105). These authors believe it highly likely that Maritime Beakers and other Bell Beaker types occurred together, although no clear-cut examples of this are found (*ibid.*: 106). The site of Oostwoud, which Van Giffen (1961) and Lanting and Mook (1977: 90) considered an example of the co-existence of the different types, is not seen as such by Drenth (in prep.).

#### *The zone-contraction hypothesis*

According to Lanting and Van der Waals (1976: 9), the beakers changed in two respects after the Maritime phase.

On the one hand, the profile of the pots became S-shaped (type 2Ib) and subsequently more squat (type 2Ic). On the other, the decorated zones on the former pot type started to contract, whereas the latter pot type has contracted decorated zones on the neck, its greatest belly circumference and near the foot. Drenth and Hogestijn (1999: 110) state that the zone-contraction hypothesis needs more evidence. According to Drenth (in prep.), the very low numbers of beakers on which the theory is based are a weak point. Rather than seeing them as derived from the Maritime Beakers, Drenth and Hogestijn regard the 2Ib Beakers as derived from PF Beakers with or without zoned decoration. Drenth and Hogestijn (1999) have difficulty categorizing the type-2Ic Beakers. This type can be classified as an exponent of AOO Beakers, as a variant of Veluwe Beakers, or as a hybrid form. Drenth (in prep.: 42) does not favour any particular option but instead argues that the overall picture does not alter if these type-2Ic vessels are not taken into account, since this group comprises only 35 specimens.

#### *Veluwe Beakers*

In the two-track model, the Veluwe Beakers have a genesis different from that in the unilinear model (Drenth, in prep.). Various settlement sites in the province of Noord-Holland (Mienakker, Zeewijk-west and Aartswoud) and one site in the province of Zuid-Holland (Puttershoek-De Grienden) have yielded undecorated pots with profiles comparable to those of Veluwe Beakers (Drenth & Hogestijn, 2006: 89). The vessels have a cylindrical shape and an abrupt transition from neck to belly. Also, many of the decorative techniques and motifs found on Veluwe Beakers have counterparts at SGC sites (Drenth, in prep.). The origin of vertical decoration need not be sought in Bohemia, as Van der Waals and Glasbergen (1955) suggested, but was already present on beakers of the SGC. As examples, Drenth (in prep.) mentions beakers from the sites of Zeewijk, Emmen-Angelslo, Elspeet and Ede-Ginkelse Heide. Although Drenth (in prep.) points to the SGC for the origin of (characteristics of) the Veluwe Beaker, he also stresses that the latter is not a direct descendant. There are intermediate forms, an example of which was found at Nijmegen, where a PF Beaker with cross-hatching was found, a decoration motif frequently occurring on Veluwe Beakers (*ibid.*: in prep.). The exact moment when Veluwe Beakers appeared is not clear; Drenth (in prep.) believes a start in the early Bell Beaker Culture is likely. The Veluwe types probably existed up until the end of this culture. Furthermore, there are no potent arguments for assuming chronological differences between the Veluwe types (*ibid.*: in prep.).

#### *Hybrid beakers*

The division into half-decorated and fully-decorated pots, the two tracks of this model, is not as clear-cut for the Bell Beaker types as it is for the Early Bronze Age ceramics (Drenth & Hogestijn, 1999: 110). Notable examples

are those Veluwe Beakers that have uninterrupted decoration on the neck and belly, followed by an undecorated zone and another decorated zone near the foot. These beakers, for example the one found at Voorthuizen, have characteristics of both half-decorated and fully-decorated beakers (Drenth, in prep.). To resolve this problem with the two-track model, Drenth and Hogestijn propose the possibility of a hybrid beaker form (Drenth & Hogestijn, 1999: 110), which could have arisen from one form being influenced by the other.

#### *Radiocarbon dates and relative chronology*

Drenth and Hogestijn do not present a different <sup>14</sup>C chronology for the SGC and BBC. They (1999: 101) quote the critique of Kinnes *et al.* (1991) who doubted the possibility of establishing a chronology for the Late Neolithic in the Netherlands on the basis of <sup>14</sup>C dates, because most datings are of charcoal, which could have been from old wood, and the association of the dated material with the finds is not always clear. To what extent the authors acknowledge this criticism is not quite clear; they do mention that some reliable material was dated: burnt twigs (Drenth & Hogestijn, 1999: 101). Yet Drenth (in prep.) also mentions that by the <sup>14</sup>C method alone one cannot establish a precise chronology. Drenth and Hogestijn (1999: 101/102) do list new <sup>14</sup>C dates for the SGC in the northwestern coastal area (table 2) and some probable BBC dates (table 1).

### 3. THE RADIOCARBON DATES

#### 3.1. Earlier critiques

In the past, several authors have criticized the dates and chronology put forward by Lanting and Van der Waals (1976) and Lanting and Van der Plicht (1999/2000). Both the quality and the quantity of the dates have been criticised. The British Museum ran a large-scale programme for dating beakers: twenty samples of human bone were dated. One of the main conclusions was that the <sup>14</sup>C dates failed to confirm the sequence of styles that were believed to represent chronological phases in Britain (Kinnes *et al.*, 1991: 39). The researchers also assessed the Dutch dates and the unilinear model. Kinnes *et al.* (1991: 36) classify the association between much of the dated material and the finds as weak. They state that only seven of the 28 Bell Beaker dates provide a robust association, four of which date a single house (Vlaardingen). All of these datings were performed on charcoal, a material rejected in the British Museum dating programme because of the risk of dating wood that is considerably older than the associated Bell Beaker (*ibid.*: 36).

Lanting and Van der Waals (1991) wrote a response to the critiques by Kinnes *et al.* (1991). In defence of the Dutch model, they argue that the aim of their 1976 publication was to demonstrate the cultural continuity from PF

to AOO and Bell Beakers. In their opinion, Kinnes *et al.* (1991) neglect this point by not taking the PF and AOO Beaker dates into account. Furthermore, they point out that in the Netherlands, where many funerary sites are found on sandy soils, charcoal is the only datable material available, since bones will decay. Charcoal was used with full awareness of the problems that might arise from the old-wood effect and from uncertain associations (Lanting & Van der Waals, 1991). Though even when used consciously, the problem itself persists.

A second researcher who criticised the Dutch model was Salanova (1998). She performed a technological study of 750 Bell Beakers from France, which made it possible to assign sets of vessels to individual potters (Salanova, 1998). One of her conclusions was that for chronology, motifs are not significant (*ibid.*: 4). With regard to the chronology in the Netherlands, Salanova states that the Dutch Model shows inconsistencies (1998: 1/2); when the dates used by Lanting and Van der Waals are calibrated they do not demonstrate the proposed sequence. In addition, she sees no evidence for a Maritime phase. Salanova (1998: 5) expresses her view on how to establish a new chronology for the Bell Beaker period. Radiocarbon dates should not be used, since they are, in this period, too imprecise. Stratified settlement sites will, according to Salanova, not offer a solution either, because they represent a local situation. Associated items from closed assemblages (cemeteries) must be the key to the solution (*ibid.*: 5). Large-scale technological studies, comparing styles as well as technological characteristics of the production process, may also enhance our understanding of the people behind the vessels.

As a final argument, Furholt (2003) reassessed all <sup>14</sup>C dates available for the different branches of the Corded Ware Culture in Central Europe and southern Scandinavia. The 'stages' that Furholt (2003: 15) defines are based on the wiggles in the (INTCAL 98) calibration curve. The Netherlands and northwestern Germany were treated as one Corded Ware branch, with a total of thirty dates, of which twenty from the Netherlands were assessed. Furholt (2003: 91) too considers problematical the high percentage of charcoal dates, which may suffer severely from the old-wood effect. The Dutch SGC is dated to Furholt's stages D to F (2900/2600-2400/2300 BC). A start before wiggle D is thought to be unlikely, as most of the earliest dates (Hijken-I and -II, Noordbarge, Silvolde and Vlaardingen) are of doubtful quality: the link between the charcoal and beaker is often uncertain and such dates must therefore be seen as a *terminus post quem*. The date for Anlo-grave E is the exception, but if an old-wood effect of 100 years is taken into account this date too can be placed in stage D (Furholt, 2003: 91). In Furholt's opinion, the early phase (D) of the Dutch SGC saw types 1a and AOO 2IIb, while the late phase produced types 1b, 1d and 1e; and datings with a lower reliability also date types 1b, 1d, 1e and AOO 2IIb (*ibid.*: 97). Since wiggle D is very broad and there

are many problems with the Dutch dates, it seems impossible to seriate types 1a to 1f. Type 1a can be seen as the start of a development, but fully-decorated beakers occur even in the early phase. Type 1e cannot be a late type only (*ibid.*: 97). An important conclusion is that if the wiggles of the calibration curve are taken into account there is no reason to assume that AOO Beakers occurred any longer than did PF Beakers. Indeed there are reliably dated examples of PF Beakers (De Eese) that are younger than any of the AOO Beakers. However, Furholt does see younger AOO Beakers (stage F) as a possibility, although there are many problems and uncertainties about the dates that can be placed in this wiggle. Furholt (2003: 98) concludes that PF and AOO Beakers are parallel developments. Regarding the possibility of continuous development from PF to AOO to Bell Beakers, Furholt (2003: 98) decides that it is unlikely that Bell Beakers developed out of AOO and PF Beakers, as there are no high-quality Dutch Bell Beaker dates that can be placed before wiggle F. If all dates are taken into account, the Dutch Bell Beakers must be dated to wiggles F and partly G (*ibid.*: 98). The Bell Beakers could have replaced the PF and AOO Beakers, but a chronological overlap still remains a possibility. In France, older Bell Beakers have been found (at Tremery-Flevy, Lorraine) (*ibid.*: 98). The Dutch Bell Beakers can therefore not be regarded as the progenitors of the Europe-wide development (*ibid.*: 98).

### 3.2. The chronology re-examined

#### *The problems*

The problems occurring with  $^{14}\text{C}$  dates can be divided into two groups: a technical and an archaeological one. Technical problems occurring in this dataset are: poor quality of the sample, reservoir effect, inadequate sample preparation and contamination of the sample. Archaeological problems may be: old-wood effect and lack of a certain association with the cultural material. In addition, there are problems arising from the calibration curve.

- Quality and preparation of the sample: Both the quality of the sample and the preparation of the sample can affect the outcome of the dating. For the assessment of the quality of the sample there are different methods for the various materials to be dated (DeNiro *et al.*, 1985; Lanting & Van der Plicht, 1998; Mook & Streurman, 1983). The way a sample was prepared affects the reliability of the date; charcoal samples should ideally be pre-treated with AAA and unburnt bone needs to get the ‘Longin’ treatment (Mook & Streurman, 1983; Lanting *et al.*, 2001);
- Reservoir effect: The absorption of  $^{14}\text{C}$  differs for terrestrial, marine and freshwater environments. This causes a marine and freshwater reservoir effect (Brindley, 2007: 20). For marine samples from the northern Atlantic and North Sea the effect can be corrected, for freshwater samples this is impossible (Lanting & Van

der Plicht, 1995/96). Dates on (human) bones from individuals with a diet largely based on marine or freshwater (shell) fish will be too old. The same goes for dates of residues on sherds if the vessel was used to prepare (shell) fish. For dates on bone, also the isotopic fractionation, the change in the  $^{14}\text{C}/^{13}\text{C}$  ratio needs to be taken into account. This is standard procedure nowadays, but in early years radiocarbon laboratories did not reckon this in. Therefore, old bone dates are problematic, since again there is no standard correction if the diet was based on marine or freshwater (shell) fish (Brindley, 2007: 20);

- Old wood effect: This is an archaeological problem frequently encountered when charcoal samples are used for  $^{14}\text{C}$  dates. If the wood has a considerable age of its own, the dated archaeological material gets a date that is too old (Waterbolk, 1971; Lanting & Van der Plicht, 1993/94);
- No or uncertain association: The association between the sample and the archaeological material to be dated needs to be secure to obtain a sound date. Waterbolk (1971) developed an A-B-C-D scale to denote the certainty of association. Furthermore, there are dates that can only be seen as a *terminus post quem* (*t.p.q.*) or a *terminus ante quem* (*t.a.q.*). Our dataset has yet another problem, which is that the association between the dated material and the supposedly dated artefact is not always expressed. This especially goes for the datings of the settlements, the finds from which have been only sparsely published;
- Calibration curve: Another problem affecting the dataset under study is that of the calibration curve; the structure of the curve for this period has some broad plateaus or wiggles (Reimer *et al.*, 2009). Therefore, many dates end up in the same plateau, making it hard or impossible to confirm or reject competing typochronological claims (Furholt, 2003).

#### *Assessing the dates*

The technical and archaeological problems described above reduce the reliability of the dates. The quality of the dates for the dataset under investigation was established on the basis of literature study, examination of the  $^{14}\text{C}$  forms at the Centre for Isotope Research (CIO) of Groningen University and analysis of the dates themselves. For the various problems, one and two minus rankings were given. Dates being assigned two or more minuses were completely suppressed. Dates with a one-minus ranking were used in the analysis but were given less weight than those unaffected by these problems. The following strategy was adopted for ranking the dates:

- Quality and preparation of the sample: Samples that had a quality unsuitable for dating or that were inadequately prepared were assigned two minuses and hence were suppressed. Dates taken from charcoal samples that were only cleaned with acid and did



not get the preferred AAA treatment, were assigned one minus;

- Reservoir effect: A marine diet may cause huge errors, but dates on, for example, residues from vessels in which freshwater fish was prepared may suffer from a smaller reservoir effect. Therefore, a two-scale strategy was used. All the bone and residue dates that were complete outliers (older than 4400 BC for the SGC and older than 4000 for the BBC) were excluded from further analysis. Bone and residue dates that were not complete outliers but still older than any of the dates related to the same vessel type were assigned one minus. For example, the residue date for the Veluwe-type sherds from Barendrecht 2 (GrN-25917, 3870±50) is older than any other date for this type of vessel, but is not a complete outlier. This date therefore was assigned one minus;
- Old-wood effect: This effect may hugely affect the date; however, establishing whether it occurred or not is not a straightforward matter. Some authors have suggested that dates from charcoal should not be used at all (see Kinnes *et al.*, 1991). Lanting and Van der Plicht (1999/2000) use a one-scale strategy and reject complete outliers as well as any dates that are older than other dates related to the same type of vessel. A system in which complete outliers are assigned two minuses and early dates on charcoal that may – but do not necessarily – suffer from this effect are assigned one minus seems to be more appropriate. Rejecting dates that can be placed in the <sup>14</sup>C range for this period but are older than dates for the same type can produce circular reasoning. The dates confirming typological arguments are in that case rejected on the basis of technical arguments;

In this study, the dates that were complete outliers (older than 4400 BC for the SGC and older than 4000 for the BBC) were assigned two minuses and were rejected for further analysis. The datings performed on charcoal that are the oldest dates for the types of vessel they relate to but that were not complete outliers, were assigned one minus. Thus, they were classed as less reliable but still were taken into account in the further analysis. For example, while the date for the type-1e Beaker and the ZZ Beaker from Annen-Holtkampen (GrN-11918, 4165±30 BP) fits into the range of dates for the Single Grave Culture, this date is older than any other date for these types. It was therefore accorded one minus;

- No or uncertain association: In this study, all dates that were not related to ceramics were suppressed. The samples whose relation with the dated vessel was very uncertain were assigned two minuses and were suppressed as well. A rating of one minus was dealt to four groups of dates. All *t.p.q.* and *t.a.q.* dates were assigned one minus. Dates with a C rating in the Lanting and Van der Waals study (1976; sequence by Waterbolck, 1971: 16) indicating that the relation was probable but

not certain, were assigned one minus. One minus was also assigned also went to a large group of settlement dates for which the relation between the dated sample and the cultural material had not been published.

Abnormal dates: A final category of dates to be excluded were the abnormal dates. These dates are complete outliers, while the exact cause of this is unclear. This applies to dates older than 4400 BC for the SGC and older than 4000 BC for the BBC, or younger than 3800 BC for the SGC and younger than 3400 BC for the BBC.

#### *Technical problems*

Two dates were excluded from the analysis because of the poor quality of the sample (compare Lanting & Van der Plicht, 1999/2000: 77/79, appendix 1). Four dates were rejected because the bone or residue sample might have contained an amount of (marine or freshwater) fish. All of these six dates were also rejected by Lanting and Van der Plicht (1999/2000). Two other dates from residues on sherds were assigned one minus; these are the above-mentioned date for Barendrecht 2 and a date for a sherd from Zandwerven (appendix 1). This last date (GrN-116, 4320±60) is problematic. The type of sherd to which the residue was attached was not published; therefore, either the date may suffer from a reservoir effect or the actual sherd may be older. A total of six dates were assigned two minuses because the samples were very probably contaminated. Sixteen datings performed on charcoal received a one-minus rating because the sample was only cleaned with acid and did not get the AAA treatment (appendix 1). The first dates were suppressed also by Lanting and Van der Plicht (1999/2000), while mention was made of the less suitable cleansing of the group of sixteen samples, but their dates were not completely suppressed. Four further dates must be rejected because they are abnormal (appendix 1).

#### *Archaeological problems*

In this study, a total of five dates have two minuses in the old-wood effect category, nine dates were assigned one minus, in contrast to Lanting and Van der Plicht (1999/2000) who listed twelve instances in which an old-wood effect had occurred. Next to complete outliers, almost all the datings performed on charcoal that were the oldest date for the type of ceramics that they relate to, were rejected. This, however, was not done to the dates on the oldest beaker with Veluwe-style decoration (Epe-Klokbekeweg, GrN-13714) and the second oldest ZZ Beaker (Eext-tumulus Visplas 1937, GrN-6727) which in years BP is just 20 years younger than the oldest date on this type of vessel, rejected for old-wood effect. These dates, Epe-Klokbekeweg and Eext-tumulus Visplas 1937, were assigned one minus as well. There are 53 dates that were completely unrelated to ceramics; these were assigned two minuses (appendix 1). Three more dates were rejected because the association of the dated

sample with the ceramics was too uncertain. For another seventeen dates the association was questionable but not completely uncertain, and they therefore were assigned one minus.

Regarding the dates from some sites, the various authors discussing the  $^{14}\text{C}$  dates are unanimous. This especially applies to the eight dates from the site Oostwoud-De Tuithoorn. This site and its dates have been discussed in many publications (Van Giffen, 1962; Dekker & De Weerd, 1975; Drenth & Hogestijn, 2006; Louwe Kooijmans, 1985; De Weerd, 1967; Lanting, 1979; Lanting & Van der Plicht, 1999/2000; Runia, 1987). Lanting and Van der Plicht (1999/2000: 86/87) provide a detailed reconstruction of the various excavations that took place. In their opinion, the oldest sherds from within and beneath the mound may date from the time when a flat grave was constructed, and the youngest sherd may date from when the site was used as a field. According to Drenth and Hogestijn (2006: 74), it is impossible to tell whether the Maritime and 'proper' Bell Beaker sherds did or did not belong to the same, closed assemblage. In the present re-examination it was decided to assign two minuses to seven of the dates, since the association with the ceramics cannot be established, and one minus to the date (GrN-6650C) with at any rate a probable association with the sherds decorated in Maritime style (appendix 1).

The date from De Eese-tumulus 1918-IV (GrN-6127) is employed in two different ways by Lanting and Van der Plicht (1999/2000: 76 and 83) and Lanting and Van der Waals (1976: 40/41). The date can be linked to a shallow and findless 'beehive grave' or can be regarded as a *t.p.q.* for the Bell Beaker with Maritime-like decoration but without cord impressions delimiting the zones – a beaker placed in the mound secondarily. In the present study, the dating was assigned two minuses for both options: no association with ceramics (two minuses); or an uncertain association (one minus) plus a *t.p.q.* date (one minus), respectively (appendix 1).

Furthermore, seven dates can only function as a *t.a.q.* and nine as a *t.p.q.* The subdivision in the publications by Lanting and Van der Waals (1976) and Lanting and Van der Plicht (1999/2000) was not always followed. The date for the type-2Ib Beaker from Ede-Ginkelse Heide was suppressed in this re-examination, as it was assigned three minuses. Lanting and Van der Waals (1976: 41) see this date as a *t.p.q.* for the grave, Lanting and Van der Plicht (1999/2000: 83) state that the charcoal may have been brought in from elsewhere with the sods and hence has no direct association with the grave and the grave goods.

About one third (54 of the total of 157) datings were performed on material from settlement contexts; of 22 samples the contexts had not been published. This problem is relevant for the SGC-settlement sites in Noord-Holland (eighteen dates), which play a key part in the two-track model, and for the site of Voorschoten-De

Donk (one date) and partly for the site of Hazendonk (three dates) (appendix 1).

The dates and the ceramics from the Noord-Holland SGC-settlement sites are discussed in several publications, but the exact association of the dated material with the ceramics remains unclear (Hogestijn, 1997; Van Ginkel & Hogestijn, 1997; Drenth & Hogestijn, 1999 and 2006; Sier, 2001). Drenth and Hogestijn (1999: 102) present a table (table 2) in which they list the kinds of ceramics found at the various sites. They state that both PF and AOO Beakers have been found at the settlement sites of Zeewijk-west, Mienakker, Molenkolk-1 and -2, Maantjesland and Portelwoid. At the sites of Zandwerven and Zeewijk-oost only PF Beakers were present. AOO Beakers and sherds of probably Maritime or epi-Maritime Beakers were found at the site of Sijbekarspel-De Veken. As regards the date of the Zeewijk-oost house (GrN-18488), Hogestijn (1997: 40/41) states that no cultural material was found at this house.

For the two stratified sites of Aartswoud and Zandwerven more information on the types of recovered ceramics is available. The Aartswoud settlement was published by Iterson Scholten and De Vries-Metz in 1981; at that time there were no  $^{14}\text{C}$  datings. Two of the Aartswoud dates came from material that was found beneath the cultural layer (GrN-12013 and GrN-12014). It seems probable that these should be treated as *t.p.q.* dates or as the earliest stage. In trench 1, spit V contained the types 1b, 1d and ZZ and decorated and undecorated ceramics that cannot be placed typologically (Iterson Scholten *et al.*, 1981: table IIa). In trench 2 the cultural layer is less thick; here the deepest spit, IV, only contained one vessel of type 1d (Iterson Scholten *et al.*, 1981: table IIb). It seems the most likely that the dates came from material from trench 1, since here the cultural layer is indeed 1 m thick. However, this association is rather a guess based on combining publications than a certainty. The third Aartswoud date (GrN-12015) comes from halfway down the 1-m-thick cultural layer (Lanting & Van der Plicht, 1999/2000: 78). Since the exact spit remains unclear, it is also unclear which phase of occupation the date represents. In trench 1 the various spits contain the following types; IV: 1b, 1d, ZZ; III: 1a, 1b, 1c/d, ZZ, 1a/2IIb; II: 1a, 1d, 1e, ZZ, 2IIb; and I: 1d, 1e, ZZ, 2IIb, 1a/2IIb (Iterson Scholten *et al.*, 1981: tables IIa and b, figs. 6, 14–19).

Van der Waals and Glasbergen (1956) give a description of the PF s found in the earliest excavation campaign in 1929 at the site of Zandwerven: types 1a and 1b. Van Regteren Altena and Bakker (1966) list the finds from Van Giffen's excavation in 1929 as well as those from the campaigns in 1957-1958. During these latter excavations the number of PF Beakers grew to 15-20 vessels; one of them of type 1c, the others belonging to types 1a and 1b (Van Regteren Altena & Bakker, 1966: 37). The  $^{14}\text{C}$  dates are not mentioned in any of these three publications. In the Van Regteren Altena *et al.* publication of 1962, the date of GrN-2221 is listed as well as a description of the

Table 1. Dates per type.

Type	Total number of dates	No problems	1 minus	Rejected: 2 minuses or more	Dates ranging between (in BP) (1 minus ratings between brackets)
1a	9	3	1	5	(4270±70)4165±55-3955±50 BP
1b	2	1	1	x	(3970±35)3945±40 BP
1c	1	1	x	x	3955±50 BP
1d	8	2	2	4	(4065±55)3940±40-3935±35 BP
1e	5	1	4	x	(4165±30)4065±45 BP
ZZ	4	x	4	x	(4165±30)-(3880±50) BP
2IIa	x	x	x	x	x
2IIb	3	2	1	x	4140±70-4005±30(3965±50) BP
2IIc	1	1	x	x	4035±55 BP
2IId	x	x	x	x	x
2Ia	6	2	2	2	(3910±30)3910±100-3860±110(3850±50)BP
2Ib	1	x	x	1	x
2Ic	x	x	x	x	x
Epi-Maritime	2	2	x	x	3880±50-3840±50 BP
Veluwe (2Id-2If)	17	9	4	4	(3870±50)3850±40-3665±40(3665±35) BP
Veluwe and Barbwire	4	3	x	1	3630±35-3460±40 BP
Bell Beaker and Barbwire	2	x	2	x	(3865±30)(3710±50) BP
(Neck) Potbeaker	5	2	1	2	(3915±45)3830±20-3685±37 BP
Bell Beaker and neckpot	1	x	1	x	3685±40 BP
No type	8	4	4	x	(3945±55)3910±50-3725±35 BP
Settlement	33	3	22	8	(4320±60)3980±60-3930±50(3890±70)BP

ceramics. The dated material is said to come from a refuse pit containing only Vlaardingen ware and no SGC ceramics (Van Regteren Altena *et al.*, 1962: 9/10). Contrary to the Van Regteren Altena and Bakker (1966) publication, Van Regteren Altena *et al.* (1962: 224) identifies not only types 1a, 1b and 1c, but also type 1f and possibly type 1d among the ceramic finds.

After assessing the dates and their quality, the conclusion must be drawn that almost half of the dates (73, 46%) for this period are too problematic to use (a score of two or more minuses). Another 50 dates (32%) were not problem-free either and were assigned one minus. Just 35 (22%) of the dates seem unaffected by any technical or archaeological problems (appendix 1). In order to analyse and test the chronological models, a diagram was made plotting the dates per type in chronological order (table 1 and appendix 2). Appendix 2 on the left illustrates examples of the dated types, and on the right shows the different dates per type. Here also the one-minus-rated dates were taken into account to analyse whether any trends might emerge. It is striking that for three types

(2IIa, 2IId and 2Ic) no dates at all are available. For type 2Ib, the only available date was suppressed. Furthermore, all or most of the available dates for some of the types are burdened with one minus.

#### 4. TESTING THE MODELS

##### 4.1. The unilinear model

In the various editions of the unilinear model, different claims were made concerning: 1. the chronology of the continuous development from PF Beakers to AOO Beakers and then Bell Beakers, and specifically the placing and start of the AOO Beakers; 2. the ordering of the different types; 3. trends visible in the PF Beakers; 4. the phases in the SGC; 5. a Maritime phase; and 6. the phases in the northwestern Netherlands and northwestern Germany during the Bell Beaker period. Here these claims will be tested.

On the chronology, Lanting and Van der Waals (1976) state that it was their aim to demonstrate the continuity from PF to AOO and to Bell Beakers. The  $^{14}\text{C}$  dates do indeed indicate that AOO Beakers need to be placed before, or partly alongside the Bell Beakers, and should not be seen as hybrid forms of PF and Bell Beakers as was proposed in the initial (1955) publication by Van der Waals and Glasbergen. Lanting regarded the AOO Beakers as a product of the late SGC society (2007/08: 35). This conclusion seems to be correct; there is an overlap in time between PF and AOO Beakers.

Furholt (2003) postulated that at the very start of the SGC there were also AOO Beakers. This, however, seems to be incorrect. At the early SGC site of Zandwerven, for instance, only PF Beakers were found. Although the oldest date was taken from a residue on a sherd (GrA-116 4320±60 BP), and might be too old owing to the reservoir effect for which it was awarded one minus, there are no such arguments against the dating performed on charred twigs (GrA-118 4220±30 BP, a date without minuses). Still, the contexts of these dates were not published, and the site may in fact represent a local situation. The hypothesis of an early start of the AOO Beakers in the early phase of the SGC can therefore not be tested. Furholt's hypothesis (2003) should therefore be put aside.

From the  $^{14}\text{C}$  dates it seems that the PF Beakers outlived the AOO Beakers. The youngest dated PF Beaker of type 1e from De Eese-mound 1918 V dates to GrN-6687C 3870±35 BP; however, this date has one minus. Whereas the youngest AOO Beakers, from Ermelose Heide tumulus 1 (two pots of type 2IIB, no minuses), date to GrN-6351 4005±30 and the 2IIB Beaker from Anloveckraal grave C has a *t.a.q.* date (one minus) of GrN-1976 3965±50 BP. After calibration, the type-1e Beaker dates to the wiggle between 2460 and 2200 BC, and the AOO 2IIB Beakers to the wiggle between 2620-2480 BC. The date for the type-1e Beaker however was assigned one minus since the association is not quite certain (see appendix 1). The only certain conclusion is that there is a considerable overlap in time between PF and AOO Beakers, as is confirmed by the co-occurrence of both types in settlement contexts.

The overlap in time is also confirmed by the co-occurrence of PF and AOO Beakers in graves and settlement contexts. There are four (undated) funerary contexts in which PF and AOO Beakers occur together, though in two cases the association is only 'probable'. Types 1d and 2IIC occur together at Soesterberg and Aalten, types 1d and 2IIB at Swalmen and types 1e and 2IIB at Emst-Hanendorp (Lanting & Van der Waals, 1976: table 1). Different AOO types also occur together; twice a 2IIB and a 2IIa Beaker were found together (Elsloo and Hoenderlo); and a 2IIB and a 2IIC Beaker probably came from the same grave at Mallem. At the settlement sites in Noord-Holland PF and AOO types are said to occur together more frequently; but these sites have been just minimally published. The occurrence of the same traits

on beakers from the different groups is another argument for continuity. Diagonal notches on the rim and decoration on the inside of the rim occur on (late) PF, AOO and Bell Beakers, and according to Lanting and Van der Waals (1976: 6) thus are another argument for continuous development. This trend can also not be confirmed with  $^{14}\text{C}$  dates, but might indeed be a distinctive feature that may be studied further.

On the ordering of the different types, Lanting and Van der Waals (1976) concluded that the  $^{14}\text{C}$  dates were in line with their seriation of these types, and they also noted a number of trends in the development of the beakers. This ordering and the different trends are even harder to confirm with  $^{14}\text{C}$  dates, especially when calibrated dates are used. For the PF Beakers, Lanting and Van Der Waals (1976: 5) describe three trends: 1. the earliest beakers have a clearly pinched-out foot, while later beakers have a flatter or even a concave base; 2. the decoration changes from one of impressed-cord lines to one of grooved lines and lines made with a plain spatula; and 3. the earliest decoration consists of horizontal lines; the motifs first change into a herringbone design and later into horizontal rows of diagonal impressions in one direction.

At the start of the SGC most of the beakers have a protruding foot and in the later phase more beakers have a flat foot, but an overlap is present. The oldest beaker with a flat foot comes from Ede-Hotel Bosbeek and dates to GrN-6129 4165±55 BP. The youngest beakers with a protruding foot are the type-1d Beakers found at Eext-Galgwanderingveen in tumulus 3 (GrN-6635, GrN-6368 3940±40 or 3935±35 BP). The type-1e Beaker from Eext-Galgwanderingveen tumulus 1 has a small pinched-out foot and has a *t.p.q.* date of GrN-8254 3930±45. The second trend seems to be correct: the oldest beakers are indeed cord-decorated and the youngest decorated with grooved lines and lines made with a plain spatula. Here again an overlap is visible; from the  $^{14}\text{C}$  dates it is not even certain that there was a gap between the cord-decorated PF type 1a and the cord-decorated AOO type 2IIB (appendix 2). The youngest two type-1a Beakers date to GrN-7802 4140±50 BP and GrN-5068 3955±50 (Maarn-De Halm and Odoorn-Eeserveld, respectively). The oldest type-2IIB Beaker dates to GrN-851 4140±70 BP (Anloveckraal grave B). For the third, the decorative motifs change from horizontal lines to herringbones and then to lines of oblique impressions in one direction; again, overlap in the dates is visible; type-1e Beakers with oblique spatula impressions in one direction are the most long-lived. But the youngest dated type-1b Beaker, from Eext-Bergakkers, is decorated with horizontal lines and dates to GrN-6349 3945±40 BP. The youngest beaker with herringbone decoration is just slightly older, and dates to GrN-6635 3940±40 BP and GrN-6368 3935±35 BP (Eext-Galgwanderingveen, tumulus 3).

According to Lanting and Van der Waals (1976), the full seriation of the PF types cannot be established, but type 1a is the oldest and type 1e is the youngest. This is

indeed supported by the  $^{14}\text{C}$  dates. Regarding the order of the AOO types, Lanting and Van der Waals state that types 2IIc and 2IIb must be the oldest and 2IIa the youngest. Since there are no dates for either type 2IIa or type 2IIc, this cannot be tested. This also goes for the Bell Beaker types 2Ia, 2Ib and 2Ic. Lanting and Van der Waals (1974) propose this chronological order, but since type 2Ib only had one rejected date and no beakers of type 2Ic were dated, this cannot be confirmed. An overlap is visible between dates for the Maritime Beakers of type 2Ia and the PF and AOO Beakers. Again, the dates are not very certain: the date for the Buinen type-2Ia Beaker was assigned two minuses, and two of the four dates for the Vlaardingen 2Ia Beaker were awarded one minus rating.

For the Veluwe types, Lanting (2007/08: 49) considers it plausible, but difficult to prove, that type 2Id was the first type to occur and type 2If the last, with a chronological overlap of the different types. The  $^{14}\text{C}$  dates again fail to resolve this problem, indeed there is a type-2If vessel that appears to be older than any of the type-2Id vessels. This date, GrA-14840 3850±40 BP, relates to a vessel from Nijmegen. The oldest date for a type-2Id vessel, from Lunteren, is GrN-6332 3790±35 BP. When calibrated, the first date ends up in the wiggle between 2460 and 2200 BC, and the second date in either the same wiggle or that between 2200 and 2020 BC.

The four-phase division defined by Lanting and Drenth (1991) and redefined by Lanting and Van der Plicht (1999/2000) cannot be confirmed by calibrated  $^{14}\text{C}$  dates either. Three of the four phases (phases 1, 2 and 3) turn up on the plateau between 2880 and 2580. Phase 4 may be placed on two plateaus: that between 2620 and 2480 BC and that between 2460 and 2200 BC. The authors were aware of this problem and sought parallels for hammer-axe types that occur both here and in stratified contexts in Jutland, and employed Danish  $^{14}\text{C}$  dates for hammer-axe graves. Lanting and Van der Plicht (1999/2000) also use dendrochronological dates from Switzerland and France to confirm their phases. Although this helps to construct phases, it still remains impossible to confirm the chronology of beaker types.

Drenth and Hogestijn argue that there could not have been a Maritime phase as was suggested in the unilinear model by Lanting and Van der Waals (1976) and Lanting and Van der Plicht (1999/2000). Given the  $^{14}\text{C}$  dates, this notion seems to be correct. The four most reliable dates for type 2Ia, ranging between 3910±30 and 3850±50 BP, all point toward overlaps with PF type 1e, AOO types 2IIb and 2IIc and the oldest Veluwe Beakers. The co-occurrence of Maritime sherds with other types in settlement contexts is hard to test, owing to the minimal publication of these sites.

For the five phases of the northeastern Netherlands and northwestern Germany as proposed by Lanting 2008/09, there are five dates. The first date, for Loonhunebed D-15 GrA-15641 4480±60 BP, is rejected because the dated cremation and the two beakers

clearly did not belong together. Two of the dates are from Oudemolen, the first of which dates stage 3 (GrN-25303 3740±25 BP), but this grave did not contain any ceramics. The second dates stage 4, GrN-25304 3800±30 BP (see appendix 2 'no type'). The final two datings are from Rolde-Volmachtenlaan A and B and are both supposed to date phase 3 (see appendix 2, 'epi-Maritime'): GrA-13602 3880±50 and GrA-11264 3840±50. A total of five dates of which one is rejected and one is unrelated to ceramics is clearly inadequate for firmly dating five phases.

#### 4.2. The two-track model

The two-track model devised by Drenth and Hogestijn (1999 and 2006) is based on the notion that both in the later phase of the SGC and the Early Bronze Age there is a class of fully-decorated and a class of half-decorated beakers. They assume that both these classes must therefore also have been present during the Bell Beaker period. In their 2006 publication they present a series of three graphs (SGC, BBC and Early Bronze Age), in which the vertical extent of the decoration is expressed in percentages against the number of beakers.

The graphs that express the extent of decoration for the SGC and the Early Bronze Age clearly show two groups of beakers. With respect to the graph on the Bell Beaker period, the outcomes are less clear: over 70% of the beakers are fully decorated, only a small class of around 13% of the beakers are less than 75% decorated, and the other beakers are between 76% and 95% decorated.

It is hard to find out from the publication of Drenth and Hogestijn exactly on which beakers these graphs are based. In footnote 50, Drenth and Hogestijn (2006: 55/56) supply each graph with a list of the heights that were measured and a list of publications. The names of the sites, however, were not published. Moreover, there is no link between the measured heights and the sites and/or the beakers from those sites. In all, 140 SGC Beakers were measured, 120 Bell Beakers and just 19 Early Bronze Age beakers.

In order to test the two-track model for all the beakers with  $^{14}\text{C}$  dates that scored one minus or none, the length of the decoration was measured (table 2). Plotting these measurements in bar charts produces the same picture as that published by Drenth and Hogestijn (2006: figs. 8 and 9), based on far fewer vessels. But if the heights of the decoration are compared with the dates, a completely different picture arises (fig. 2). It shows that at the start of the SGC the vessels had short decoration. In the period when PF and AOO Beakers occur together, there are two classes of decoration and during the BB period all vessels are almost fully decorated. Drenth and Hogestijn (1999: 110) already admitted that it is hard to find examples of half-decorated beakers from the BB period. There are no examples of such beakers with secure dates. Hybrid beakers, combining features of both half-decorated and

Table 2. Vessels and percentage of decoration.

<i>Vessel</i>	<i>Minuses</i>	<i>Type</i>	<i>Decoration</i>	<i>Date</i>
Silvolde	1	1a	50%	4270±70 BP
Ede-Hotel Bosbeek	0	1a	66%	4165±55 BP
Eext-tumulus visplas	1	ZZ	67%	4145±30 BP
Anlo-veekraal grave B	0	2IIb	99%	4140±70 BP
Witrijt	0	2IIc	97%	4035±55 BP
Hijkerveld-grave V	1	1b	65%	3970±35 BP
Odoorn-Esserveld	0	1a	31%	3955±50 BP
Eext-Bergakkers	0	1b	43%	3945±40 BP
Rolde-Volmachtenlaan A	0	epi-Maritime	100%	3880±50 BP
Annertol-tumulus III	0	no type	67%	3870±35 BP
Nijmegen	0	2If	97%	3850±40 BP
Rolde-Volmachtenlaan B	0	epi-Maritime	100%	3840±50 BP
Bennekom	0	2Ie	76%	3820±35 BP
Bennekom	0	2Ie	81%	3820±35 BP
Oudemolen-tumulus 13 period 1	0	no type	100%	3800±30 BP 3725±35 BP
Lunteren	0	2Id	98%	3790±35 BP
Beuningen-Hogewald	0	Veluwe	98%	3765±45 BP
Molenaarsgraaf	0	2If	95%	3665±40 BP

Vessels are illustrated in the following publications: Silvolde: Bantelmann *et al.*, 1979/80; Ede-Hotel Bosbeek: Moderman, 1954; Eext-tumulus visplas: Furholt, 2003; Anlo-veekraal grave B: Waterbolk, 1960; Witrijt: Beex, 1957; Hijkerveld-grave V: Furholt, 2003; Odoorn-Esserveld: Archive BAI; Eext-Bergakkers: Jager, 1985; Rolde-Volmachtenlaan A: Lanting, 2007/08; Annertol-tumulus III: Butler, Lanting & Van der Waals, 1972; Nijmegen: Drenth & Hogestijn, 2006; Rolde-Volmachtenlaan B: Van Giffen, 1954; Bennekom: Clarke, 1970; Oudemolen-tumulus 13 period 1: Butler & Van der Waals, 1966; Beuningen-Hogewald: Ufkes, 2006; Molenaarsgraaf: Louwe Kooijmans, 1974.

The associated dates are discussed in: Lanting & Van der Plicht, 1999/2000; Lanting & Van der Waals, 1976; Drenth & Hogestijn, 2006; Lanting, 2007/08.

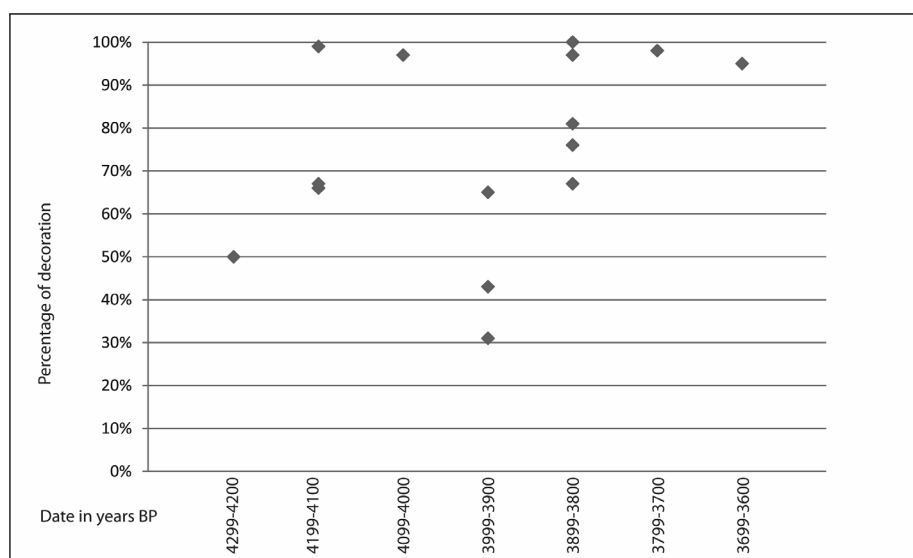


Fig. 2. Percentages of decoration over time (Illustration S.M. Beckerman, RUG/GIA) (based on the same vessels as table 2).

fully-decorated beakers, also seem to be absent among the well-dated beakers.

The zone-contraction hypothesis is criticised by Drenth and Hogestijn (1999: 110). Type 2Ib is not seen as a derivative of the Maritime Beakers, but as a derivative of PF Beakers with or without zoned decoration. Drenth and Hogestijn (1999) have problems categorizing the type-2Ic Beakers. This is hard to test with  $^{14}\text{C}$  dates: type 2Ib only has one rejected date and type 2Ic was not dated at all.

Drenth and Hogestijn (1999) state that the SGC-settlement sites in Noord-Holland yielded valuable finds for understanding the origin of different types. Zeewijk-West and Aartswoud are, according to Drenth and Hogestijn (2006: 79), very important for understanding the beginning of Bell Beakers, because, next to SGC and AOO types, also sherds with zoned decoration were found there. The site of Sijbekarspel-De Veken yielded AOO Beakers and sherds of probably Maritime or epi-Maritime Beakers (Drenth & Hogestijn, 1999: 103). Drenth and Hogestijn (2006: 73) also especially mention the site of Molenkolk-1, since at this site two sherds of Bell Beaker ceramics were found with zoned decoration consisting of coupled half herringbones, applied with a notched or ridged spatula (*ibid.*: 73). The sherds are related to the Maritime decoration style but both the extent of the decorated and undecorated zones and the incipient zone contraction makes them no 'pure' representatives of this style. These sherds were surface finds. Furthermore, the sites of Mienakker, Zeewijk-West and Aartswoud yielded plain pots that resemble Veluwe shapes (*ibid.*: 89). However, all these sites are insufficiently published and the relation of the dated samples to the ceramics is not made explicit.

#### 4.3. Further research

The question whether either of the two chronological models was correct, was raised at the start of a new study of the ceramics from SGC-settlement sites in Noord-Holland. The current study demonstrates that with the knowledge of today it is impossible to decide whether either of the models is indeed correct. However, it has also become clear that the settlement sites in Noord-Holland can indeed be the basis of enhanced understanding of the chronology and the different contexts in which these ceramics occur. At a number of these sites PF Beakers and AOO Beakers occur together and possibly even early Bell Beakers or Bell Beaker traits are encountered (Drenth & Hogestijn, 2006). Of special interest are the sites of Zandwerven and Aartswoud. The stratified site of Zandwerven seems to represent one of the oldest SGC habitations known (Van Giffen, 1930; Van der Waals & Glasbergen, 1956; Van Regteren Altena & Bakker, 1966 and appendix 2). In some spits at the stratified site of Aartswoud only PF Beakers were found, while in some higher-up spits PF and AOO Beakers occurred together

(Van Regteren Altena & Bakker, 1966; Iterson Scholten & De Vries-Metz, 1981). This site may therefore contribute to our understanding of the advent of the AOO Beakers. To further our understanding of both, we can analyse the chronology and the life of the SGC people on these sites when studying larger as well as smaller settlements, such as the larger Zeewijk-West site and the smaller sites of Mienakker and Sijbekarspel-De Veken.

Besides the decoration and morphological characteristics, also the technological features need to be studied. Attention should be given to finding (chronological) trends that also can be identified at the level of the individual sherd. These characteristics might make it possible to find new chronologically relevant traits, as well as to interpret and date sites that yield only small fragments.

## 5. CONCLUSION

After testing the different propositions on which the competing chronological models are based, we must conclude that it is impossible to prove whether either of these models is indeed fully correct. Due to the reliance on funerary contexts, co-occurrences of different vessel types can be rarely used. It must also be concluded that for this period  $^{14}\text{C}$  dates cannot be used to confirm the relative chronology. The  $^{14}\text{C}$  dates may suffer from old-wood effect, reservoir effect, poor sample quality, inadequate sample preparation, and no or uncertain relations of the dated to the archaeological material. Almost half (73) of the dates had to be rejected and another 50 dates suffered to a lesser extent from problems of reliability. Only 35 unaffected dates are available for these periods (appendix 1). But since the calibration curve for these periods shows broad wiggles, calibrated dates show huge overlaps in time (INTCAL09; Furholt, 2003: 15).

The main proposition of the two-track model, that both in the (late) SGC and the BBC there is a class of half-decorated and a class of fully-decorated beakers, is not supported by the reliable subset of  $^{14}\text{C}$  dates. In the late SGC these two classes are in evidence, but for the Bell Beaker period this could not be proved. A co-occurrence of Maritime Beakers and other beaker types in settlement contexts is hard to confirm, owing to sparse publication. Two other aspects of the two-track model, viz. the zone-contraction hypothesis and the notion that the genesis of Veluwe Beakers can be sought on SGC-settlement sites could not be tested either.

The  $^{14}\text{C}$  dates are in line with the proposed chronological development from PF to AOO to Bell Beakers. However, the position of AOO Beakers remains unclear. Furholt (2003) concluded that such vessels were already present in the earliest phase of the SGC. This does not seem likely, since the early Zandwerven site yielded only PF Beakers and at the site of Aartswoud one of the layers contained none but PF Beakers, whereas a higher spit contained beakers of both groups (Van Regteren Altena &

Bakker, 1966; Iterson Scholten & De Vries-Metz, 1981). Co-occurrence of PF and AOO types in graves (Lanting & Van der Waals, 1976: table 1) and in settlements (Drenth & Hogestijn, 2006) also indicates an overlap in time. On the basis of one  $^{14}\text{C}$  date, the PF Beakers seem even to outlive the AOO Beakers; this dating, however, does carry one minus. The start of the Bell Beakers too is unclear; the  $^{14}\text{C}$  dates point towards an overlap of the Maritime types and PF and AOO Beakers. A Maritime phase with just Maritime Beakers is indeed unlikely, judging by the  $^{14}\text{C}$  dates that show an overlap with PF and AOO Beakers as well as Veluwe types. The ordering of the various PF, AOO and Bell Beaker types and the different proposed trends governing their development cannot be tested with the  $^{14}\text{C}$  dates either. Some types that are crucial to this ordering (2IIa, 2IIc, 2Ib and 2Ic) are not reliably dated at all. In some instances, the available dates are in contradiction with the proposed ordering.

The research currently conducted at the group of settlement sites in Noord-Holland sites may offer a solution to the described problems with the chronology of the SGC and BBC: at these sites more types may appear in association, and two sites, Zandwerven and Aartswoud, offer the prospect of stratified finds.

## 6. NOTE

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APPENDIX 1. CORPUS OF <sup>14</sup>C DATES

This catalogue presents all the <sup>14</sup>C-dates for the beaker periods in the Netherlands. For every date basic information is given on the identification number, the site name, the type of site, the dated material, the culture, the associated ceramics and other finds and the literature in which the date is presented. Moreover, this catalogue presents the problems affecting the reliability of these dates.

## LITERATURE:

LW	=	Lanting & Van der Waals, 1976
LP	=	Lanting & Van der Plicht, 1999/2000
L	=	Lanting, 2007/08
H	=	Hogestijn, 1997
DH	=	Drenth & Hogestijn, 2006
M	=	Müller <i>et al.</i> , 2008
B	=	Bulten <i>et al.</i> , 2002
C	=	Carmiggelt <i>et al.</i> , 2011

## COLOUR CODES:

Date = no problems

— = one minus

— = two minuses or more

**Identification number:** GrA-100  
 Date: 4130±30 BP  
 Site name: Molenkolk 2  
 Type of site: Settlement  
 Dated material: Charred reed  
 Culture: SGC  
 Associated ceramics: ?  
 Other associated finds: ?  
 Literature: LP: 78; H: 27

Problems with the date:  
 1. settlement ceramics: —

**Identification number:** GrA-103  
 Date: 3910±30 BP  
 Site name: Molenkolk 1  
 Type of site: Settlement  
 Dated material: Charred reed  
 Culture: SGC  
 Associated ceramics: ?  
 Other associated finds: ?  
 Literature: LW: 40-41; LP: 82-83; L: 38 and 53

Problems with the date:  
 1. settlement ceramics: —

**Identification number:** GrA-101  
 Date: 3890±70 BP  
 Site name: Portelwoid  
 Type of site: Settlement  
 Dated material: Charred reed  
 Culture: SGC  
 Associated ceramics: ?  
 Other associated finds: ?  
 Literature: LP: 78; L: 38; H: 27

Problems with the date:  
 1. settlement ceramics: —

**Identification number:** GrA-104  
 Date: 4070±30 BP  
 Site name: Maantjesland  
 Type of site: Settlement  
 Dated material: Charred hazelnut shells  
 Culture: SGC  
 Associated ceramics: ?  
 Other associated finds: ?  
 Literature: LP: 78; H: 27

Problems with the date:  
 1. settlement ceramics: —

Date — = one minus

— = two minuses or more

**Identification number:** GrA-107  
**Date:** 3960±30 BP  
**Site name:** Sijbekarspel-De Veken  
**Type of site:** Settlement  
**Dated material:** Charred hazelnut shells  
**Culture:** SGC  
**Associated ceramics:** 2IIa/2Ia  
**Other associated finds:** ?  
**Literature:** LP: 78; L: 38; H: 27; DH: 72  
**Problems with the date:** none

**Identification number:** GrA-114  
**Date:** 4140±40 BP  
**Site name:** Zeewijk-west  
**Type of site:** Settlement  
**Dated material:** Charred twigs  
**Culture:** SGC  
**Associated ceramics:** ?  
**Other associated finds:** ?  
**Literature:** LP: 79; H: 27; DH: 74  
**Problems with the date:**  
 1. settlement ceramics: —

**Identification number:** GrA-108  
**Date:** 4130±40 BP  
**Site name:** Hoogwoud-Mienakker  
**Type of site:** Settlement  
**Dated material:** Charred reed  
**Culture:** SGC  
**Associated ceramics:** ?  
**Other associated finds:** ?  
**Literature:** LP: 78-79; H: 27  
**Problems with the date:**  
 1. settlement ceramics: —

**Identification number:** GrA-116  
**Date:** 4320±60 BP  
**Site name:** Zandwerven  
**Type of site:** Settlement  
**Dated material:** Residue on sherd  
**Culture:** SGC  
**Associated ceramics:** ?  
**Other associated finds:** ?  
**Literature:** LP: 78; H: 27  
**Problems with the date:**  
 1. reservoir effect: —

**Identification number:** GrA-109  
**Date:** 4100±30 BP  
**Site name:** Hoogwoud-Mienakker  
**Type of site:** Settlement  
**Dated material:** Charred reed  
**Culture:** SGC  
**Associated ceramics:** ?  
**Other associated finds:** ?  
**Literature:** LP: 78-79; H: 27  
**Problems with the date:**  
 1. settlement ceramics: —

**Identification number:** GrA-118  
**Date:** 4220±30 BP  
**Site name:** Zandwerven  
**Type of site:** Settlement  
**Dated material:** Charred twigs  
**Culture:** SGC  
**Associated ceramics:** ?  
**Other associated finds:** ?  
**Literature:** LP: 78; H: 27  
**Problems with the date:**  
 1. settlement ceramics: —

**Identification number:** GrA-110  
**Date:** 4120±30 BP  
**Site name:** Hoogwoud-Mienakker  
**Type of site:** Settlement  
**Dated material:** Charred reed  
**Culture:** SGC  
**Associated ceramics:** ?  
**Other associated finds:** ?  
**Literature:** LP: 78-79; H: 27  
**Problems with the date:**  
 1. settlement ceramics: —

**Identification number:** GrN-318  
**Date:** 4435±320  
**Site name:** Schaarsbergen tumulus 1  
**Type of site:** grave  
**Dated material:** SGC  
**Culture:** Charcoal  
**Associated ceramics:** 1a  
**Other associated finds:** flint blade, flint axe  
**Literature:** LW: 40-41; LP: 82-83; L: 38 and 53  
**Problems with the date:**  
 Abnormal date: —

**Identification number:** GrA-112  
 Date: 4030±30 BP  
 Site name: Zeewijk-west  
 Type of site: Settlement  
 Dated material: Charred reed  
 Culture: SGC  
 Associated ceramics: ?  
 Other associated finds: ?  
 Literature: LP: 79; H: 27; DH: 74  
 Problems with the date:  
 1. settlement ceramics: —

**Identification number:** GrA-113  
 Date: 4150±30 BP  
 Site name: Zeewijk-west  
 Type of site: Settlement  
 Dated material: Charred reed  
 Culture: SGC  
 Associated ceramics: ?  
 Other associated finds: ?  
 Literature: LP: 79; H: 27; DH: 74  
 Problems with the date:  
 1. settlement ceramics: —

**Identification number:** GrN-946  
 Date: 3880±50 BP  
 Site name: Eext-Schaapdijksweg, tumulus b  
 Type of site: Grave  
 Dated material: Charcoal (from the hill)  
 Culture: SGC  
 Associated ceramics: ZZ  
 Other associated finds: GP dagger, H-hammer  
 Literature: LW: 40; LP: 76  
 Problems with the date:  
 1. t.a.q: —

**Identification number:** GrN-1676  
 Date: 3775±55 BP  
 Site name: Eext-Ketenberg  
 Type of site: Grave  
 Dated material: Charcoal (probably from bottom of coffin)  
 Culture: BBC  
 Associated ceramics: ?  
 Other associated finds: ?  
 Literature: LP: 94  
 Problems with the date:  
 1. Old wood effect: —  
 2. No ceramics: — —

**Identification number:** GrN-851  
 Date: 4140±70 BP  
 Site name: Anlo-veekraal grave B  
 Type of site: Grave  
 Dated material: Charcoal (charred coffin wall)  
 Culture: SGC  
 Associated ceramics: 2IIB  
 Other associated finds: x  
 Literature: LW: 40; LP: 79  
 Problems with the date: none

**Identification number:** GrN-939  
 Date: 3885±65 BP  
 Site name: Eext-Schaapdijksweg, tumulus b  
 Type of site: Grave  
 Dated material: Charcoal (from the hill)  
 Culture: SGC  
 Associated ceramics: ZZ  
 Other associated finds: GP dagger, H-hammer  
 Literature: LW: 40; LP: 76  
 Problems with the date:  
 1. t.a.q: —

**Identification number:** UtC-1946  
 Date: 3870±60 BP  
 Site name: Schokland P14-grave 4  
 Type of site: Grave  
 Dated material: Bone  
 Culture: SGC  
 Associated ceramics: x  
 Other associated finds: x  
 Literature: LP: 77  
 Problems with the date:  
 1. Sample tPreatment: — —  
 2. No ceramics: — —

**Identification number:** UtC-1948  
 Date: 3740±50 BP  
 Site name: Schokland P14-grave 3  
 Type of site: Grave  
 Dated material: Bone  
 Culture: SGC  
 Associated ceramics: x  
 Other associated finds: x  
 Literature: LP: 77  
 Problems with the date:  
 1. Sample treatment: — —  
 2. No ceramics: — —

<b>Identification number:</b>	GrN-1855	<b>Identification number:</b>	UtC-1949
Date:	4420±55BP	Date:	3910±50 BP
Site name:	Anlo-veekraal grave E	Site name:	Schokland P14-grave 10
Type of site:	Grave	Type of site:	Grave
Dated material:	Charcoal (from coffin)	Dated material:	LP: 77
Culture:	SGC	Culture:	SGC
Associated ceramics:	1a	Associated ceramics:	x
Other associated finds:	x	Other associated finds:	x
Literature:	LW: 39; LP: 75	Literature:	LP: 77
Problems with the date:		Problems with the date:	
1. Old wood effect:	— —	1. Bad sample quality:	— —
		2. No ceramics:	— —
<b>Identification number:</b>	UtC-1941	<b>Identification number:</b>	UtC-1950
Date:	3760±70 BP	Date:	3640±100 BP
Site name:	Schokland P14-grave 7	Site name:	Schokland P14-grave 12
Type of site:	Grave	Type of site:	Grave
Dated material:	Dentine	Dated material:	DBone
Culture:	SGC	Culture:	SGC
Associated ceramics:	x	Associated ceramics:	x
Other associated finds:	x	Other associated finds:	x
Literature:	LP: 77	Literature:	LP: 79; H: 27 and 40-41
Problems with the date:		Problems with the date:	
1. Sample treatment:	— —	1. Sample treatment:	— —
2. No ceramics:	— —	2. No ceramics:	— —
<b>Identification number:</b>	UtC-1945	<b>Identification number:</b>	GrN-1965
Date:	4040±70 BP	Date:	4195±70
Site name:	Schokland P14-grave 9	Site name:	Anlo-veekraal, grave A
Type of site:	Grave	Type of site:	Grave
Dated material:	Bone	Dated material:	Charcoal (charred coffin wall)
Culture:	SGC	Culture:	SGC
Associated ceramics:	x	Associated ceramics:	x
Other associated finds:	x	Other associated finds:	x
Literature:	LP: 77	Literature:	
Problems with the date:		Problems with the date:	LP: 80
1. Sample treatment:	— —	1. No ceramics:	— —
2. No ceramics:	— —		
<b>Identification number:</b>	GrN-1967	<b>Identification number:</b>	GrN-2306
Date:	39655±50	Date:	4410±100 BP
Site name:	Anlo-veekraal, grave C	Site name:	Vlaardingen
Type of site:	Grave	Type of site:	Settlement
Dated material:	Charcoal (pit dug into grave)	Dated material:	?
Culture:	SGC	Culture:	SGC
Associated ceramics:	2IIIb	Associated ceramics:	x
Other associated finds:	x	Other associated finds:	x
Literature:	LW: 40; LP: 80	Literature:	LW: 39; LP: 78
Problems with the date:		Problems with the date:	
1. t.a.q:	—	1. Sample treatment:	—
		2. No ceramics:	— —
		3. Relation uncertain:	—

**Identification number:** GrN-2158  
 Date: 3910±30  
 Site name: Vlaardingen  
 Type of site: Settlement  
 Dated material: Charcoal (cult layer trench 9)  
 Culture: BBC  
 Associated ceramics: 2Ia  
 Other associated finds: x  
 Literature: LP: 78; L: L: 38; H: 27; DH: 73

Problems with the date:

. Sample treatment: —

**Identification number:** GrN-2221  
 Date: 4000±65 BP  
 Site name: Zandwerven  
 Type of site: Settlement  
 Dated material: Charcoal (pit basis of cultural layer)  
 Culture: SGC  
 Associated ceramics: ?  
 Other associated finds: ?  
 Literature: LP: 78

Problems with the date:

1. Settlement ceramics: —

**Identification number:** GrN-2303  
 Date: 4330±60 BP  
 Site name: Vlaardingen  
 Type of site: Settlement  
 Dated material: ?  
 Culture: SGC  
 Associated ceramics: x  
 Other associated finds: x  
 Literature: LW: 39; LP: 78

Problems with the date:

1. Sample treatment: —

2. No ceramics: — —

3. Relation uncertain: —

**Identification number:** GrN-2304  
 Date: 4250±75 BP  
 Site name: Vlaardingen  
 Type of site: Settlement  
 Dated material: ?  
 Culture: SGC  
 Associated ceramics: x  
 Other associated finds: A-hammer  
 Literature: LW: 39; LP: 78

Problems with the date:

1. Sample treatment: —

2. No ceramics: — —

3. Relation uncertain: —

**Identification number:** GrN-2388  
 Date: 3910±55 BP  
 Site name: Mander, tumulus 1958-I  
 Type of site: Grave  
 Dated material: Charcoal (from coffin)  
 Culture: BBC  
 Associated ceramics: x  
 Other associated finds: x  
 Literature: LP: 94

Problems with the date:

1. Old wood effect: —

2. No ceramics: — —

**Identification number:** GrN-2419  
 Date: 3910±100 BP  
 Site name: Vlaardingen  
 Type of site: Settlement  
 Dated material: Charcoal (cultural layer)  
 Culture: BBC  
 Associated ceramics: 2Ia  
 Other associated finds: x  
 Literature: LW: 40-41; LP: 82-83; L: 38 and 53

Problems with the date:

none

**Identification number:** GrN-2480  
 Date: 4410±100 BP  
 Site name: Vlaardingen  
 Type of site: Settlement  
 Dated material: ?  
 Culture: SGC  
 Associated ceramics: x  
 Other associated finds: x  
 Literature: LW: 39; LP: 78

Problems with the date:

1. Sample treatment: —

2. No ceramics: — —

3. t.a.q: —

**Identification number:** GrN-2481  
 Date: 3860±110 BP  
 Site name: Vlaardingen  
 Type of site: Settlement  
 Dated material: Wood (outermost 5 rings of pole)  
 Culture: BBC  
 Associated ceramics: 2Ia  
 Other associated finds: x  
 Literature: LW: 40-41; LP: 82-83; L: 38 and 53

Problems with the date:

none

<b>Identification number:</b>	GrN-2487	<b>Identification number:</b>	GrN-4114
Date:	4280±100 BP	Date:	4420±120 BP
Site name:	Vlaardingen	Site name:	Vlaardingen
Type of site:	Settlement	Type of site:	Settlement
Dated material:	?	Dated material:	charcoal (cultural layer, trench 9)
Culture:	SGC	Culture:	BBC
Associated ceramics:	x	Associated ceramics:	x
Other associated finds:	A-hammer	Other associated finds:	A-hammer
Literature:	LW: 39; LP: 78	Literature:	LW: 39; LP: 78
Problems with the date:		Problems with the date:	
1. Sample treatment:	—	1. No ceramics:	— —
2. No ceramics:	— —	2. Relation uncertain:	—
3. Relation uncertain:	—		
<b>Identification number:</b>	GrN-2969	<b>Identification number:</b>	GrN-4635
Date:	3660±55 BP	Date:	3685±40 BP
Site name:	Mander	Site name:	Haarlem-Schoterweg
Type of site:	Grave	Type of site:	Settlement
Dated material:	Charcoal (from stone coffin)	Dated material:	Peat
Culture:	BBC	Culture:	BBC
Associated ceramics:	x	Associated ceramics:	Bell Beaker and Neck Potbeaker (sherds)
Other associated finds:	x	Other associated finds:	x
Literature:	LP: 94; L: 66	Literature:	LP: 91; L: 54
Problems with the date:		Problems with the date:	
1. No ceramics:	— —	1. Relation uncertain:	—
<b>Identification number:</b>	GrN-2982	<b>Identification number:</b>	GrN-4908
Date:	3620±70 BP	Date:	3980±60 BP
Site name:	Mander, tumulus 1958-I	Site name:	Voorschoten-Boschgeest
Type of site:	Grave	Type of site:	Settlement
Dated material:	Charcoal (from the grave)	Dated material:	Charcoal (layer 10)
Culture:	BBC	Culture:	Vlaardingen and SGC
Associated ceramics:	x	Associated ceramics:	1a, 1b, 1d, 2IIb (sherds)
Other associated finds:	Flint knife	Other associated finds:	x
Literature:	LP: 93; L: 66	Literature:	LW: 40; LP: 79
Problems with the date:		Problems with the date:	none
1. No ceramics:	— —		
<b>Identification number:</b>	GrN-2996	<b>Identification number:</b>	GrN-4948
Date:	3705±80 BP	Date:	4130±40 BP
Site name:	St. Walrick-tumulus I	Site name:	Vlaardingen
Type of site:	Grave	Type of site:	Settlement
Dated material:	Charcoal (grave 2 or 3)	Dated material:	?
Culture:	BBC	Culture:	SGC
Associated ceramics:	x	Associated ceramics:	a-typical SGC amphora
Other associated finds:	x	Other associated finds:	x
Literature:	LP: 88-90	Literature:	LP: 78
Problems with the date:		Problems with the date:	
1. No ceramics:	— —	1. t.a.q.:	—

**Identification number:** GrN-3097  
**Date:** 3850±50 BP  
**Site name:** Vlaardingen  
**Type of site:** Settlement  
**Dated material:** charcoal (cultural layer, trench 9)  
**Culture:** BBC  
**Associated ceramics:** 2Ia  
**Other associated finds:** x  
**Literature:** LW: 40-41; LP: 82-83; L: 38 and 53  
**Problems with the date:**  
 1. Sample treatment: —

**Identification number:** GrN-5131  
**Date:** 3665±40 BP  
**Site name:** Molenaarsgraaf  
**Type of site:** Grave  
**Dated material:** Collagen (femur)  
**Culture:** BBC  
**Associated ceramics:** Veluwe, 2If  
**Other associated finds:** x  
**Literature:** LW: 41. LP: 85; L: 53  
**Problems with the date:** none

**Identification number:** GrN-5132  
**Date:** 3780±50 BP  
**Site name:** Molenaarsgraaf  
**Type of site:** Grave  
**Dated material:** Charcoal (from pit)  
**Culture:** BBC  
**Associated ceramics:** Two sherds  
**Other associated finds:** x  
**Literature:** LP: 91  
**Problems with the date:**  
 1. Old wood effect: —

**Identification number:** GrN-5295  
**Date:** 3930±50 BP  
**Site name:** Bornwerd  
**Type of site:** Settlement  
**Dated material:** Peat (covering prehistoric field)  
**Culture:** SGC  
**Associated ceramics:** SGC and TRB sherds  
**Other associated finds:** x  
**Literature:** LP: 79  
**Problems with the date:** none

**Identification number:** GrN-5068  
**Date:** 3955±50 BP  
**Site name:** Odoorn-Eesserveld  
**Type of site:** Settlement  
**Dated material:** Charred grain  
**Culture:** SGC  
**Associated ceramics:** 1a, 1c, *Wellenbandpot*  
**Other associated finds:** x  
**Literature:** LW: 40; LP: 79  
**Problems with the date:** none

**Identification number:** GrN-5988  
**Date:** 5045±75 BP  
**Site name:** Swalemen-tumulus Bosheide 1  
**Type of site:** Grave  
**Dated material:** Charcoal (scattered from filling of ditch around grave)  
**Culture:** SGC  
**Associated ceramics:** 1d  
**Other associated finds:** Flint blade  
**Literature:** LW: 41; LP: 77  
**Problems with the date:**  
 1. Old wood effect: — —

**Identification number:** GrN-6126  
**Date:** 3970±35 BP  
**Site name:** Hijkerveld-grave V  
**Type of site:** Grave  
**Dated material:** Charcoal (from grave)  
**Culture:** SGC  
**Associated ceramics:** 1b  
**Other associated finds:** Flint axe, flint blade and E-hammer  
**Literature:** LW: 39; LP: 75  
**Problems with the date:**  
 1. Relation uncertain: —

**Identification number:** GrN-6127  
**Date:** 4055±555 BP  
**Site name:** De Eese tumulus IV, period 1  
**Type of site:** Grave  
**Dated material:** Charcoal (ditch around tumulus)  
**Culture:** BBC  
**Associated ceramics:** 2Ia  
**Other associated finds:** x  
**Literature:** LW: 40-41; LP: 83  
**Problems with the date:**  
 1. Relation uncertain: —  
 2. t.p.q: —



<b>Identification number:</b>	GrN-5497	<b>Identification number:</b>	GrN-6127
Date:	3915±45 BP	Date:	4055±555 BP
Site name:	Vaassen	Site name:	De Eese tumulus IV, period 1
Type of site:	Settlement	Type of site:	Grave
Dated material:	Charcoal (dispersed under Celticfield)	Dated material:	Charcoal (ditch around tumulus)
Culture:	BBC	Culture:	SGC
Associated ceramics:	Potbeaker (sherds)	Associated ceramics:	x
Other associated finds:	x	Other associated finds:	x
Literature:	LP: 91	Literature:	LP: 76
Problems with the date:		Problems with the date:	
1. Relation uncertain:	—	1. No ceramics:	— —
<b>Identification number:</b>	GrN-5705	<b>Identification number:</b>	GrN-6128
Date:	3635±60 BP	Date:	4035±55 BP
Site name:	Molenaarsgraaf	Site name:	Witrijt
Type of site:	Settlement	Type of site:	Grave
Dated material:	Charcoal (from pit)	Dated material:	Charcoal (presumably from charred pole in ditch around grave)
Culture:	BBC	Culture:	SGC
Associated ceramics:	Veluwe and other sherd	Associated ceramics:	2IIC
Other associated finds:	x	Other associated finds:	GP dagger
Literature:	LP: 91	Literature:	LW: 40; LP: 80
Problems with the date:		Problems with the date:	none
1. Relation uncertain:	— —		
<b>Identification number:</b>	GrN-6129	<b>Identification number:</b>	GrN-6212
Date:	4165±55 BP	Date:	3630±35 BP
Site name:	Ede-Hotel Bosbeek	Site name:	Hazendonk (2)
Type of site:	Grave	Type of site:	Settlement
Dated material:	Charcoal (from grave pit)	Dated material:	Peat (zone 5)
Culture:	SGC	Culture:	BBC
Associated ceramics:	1a	Associated ceramics:	Veluwe and Barbed wire ceramics
Other associated finds:	Flint blade, hammer type 1	Other associated finds:	x
Literature:	LW: 39; LP: 75	Literature:	LP: 91
Problems with the date:	none	Problems with the date:	none
<b>Identification number:</b>	GrN-6145	<b>Identification number:</b>	GrN-6225
Date:	3665±35 BP	Date:	3705±35 BP
Site name:	St. Warick-tumulus	Site name:	Oudemolen, tumulus 13, period 2
Type of site:	Grave	Type of site:	Grave
Dated material:	Charcoal (from grave)	Dated material:	Charcoal (from coffin)
Culture:	BBC	Culture:	BBC
Associated ceramics:	Veluwe, 2Ie	Associated ceramics:	x
Other associated finds:	Schleifennadel	Other associated finds:	x
Literature:	LW: 41; LP: 88-90	Literature:	LP: 92; L: 58; DH: 53
Problems with the date:		Problems with the date:	
1. t.a.q:	—	1. No ceramics:	— —

**Identification number:** GrN-6146  
**Date:** 3725±35 BP  
**Site name:** Oudemolen-tumulus 13, period 1  
**Type of site:** Grave  
**Dated material:** Charcoal (from coffin)  
**Culture:** BBC  
**Associated ceramics:** Bell beaker (highly decorated sherds) and small undecorated beaker  
**Other associated finds:** x  
**Literature:** LP: 92; L: 58; DH: 53  
**Problems with the date:** none

**Identification number:** GrN-6261  
**Date:** 3665±35 BP  
**Site name:** Hijken-Hooghalen, tumulus I  
**Type of site:** Grave  
**Dated material:** Charcoal (from coffin)  
**Culture:** BBC  
**Associated ceramics:** x  
**Other associated finds:** x  
**Literature:** LP: 94  
**Problems with the date:**  
 1. No ceramics: —

**Identification number:** GrN-6152  
**Date:** 3945±35 BP  
**Site name:** Buinen  
**Type of site:** Grave  
**Dated material:** Charcoal (from surface directly under burial)  
**Culture:** BBC  
**Associated ceramics:** 2Ia  
**Other associated finds:** x  
**Literature:** LW: 40; LP: 82; L: 38 and 58  
**Problems with the date:**  
 1. Sample treatment: —  
 2. Relation uncertain: —

**Identification number:** GrN-6295  
**Date:** 4495±60 BP  
**Site name:** Hijkerfeld-grave I  
**Type of site:** Grave  
**Dated material:** Charcoal (dispersed, from posthole in ditch around the grave)  
**Culture:** SGC  
**Associated ceramics:** 1a  
**Other associated finds:** Flint blade, A3 hammer, grinding stone  
**Literature:** LW: 39; LP: 75  
**Problems with the date:**  
 1. Sample treatment: —  
 2. Old wood effect: —  
 3. Relation uncertain: —

**Identification number:** GrN-6155  
**Date:** 3820±35 BP  
**Site name:** Bennekom  
**Type of site:** Grave  
**Dated material:** Charcoal (concentration in grave pit)  
**Culture:** BBC  
**Associated ceramics:** Veluwe 2Ie (two)  
**Other associated finds:** x  
**Literature:** LW: 41; LP: 85; L: 54  
**Problems with the date:** none

**Identification number:** GrN-6332  
**Date:** 3790±35 BP  
**Site name:** Lunteren  
**Type of site:** Grave  
**Dated material:** Charred twigs (from ditch surrounding grave)  
**Culture:** BBC  
**Associated ceramics:** Veluwe, 2If  
**Other associated finds:** Copper tongue dagger, wrist guard, arrowhead (seven), strike a light, iron stone  
**Literature:** LW: 41; LP: 85; L: 53; DH: 127  
**Problems with the date:** none

<b>Identification number:</b>	GrN-6340	<b>Identification number:</b>	GrN-6367
Date:	3760±35 BP	Date:	3670±35 BP
Site name:	Eext-Kerkweg 3	Site name:	Eext-Kerkweg 2
Type of site:	Grave	Type of site:	Grave
Dated material:	Charcoal (from coffin)	Dated material:	Charcoal (from coffin)
Culture:	BBC	Culture:	BBC
Associated ceramics:	x	Associated ceramics:	Barbwire beaker
Other associated finds:	Hammer type Emmen, small hammer with unfinished perforation	Other associated finds:	Triangular flat flint flake
Literature:	LP: 93; L: 66	Literature:	LW: 41; LP: 93; L: 66
Problems with the date:		Problems with the date:	
1. No ceramics:	—	1. Relation uncertain:	—
<b>Identification number:</b>	GrN-6349	<b>Identification number:</b>	GrN-6368
Date:	3945±40 BP	Date:	3935±35 BP
Site name:	Eext-Bergakkers	Site name:	Eext-Galgwanderveen, tumulus 3
Type of site:	Grave	Type of site:	Grave
Dated material:	Charcoal (from coffin)	Dated material:	Charcoal (from coffin)
Culture:	SGC	Culture:	SGC
Associated ceramics:	1b	Associated ceramics:	1d
Other associated finds:	Heavy flint blade/flint knife	Other associated finds:	GP dagger, flint axe, H-hammer
Literature:	LW: 39; LP: 75; DH: 82	Literature:	LW: 39; LP: 75; L: 38
Problems with the date:	none	Problems with the date:	None
<b>Identification number:</b>	GrN-6350	<b>Identification number:</b>	GrN-6369
Date:	3955±55 BP	Date:	4165±40 BP
Site name:	Stroe	Site name:	Vaassen-tumulus 1941-III
Type of site:	Grave	Type of site:	Grave
Dated material:	Charcoal (from old surface under burial mound)	Dated material:	Charred branches (from ditch around grave)
Culture:	SGC/BBC	Culture:	SGC
Associated ceramics:	Late SGC sherds and <i>Golf-bandpot</i> , or t.p.q for Veluwe style Bell Beaker	Associated ceramics:	1a (sherds)
Other associated finds:	wrist guard, copper tongue dagger	Other associated finds:	P2 (C/A) hammer, flint blade, probably green stone axe
Literature:	LW: 41; LP: 87-88; DH: 127	Literature:	LW: 39; LP: 75; L: 38
Problems with the date:		Problems with the date:	None
1. Sample treatment:	—		
2. Relation uncertain:	—		
3. t.p.q.:	—		
<b>Identification number:</b>	GrN-6351	<b>Identification number:</b>	GrN-6384
Date:	4005±30 BP	Date:	3820±45 BP
Site name:	Ermelose heide-tumulus 1	Site name:	Ottoland-Kromme Elleboog
Type of site:	Grave	Type of site:	Grave
Dated material:	Charcoal (from concentration in ditch around grave)	Dated material:	Grave
Culture:	SGC	Culture:	BBC
Associated ceramics:	2IIb (two)	Associated ceramics:	x
Other associated finds:	flint blade	Other associated finds:	x
Literature:	LW: 40; LP: 79	Literature:	LP: 91-92
Problems with the date:	none	Problems with the date:	
		1. No ceramics:	—

Date — = one minus

— = two minuses or more

<b>Identification number:</b>	GrN-6352	<b>Identification number:</b>	GrA-6477
Date:	4290±45 BP	Date:	3640±50 BP
Site name:	Hijkerveld, grave II	Site name:	Oostwoud-De Tuithoorn, tumulus II
Type of site:	Grave	Type of site:	Grave
Dated material:	Charcoal (small pieces, post-holes around grave)	Dated material:	Collagen (secondary grave in mound)
Culture:	SGC	Culture:	BBC
Associated ceramics:	1a	Associated ceramics:	x
Other associated finds:	Flint blade	Other associated finds:	x
Literature:	LW: 39; LP: 75	Literature:	LP: 86-87; DH: 74
Problems with the date:		Problems with the date:	
1. Sample treatment:	—	1. No ceramics:	— —
2. Relation uncertain:	—		
<b>Identification number:</b>	GrN-6635	<b>Identification number:</b>	GrN-6683C
Date:	3940±40 BP	Date:	4385±75 BP
Site name:	Eext-Galgwanderveen, tumulus 3	Site name:	Laren-‘t Bluk, tumulus 6
Type of site:	Grave	Type of site:	Grave
Dated material:	Charcoal (from coffin)	Dated material:	Charcoal (from sod in the mound)
Culture:	SGC	Culture:	SGC
Associated ceramics:	1d	Associated ceramics:	1d
Other associated finds:	GP-dagger, flint axe, H-hammer	Other associated finds:	C-hammer
Literature:	LW: 39; LP: 75; L: 38	Literature:	LW: 39; LP: 75
Problems with the date:	None	Problems with the date:	
		1. Sample treatment:	—
		2. t.p.q:	—
<b>Identification number:</b>	GrN-6643	<b>Identification number:</b>	GrN-6687C
Date:	3870±35 BP	Date:	3870±35 BP
Site name:	Annertol-tumulus III, period 1	Site name:	De Eese-mound 1918 IV
Type of site:	Grave	Type of site:	Grave
Dated material:	Charcoal (from foot of mound)	Dated material:	Charcoal (from slope of primary mound)
Culture:	BBC	Culture:	SGC
Associated ceramics:	Low broad Bell Beaker, (Central grave: undecorated Bell Beaker, little Bell Beaker with Maritime like decoration and another beaker )	Associated ceramics:	1e
Other associated finds:	Amber	Other associated finds:	Flint blade, H/R hammer
Literature:	LW: 40-41; LP: 83; L: 58	Literature:	LW: 39; LP: 75; L: 38
Problems with the date:	None	Problems with the date:	
		1. Relation uncertain:	—

<b>Identification number:</b>	GrN-6644	<b>Identification number:</b>	GrN-6688C
Date:	4160±30 BP	Date:	4155±60 BP
Site name:	Emmen-Angelslo, mound VIII	Site name:	Ede-Ginkelse heide
Type of site:	Grave	Type of site:	Grave
Dated material:	Charcoal (from vertical piece of wood in mound)	Dated material:	Charcoal (from sod in mound)
Culture:	SGC	Culture:	BBC
Associated ceramics:	1e	Associated ceramics:	2Ib
Other associated finds:	x	Other associated finds:	Tongue dagger, wrist guard, arrow heads, strike-a-lights
Literature:	LW: 40; LP: 76	Literature:	LW: 41; LP: 83; DH: 126-127
Problems with the date:		Problems with the date:	
1. Old wood effect:	—	1. Old wood effect:	— —
		2. t.p.q:	—
<b>Identification number:</b>	GrN-6650C	<b>Identification number:</b>	GrN-6711
Date:	3945±55 BP	Date:	3735±35 BP
Site name:	Oostwoud-De Tuithoorn, tumulus II	Site name:	Laaghalerveld-tumulus 1930-I
Type of site:	Grave	Type of site:	Grave
Dated material:	Collagen	Dated material:	Charcoal (from coffin)
Culture:	BBC	Culture:	BBC
Associated ceramics:	Beaker in late maritime style	Associated ceramics:	x
Other associated finds:	x	Other associated finds:	Hammer type <i>Zuidervelde</i> , oval shaped flint knife
Literature:	LP: 86-87; DH: 74	Literature:	LP: 93; L: 66
Problems with the date:		Problems with the date:	
1. Relation uncertain:	—	1. No ceramics:	— —
<b>Identification number:</b>	GrN-6651	<b>Identification number:</b>	GrN-6712
Date:	4040±80 BP	Date:	4065±55 BP
Site name:	Hijkerveld-Grave IV	Site name:	Renkum-Kwadenoord, tumulus A
Type of site:	Grave	Type of site:	Grave
Dated material:	Charcoal	Dated material:	Charcoal (small pieces, from sod of mound)
Culture:	SGC	Culture:	SGC
Associated ceramics:	x	Associated ceramics:	1d
Other associated finds:	Flint blade	Other associated finds:	Heavy flint blade, flint axe, D-hammer
Literature:	LP: 76	Literature:	LW: 39; LP: 75
Problems with the date:		Problems with the date:	
1. Sample treatment:	—	1. t.p.q:	—
2. No ceramics:	— —		
<b>Identification number:</b>	GrN-6724	<b>Identification number:</b>	UtC-6955
Date:	4210±40 BP	Date:	3685±37 BP
Site name:	Noordbarge-Hoge Loo	Site name:	Puttershoek-Sportlaan
Type of site:	Grave	Type of site:	Settlement
Dated material:	Charcoal (from deepest 10 cm of grave pit)	Dated material:	Charcoal
Culture:	SGC	Culture:	BBC
Associated ceramics:	1d	Associated ceramics:	Neck Potbeaker (sherds)
Other associated finds:	x	Other associated finds:	Scrapers (two), flint flakes
Literature:	LP: 77	Literature:	LP: 91; L: 54
Problems with the date:		Problems with the date:	None
1. No ceramics:	— —		

**Identification number:** GrN-6725  
**Date:** 8070±75 BP  
**Site name:** Emmen-Angelslo, flat-grave 15  
**Type of site:** Grave  
**Dated material:** Charcoal (filling of grave pit)

**Culture:** SGC  
**Associated ceramics:** 1d  
**Other associated finds:** x  
**Literature:** LP: 77  
**Problems with the date:**  
 1. Old wood effect: — —

**Identification number:** GrN-7099  
**Date:** 3875±35 BP  
**Site name:** Wageningen  
**Type of site:** Grave  
**Dated material:** Charcoal (charred shelves or bars on top of old surface)  
**Culture:** BBC  
**Associated ceramics:** (Other grave: Veluwe, 2If)  
**Other associated finds:** (Other grave: amber buttons)  
**Literature:** LW: 41; LP: 85  
**Problems with the date:**  
 1. No ceramics: — —

**Identification number:** GrN-6727  
**Date:** 4145±30 BP  
**Site name:** Eext-tumulus visplas 1937  
**Type of site:** Grave  
**Dated material:** Charcoal (from charred pole in ditch around the grave)  
**Culture:** SGC  
**Associated ceramics:** ZZ  
**Other associated finds:** GP dagger, flint axe, P1 hammer  
**Literature:** LW: 39; LP: 75  
**Problems with the date:**  
 1. Old wood effect: —

**Identification number:** GrN-7802  
**Date:** 4140±50 BP  
**Site name:** Maarn-de Halm  
**Type of site:** Grave  
**Dated material:** Charcoal (concentration from bottom of ditch around grave)  
**Culture:** SGC  
**Associated ceramics:** 1a  
**Other associated finds:** Flint axe, flint blade, E-hammer  
**Literature:** LP: 75  
**Problems with the date:** None

**Identification number:** GrN-6856  
**Date:** 3835±55 BP  
**Site name:** Mander-tumulus 1972-I  
**Type of site:** Grave  
**Dated material:** Charcoal (from shelf over grave)  
**Culture:** BBC  
**Associated ceramics:** x  
**Other associated finds:** Arrowhead, flint knife (other grave: flint knife)  
**Literature:** LP: 93; L: 66  
**Problems with the date:**  
 1. Old wood effect: —  
 2. No ceramics: — —

**Identification number:** GrN-8232  
**Date:** 3965±35 BP  
**Site name:** Hazendonk  
**Type of site:** Settlement  
**Dated material:** Charcoal (from Hz6 layer)  
**Culture:** Vlaardingen and SGC  
**Associated ceramics:** x  
**Other associated finds:** x  
**Literature:** LP: 79  
**Problems with the date:**  
 1. Settlement dates: —

**Identification number:** GrN-6899  
**Date:** 2935±55 BP  
**Site name:** Swalmen-tumulus Bosheide 1  
**Type of site:** Grave  
**Dated material:** Charcoal (concentration in mound)  
**Culture:** SGC  
**Associated ceramics:** x  
**Other associated finds:** x  
**Literature:** LP: 77  
**Problems with the date:**  
 1. Abnormal dates: — —  
 2. No ceramics: — —

**Identification number:** GrN-8233  
**Date:** 4000±25 BP  
**Site name:** Hazendonk  
**Type of site:** Settlement  
**Dated material:** Charcoal (from Hz9 layer)  
**Culture:** Vlaardingen and SGC  
**Associated ceramics:** x  
**Other associated finds:** x  
**Literature:** LP: 79  
**Problems with the date:**  
 1. Settlement dates: —

<b>Identification number:</b>	GrN-8247	<b>Identification number:</b>	GrN-9133
Date:	4040±90 BP	Date:	4015±30 BP
Site name:	Noordbarge-Hoge Loo, grave 1972-IV	Site name:	Hazendonk
Type of site:	Grave	Type of site:	Settlement
Dated material:	Charcoal (scattered pieces from filing of the grave)	Dated material:	Charcoal (from Hz8c2 layer)
Culture:	SGC	Culture:	Vlaardingen and SGC
Associated ceramics:	1d	Associated ceramics:	x
Other associated finds:	Greenstone axe, flint blade	Other associated finds:	x
Literature:	LP: 75; DH: 81	Literature:	LP: 79
Problems with the date:		Problems with the date:	
1. Sample treatment:	— —	1. Settlement dates:	—
<b>Identification number:</b>	GrN-8253	<b>Identification number:</b>	GrN-10345
Date:	3750±80 BP	Date:	4270±70 BP
Site name:	Eext-Bergakkers	Site name:	Silvolde
Type of site:	Grave	Type of site:	Grave
Dated material:	Charcoal (from concentration in top layers of flat-grave)	Dated material:	Charcoal (small pieces, from postholes around a grave)
Culture:	BBC	Culture:	SGC
Associated ceramics:	x	Associated ceramics:	1a
Other associated finds:	x	Other associated finds:	Big flint axe, hammer type 1, flint blade (probably)
Literature:	LP: 93-94	Literature:	LP: 75
Problems with the date:		Problems with the date:	
1. No ceramics:	— —	1. Sample treatment:	—
<b>Identification number:</b>	GrN-8254	<b>Identification number:</b>	GrN-10463
Date:	3930±45 BP	Date:	3760±35 BP
Site name:	Eext-Galgwandenvveen, tumulus 1	Site name:	Eext-Bergakkers
Type of site:	Grave	Type of site:	Grave
Dated material:	Charcoal (from concentration around the walls of pit next to grave)	Dated material:	Charcoal (from partially charred coffin)
Culture:	SGC	Culture:	BBC
Associated ceramics:	1e	Associated ceramics:	x
Other associated finds:	Flint blade	Other associated finds:	x
Literature:	LP: 75; L: 38	Literature:	LP: 94
Problems with the date:		Problems with the date:	
1. t.p.q:	—	1. No ceramics:	— —
<b>Identification number:</b>	GrN-8801	<b>Identification number:</b>	GrA-11264
Date:	3530±25 BP	Date:	3840±50 BP
Site name:	Oostwoud-De Tuithoorn, tumulus II	Site name:	Rolde-Volmachtenlaan
Type of site:	Grave	Type of site:	Grave
Dated material:	Collagen	Dated material:	Cremation
Culture:	BBC	Culture:	BBC
Associated ceramics:	x	Associated ceramics:	Epi-Maritime
Other associated finds:	x	Other associated finds:	x
Literature:	LP: 86-87; DH: 74	Literature:	LP: 92; L: 58
Problems with the date:		Problems with the date:	None
1. No ceramics:	— —		

**Identification number:** GrN-9132  
 Date: 4015±30 BP  
 Site name: Hazendonk  
 Type of site: Settlement  
 Dated material: Charcoal (from Hz7b layer)  
 Culture: Vlaardingen and SGC  
 Associated ceramics: x

Other associated finds: x

Literature: LP: 79

Problems with the date:

1. Settlement dates: —

**Identification number:** GrN-11849  
 Date: 3865±30 BP  
 Site name: Hekelingen III, phase 4  
 Type of site: Settlement  
 Dated material: Charcoal (dispersed, from cultural layer)  
 Culture: BBC  
 Associated ceramics: Bell Beaker and Barbwire  
 Other associated finds: x  
 Literature: LP: 84; L: 53  
 Problems with the date:  
 1. Relation uncertain: —

**Identification number:** GrN-11918  
 Date: 4165±30 BP  
 Site name: Annen-Holtkampen  
 Type of site: Grave  
 Dated material: Charcoal (from grave)  
 Culture: SGC  
 Associated ceramics: 1e and ZZ  
 Other associated finds: x  
 Literature: LP: 76  
 Problems with the date:  
 1. Old wood effect: —

**Identification number:** GrN-11921  
 Date: 4170±50 BP  
 Site name: Eext-Bergakkers  
 Type of site: Grave  
 Dated material: Charcoal (from ditch around grave)  
 Culture: SGC  
 Associated ceramics: x  
 Other associated finds: x  
 Literature: LP: 76  
 Problems with the date:  
 1. No ceramics: — —

**Identification number:** GrN-11295  
 Date: 3860±60 BP  
 Site name: Rechteren  
 Type of site: Settlement  
 Dated material: Charcoal (from pit)  
 Culture: BBC  
 Associated ceramics: Beaker with grooved lines and undecorated zones, thick walled vessels, large vessels with grooved lines and spatula impressions (all sherds)  
 Other associated finds: Scraper (two), flint flakes  
 Literature: LP: 92-93  
 Problems with the date:  
 1. Old wood effect: —

**Identification number:** GrN-12015  
 Date: 4055±40 BP  
 Site name: Aartswoud  
 Type of site: Settlement  
 Dated material: Charcoal (scattered, hallway down 1m settlement material)  
 Culture: SGC  
 Associated ceramics: ?  
 Other associated finds: ?  
 Literature: LP: 78; DH: 78-80  
 Problems with the date:  
 1. Settlement ceramics: —

**Identification number:** GrN-12268  
 Date: 3770±60 BP  
 Site name: Bennekom  
 Type of site: Grave  
 Dated material: Charcoal (from pole in ditch around grave)  
 Culture: BBC  
 Associated ceramics: Veluwe (two)  
 Other associated finds: x  
 Literature: LW: 41; LP: 85; L: 54  
 Problems with the date: None

**Identification number:** GrA-12299  
 Date: 3920±60 BP  
 Site name: Puttershoek-sportlaan  
 Type of site: Settlement  
 Dated material: Residue on beaker  
 Culture: SGC  
 Associated ceramics: 1d  
 Other associated finds: x  
 Literature: LP: 79; L: 54; DH: 89  
 Problems with the date:  
 1. Bad sample quality: — —



<b>Identification number:</b>	GrN-12013	<b>Identification number:</b>	GrN-12384
Date:	3990±40 BP	Date:	4005±60 BP
Site name:	Aartswoud	Site name:	Eexterhalte
Type of site:	Settlement	Type of site:	Grave
Dated material:	Charred grain (under 1m settlement material)	Dated material:	Teeth (unburned)
Culture:	SGC	Culture:	SGC
Associated ceramics:	?	Associated ceramics:	x
Other associated finds:	?	Other associated finds:	Flint blade
Literature:	LP: 78; DH: 78-80	Literature:	LP: 76
Problems with the date:		Problems with the date:	
1. Settlement ceramics:	—	1. No ceramics:	—
<b>Identification number:</b>	GrN-12014	<b>Identification number:</b>	GrN-12387
Date:	3970±35 BP	Date:	3740±65 BP
Site name:	Aartswoud	Site name:	St. Walrick-tumulus I
Type of site:	Settlement	Type of site:	Grave
Dated material:	Charred hazelnut shells (under 1m settlement material)	Dated material:	Molar surface
Culture:	SGC	Culture:	BBC
Associated ceramics:	?	Associated ceramics:	x
Other associated finds:	?	Other associated finds:	<i>Schleifennadel</i>
Literature:	LP: 78; DH: 78-80	Literature:	LP: 88-90
Problems with the date:		Problems with the date:	
1. Settlement ceramics:	—	1. No ceramics:	—
<b>Identification number:</b>	UtC-13594	<b>Identification number:</b>	GrA-14066
Date:	3710±50 BP	Date:	3840±35 BP
Site name:	Akersloot-Klein Dorregeest	Site name:	Meerlo
Type of site:	Settlement	Type of site:	Grave
Dated material:	Peat layer	Dated material:	Cremation (?)
Culture:	BBC	Culture:	BBC
Associated ceramics:	Bell Beaker and Barbwire	Associated ceramics:	Veluwe
Other associated finds:	x	Other associated finds:	Arrow shaft grinders, arrow-heads (three)
Literature:	LP: 91-92	Literature:	LP: 84; L: 53
Problems with the date:		Problems with the date:	None
1. t.a.q:	—		
<b>Identification number:</b>	GrA-13602	<b>Identification number:</b>	GrA-14067
Date:	3880±50 BP	Date:	3830±35 BP
Site name:	Rolde-Volmachtenlaan A	Site name:	Hoog-Buurlo
Type of site:	Grave	Type of site:	Grave
Dated material:	Cremation	Dated material:	Cremation
Culture:	BBC	Culture:	BBC
Associated ceramics:	Epi-Maritime	Associated ceramics:	Veluwe, 2Ie
Other associated finds:	x	Other associated finds:	x
Literature:	LP: 92; L: 58	Literature:	LP: 85; L: 53
Problems with the date:	None	Problems with the date:	none

**Identification number:** GrA-13614  
 Date: 3940±50 BP  
 Site name: Emmen-Angelso  
 Type of site: Grave  
 Dated material: Cremation  
 Culture: BBC  
 Associated ceramics: x  
 Other associated finds: Arrow heads (fourteen, burned), flint flakes  
 Literature: LP: 93  
 Problems with the date:  
 1. No ceramics: — —

**Identification number:** GrA-13617  
 Date: 3910±50 BP  
 Site name: Dalen  
 Type of site: Grave  
 Dated material: Cremation  
 Culture: BBC  
 Associated ceramics: Small Bell Beaker (vertical rows of paired fingertip impressions)  
 Other associated finds: Wrist guard  
 Literature: LP: 93; DH: 126  
 Problems with the date: None

**Identification number:** GrN-13714  
 Date: 3865±30 BP  
 Site name: Epe-Klokbekerweg  
 Type of site: Grave  
 Dated material: Charcoal (pit under foot of mound)  
 Culture: BBC  
 Associated ceramics: Veluwe (like)  
 Other associated finds: x  
 Literature: LP: 91  
 Problems with the date:  
 1. Old wood effect: —

**Identification number:** GrA-14840  
 Date: 3850±40 BP  
 Site name: Nijmegen  
 Type of site: Grave  
 Dated material: Cremation  
 Culture: BBC  
 Associated ceramics: Veluwe, 2If  
 Other associated finds: x  
 Literature: LP: 85; L: 53; DH: 95  
 Problems with the date: None

**Identification number:** GrN-14172  
 Date: 4010±60 BP  
 Site name: Voorschoten-De Donk  
 Type of site: Settlement  
 Dated material: Charcoal  
 Culture: Vlaardingen and SGC  
 Associated ceramics: ?  
 Other associated finds: ?  
 Literature: LP: 79  
 Problems with the date:  
 1. Settlement date: —

**Identification number:** GrA-14564  
 Date: 3690±40  
 Site name: Eext-Ketenberg  
 Type of site: Grave  
 Dated material: Burned bone  
 Culture: BBC  
 Associated ceramics: x  
 Other associated finds: x  
 Literature: LP: 94  
 Problems with the date:  
 1. No ceramics: — —

**Identification number:** GrA-14831  
 Date: 3460±40 BP  
 Site name: Meteren-Boog C-Noord, site 31  
 Type of site: Settlement  
 Dated material: Calcined bone debris  
 Culture: BBC  
 Associated ceramics: Veluwe and Barbwire sherds  
 Other associated finds: x  
 Literature: LP: 91  
 Problems with the date: None

**Identification number:** GrA-15311  
 Date: 4100±50 BP  
 Site name: Molenaarsgraaf  
 Type of site: Grave  
 Dated material: Collagen  
 Culture: BBC  
 Associated ceramics: x  
 Other associated finds: x  
 Literature: LP: 92  
 Problems with the date:  
 1. Reservoir effect: — —  
 2. No ceramics: — —

<b>Identification number:</b>	GrA-14870	<b>Identification number:</b>	GrN-15565
Date:	3630±50 BP	Date:	3925±40 BP
Site name:	Meteren-Boog C-Noord, site 31	Site name:	Zeewijk-west
Type of site:	Settlement	Type of site:	Settlement
Dated material:	Charred grain	Dated material:	Bone
Culture:	BBC	Culture:	SGC
Associated ceramics:	Veluwe and Barbwire sherds	Associated ceramics:	?
Other associated finds:	x	Other associated finds:	?
Literature:	LP: 91	Literature:	LP: 79; L: 38; DH: 80
Problems with the date:		Problems with the date:	
1. Relation uncertain:	— —	1. Settlement dates:	—
<b>Identification number:</b>	GrA-14871	<b>Identification number:</b>	GrA-15597
Date:	3580±45 BP	Date:	3690±60 BP
Site name:	Meteren-Boog C-Noord, site 31	Site name:	Oostwoud-De Tuithoorn, tumulus II
Type of site:	Settlement	Type of site:	Grave
Dated material:	Charred grain	Dated material:	Collagen
Culture:	BBC	Culture:	BBC
Associated ceramics:	Veluwe and Barbwire sherds	Associated ceramics:	x
Other associated finds:	x	Other associated finds:	x
Literature:	LP: 91	Literature:	LP: 86-87; DH: 74 and 107
Problems with the date:	none	Problems with the date:	
		1. No ceramics:	— —
<b>Identification number:</b>	GrA-14965	<b>Identification number:</b>	GrA-15598
Date:	4065±45 BP	Date:	3660±50 BP
Site name:	Baarn-De Drie Eiken	Site name:	Oostwoud-De Tuithoorn, tumulus II
Type of site:	Grave	Type of site:	Grave
Dated material:	Cremation (carbonate fraction from burned bone mineral)	Dated material:	Collagen
Culture:	SGC	Culture:	BBC
Associated ceramics:	1e (two, burned)	Associated ceramics:	x
Other associated finds:	Spindle whorl, bone awl (two)	Other associated finds:	x
Literature:	LP: 76; DH: 128	Literature:	LP: 86-87; DH: 74 and 107
Problems with the date:	none	Problems with the date:	
		1. No ceramics:	— —
<b>Identification number:</b>	GrA-14966	<b>Identification number:</b>	GrA-15601
Date:	4090±45 BP	Date:	3520±60 BP
Site name:	Molenaarsgraaf	Site name:	Oostwoud-De Tuithoorn, tumulus II
Type of site:	Grave	Type of site:	Grave
Dated material:	Apatite	Dated material:	Collagen
Culture:	BBC	Culture:	BBC
Associated ceramics:	x	Associated ceramics:	x
Other associated finds:	x	Other associated finds:	x
Literature:	LP: 92	Literature:	LP: 86-87; DH: 74
Problems with the date:		Problems with the date:	
1. Reservoir effect:	— —	1. No ceramics:	— —
2. No ceramics:	— —		

**Identification number:** GrA-15602  
 Date: 3500±50 BP  
 Site name: Oostwoud-De Tuihoorn, tumulus II  
 Type of site: Grave  
 Dated material: Collagen  
 Culture: BBC  
 Associated ceramics: x  
 Other associated finds: x  
 Literature: LP: 86-87; DH: 74  
 Problems with the date:  
 1. No ceramics: — —

**Identification number:** GrN-15921  
 Date: 4050±60 BP  
 Site name: Velselbroekpolder  
 Type of site: Grave  
 Dated material: Collagen  
 Culture: BBC  
 Associated ceramics: Veluwe  
 Other associated finds: x  
 Literature: LP: 85  
 Problems with the date:  
 1. Sample treatment: — —

**Identification number:** GrA-15641  
 Date: 4480±60 BP  
 Site name: Loon-hunebed D15  
 Type of site: Grave (?)  
 Dated material: Cremation  
 Culture: BBC  
 Associated ceramics: Veluwe (style)  
 Other associated finds: x  
 Literature: LP: 93; DH: 121  
 Problems with the date:  
 1. Relation uncertain: — —

**Identification number:** GrA-16054  
 Date: 3810±60 BP  
 Site name: Molenaarsgraaf  
 Type of site: Grave  
 Dated material: Tooth enamel  
 Culture: BBC  
 Associated ceramics: x  
 Other associated finds: x  
 Literature: LP: 92  
 Problems with the date:  
 1. No ceramics: — —

**Identification number:** GrA-15696  
 Date: 3890±50 BP  
 Site name: Sijbekarspel-De Veken  
 Type of site: Grave  
 Dated material: Bone collagen  
 Culture: SGC  
 Associated ceramics: x  
 Other associated finds: x  
 Literature: LP: 76; DH: 72  
 Problems with the date:  
 1. No ceramics: — —

**Identification number:** GrA-16186  
 Date: 5200±60 BP  
 Site name: Schokland-P14, grave 7  
 Type of site: GravDental enamele  
 Dated material: Swifterbant?  
 Culture: x  
 Associated ceramics: x  
 Other associated finds: LP: 77  
 Literature:  
 Problems with the date:  
 1. Abnormal dates: — —  
 2. No ceramics: — —

**Identification number:** GrA-15698  
 Date: 4010±50 BP  
 Site name: Hoogwoud-Mienakker  
 Type of site: Grave  
 Dated material: Bone  
 Culture: SGC  
 Associated ceramics: x  
 Other associated finds: x  
 Literature: LP: 76-77  
 Problems with the date:  
 1. No ceramics: — —

**Identification number:** GrA-16893  
 Date: 3635±30 BP  
 Site name: Velselbroekpolder  
 Type of site: Grave  
 Dated material: Wood (from coffin, youngest rings)  
 Culture: BBC  
 Associated ceramics: Veluwe  
 Other associated finds: x  
 Literature: LP: 85; L: 54  
 Problems with the date:  
 1. Sample treatment: —

<b>Identification number:</b>	GrA-15919	<b>Identification number:</b>	GrN-18488
Date:	3710±50	Date:	3910±50 BP
Site name:	Ottoland-Kromme Elleboog	Site name:	Zeewijk-Oost
Type of site:	Grave	Type of site:	Settlement
Dated material:	Bone	Dated material:	Wood (from pole belonging to house, outermost 4-6 rings)
Culture:	BBC	Culture:	SGC
Associated ceramics:	x	Associated ceramics:	?
Other associated finds:	x	Other associated finds:	?
Literature:	M: 23	Literature:	LP: 77
Problems with the date:		Problems with the date:	
1. No ceramics:	— —	1. Settlement dates:	—
<b>Identification number:</b>	GrN-18673	<b>Identification number:</b>	GrN-25303
Date:	3930±55 BP	Date:	3740±25 BP
Site name:	Dalen	Site name:	Oudemolen-tumulus 13, period 2
Type of site:	Grave	Type of site:	Grave
Dated material:	Charcoal (from cremation)	Dated material:	Charcoal (from coffin)
Culture:	BBC	Culture:	BBC
Associated ceramics:	Small Bell Beaker (vertical rows of paired fingertip impressions)	Associated ceramics:	x
Other associated finds:	Wrist guard	Other associated finds:	x
Literature:	LP: 93; DH: 126	Literature:	LP: 92; L: 58; DH: 95
Problems with the date:		Problems with the date:	
1. Relation uncertain:	—	1.No ceramics:	— —
<b>Identification number:</b>	GrA-18839	<b>Identification number:</b>	GrN-25304
Date:	44360±50 BP	Date:	3800±30 BP
Site name:	Emmeloord-Rijksweg	Site name:	Oudemolen-tumulus 13, period 2
Type of site:	Settlement	Type of site:	Grave
Dated material:	Residue on sherd	Dated material:	Charcoal (from coffin)
Culture:	BBC	Culture:	BBC
Associated ceramics:	Potbeaker	Associated ceramics:	Bell beaker (highly decorated sherds) and small undecorated beaker
Other associated finds:	x	Other associated finds:	x
Literature:	B: 217	Literature:	LP: 92; L: 58; DH: 95
Problems with the date:		Problems with the date:	none
1. Reservoir effect:	— —		
<b>Identification number:</b>	GrA-18835	<b>Identification number:</b>	GrN-25316
Date:	4260±50 BP	Date:	3805±30 BP
Site name:	Emmeloord-Rijksweg	Site name:	Oostwoud-De Tuithoorn, tumulus II
Type of site:	Settlement	Type of site:	Grave
Dated material:	Residue on sherd	Dated material:	Charcoal (from settlement pit under grave)
Culture:	BBC	Culture:	BBC
Associated ceramics:	Potbeaker	Associated ceramics:	x
Other associated finds:	x	Other associated finds:	x
Literature:	B: 217	Literature:	LP: 86-87; DH: 74
Problems with the date:		Problems with the date:	
1. Reservoir effect:	— —	1. No ceramics:	— —
		2. t.p.q:	—

**Identification number:** GrA-23570  
**Date:** 3940±45 BP  
**Site name:** Zutphen  
**Type of site:** Grave  
**Dated material:** Charcoal (from cremation)  
**Culture:** SGC  
**Associated ceramics:** x  
**Other associated finds:** x  
**Literature:** DH: 121  
**Problems with the date:**  
 1.No ceramics: — —

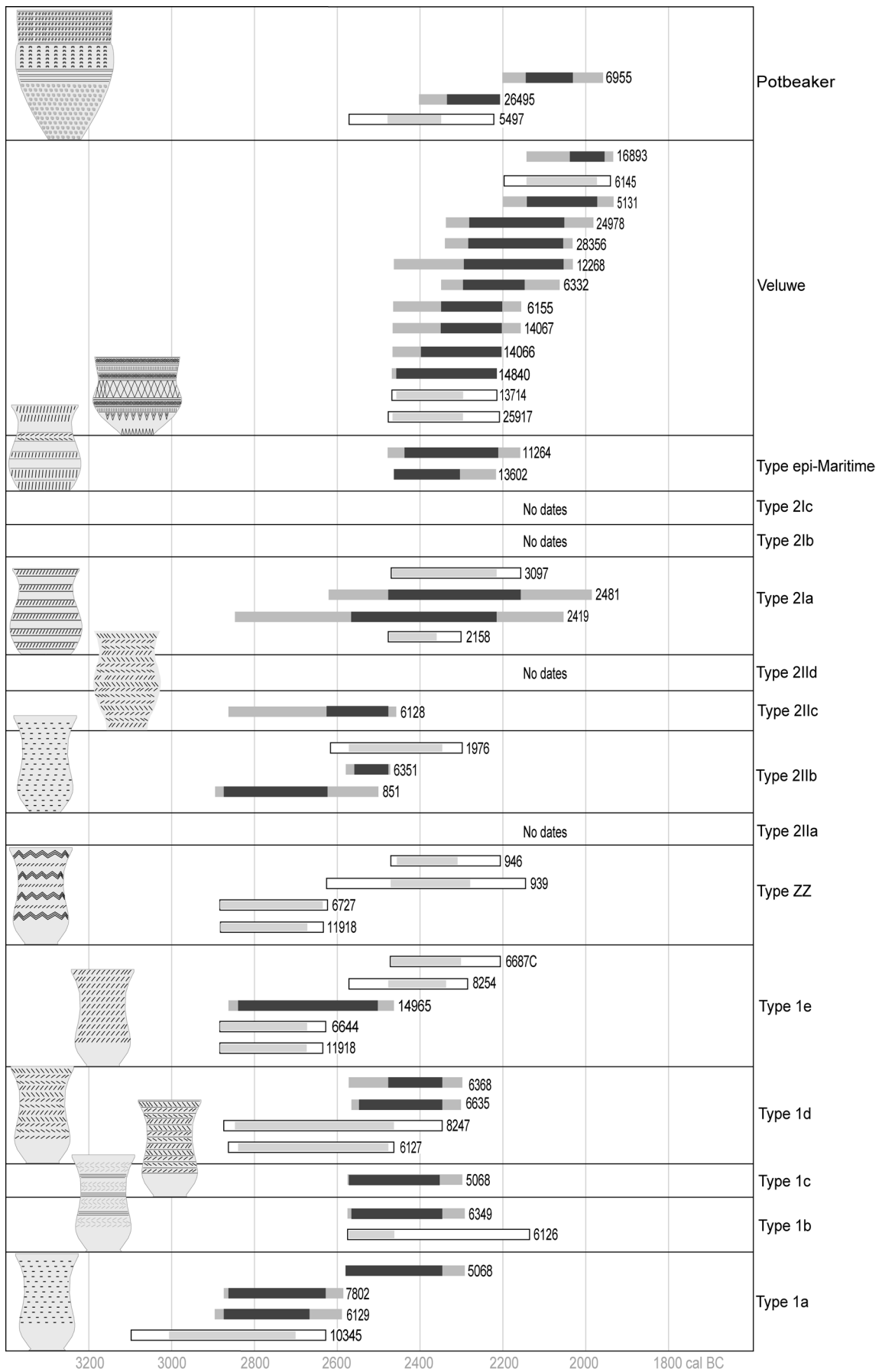
**Identification number:** GrN-25917  
**Date:** 3870±50 BP  
**Site name:** Barendrecht 2  
**Type of site:** Settlement  
**Dated material:** Residue on sherd  
**Culture:** BBC  
**Associated ceramics:** Veluwe, 2Ic-2If (sherds)  
**Other associated finds:** x  
**Literature:** C: 47-48 and 115  
**Problems with the date:**  
 1. Reservoir effect: —

**Identification number:** GrN-24978  
**Date:** 3750±50 BP  
**Site name:** Nijmegen  
  
**Type of site:** Grave  
**Dated material:** Charcoal (from grave)  
**Culture:** BBC  
**Associated ceramics:** Veluwe, 2If  
**Other associated finds:** x  
**Literature:** LW: 39; LP: 78  
**Problems with the date:** none

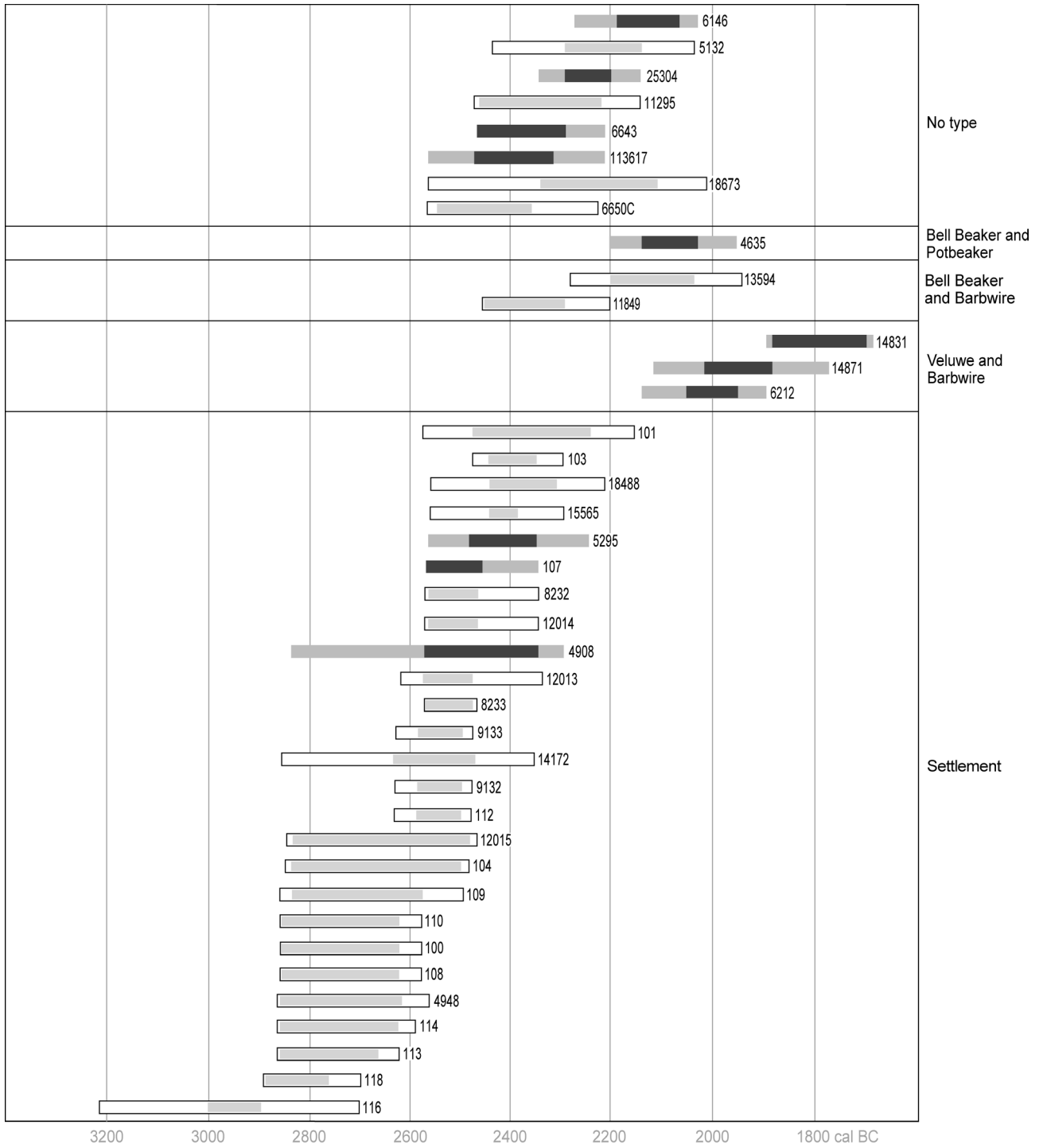
**Identification number:** GrN-26495  
**Date:** 3830±20 BP  
**Site name:** Emmeloord-Rijksweg A6/  
 kavel J 97  
**Type of site:** Settlement  
**Dated material:** Wood (from pole of fish weir)  
**Culture:** BBC  
**Associated ceramics:** Neck Potbeaker (upperhalf)  
**Other associated finds:** x  
**Literature:** L: 54; B: 217  
**Problems with the date:** none

**Identification number:** GrA-28356  
**Date:** 3765±45 BP  
**Site name:** Beuningen-Hogewald  
**Type of site:** Grave  
**Dated material:** Cremation  
**Culture:** BBC  
**Associated ceramics:** Veluwe, 2If  
**Other associated finds:** x  
**Literature:** L: 53  
**Problems with the date:** none

**Identification number:** GrA-28359  
**Date:** 3695±35BP  
**Site name:** Exlo-D30  
**Type of site:** Grave  
**Dated material:** Cremation  
**Culture:** BBC  
**Associated ceramics:** x  
**Other associated finds:** x  
**Literature:** L: 68  
**Problems with the date:**  
 1.No ceramics: — —



Appendix 2. Dates per type (Illustration S.M. Beckerman, layout S.E. Boersma, RUG/GIA).



Legend:

- = one star rated dates, white 2σ range, light grey 1 σ range
- = dates without problems, light grey 2σ range, dark grey 1 σ range
- 6134 = identification number (GrA, GrN or UtC)

Appendix 2 continued