

Bipolar Cores in Southern Norway: Classification, Chronology and Geography

Torben Bjarke Ballin

Banknock Cottage, Denny, Stirlingshire, FK6 5NA

INTRODUCTION

Since the middle of the 1970's bipolar technology (*hammer-and-anvil technology*) have gradually become better understood in southern Norwegian Stone Age research, although it must be acknowledged that bipolar cores may still be under-represented (i.e. wrongly classified) in southern Norwegian Mesolithic and Neolithic assemblages. This situation is probably partly due to the fact that knowledge of bipolar cores and bipolar technology in Scandinavia grew out of investigations of quartz-rich Stone Age settlements in middle and northern Sweden (Broadbent 1979; Callahan 1987; Knutsson 1988). On these sites bipolar technology is dominant, and it seems, that the cores occur in only one form, which from the resemblance to the bipolar cores depicted in Peter White's pioneering work from 1968 may be called *classic bipolar cores* (White 1968).

As part of the research project *Kronologiske og regionale forhold i sydnorsk stenaldre* (*Chronology and Regional Differences in the Southern Norwegian Stone Age*) (Ballin *in prep.*) a series of settlement assemblages from southern Norway (south-east Norway, southernmost Norway and west Norway) were investigated, and it was observed that the bipolar core in southern Norway occurs in not just one but several chronologically significant forms which are not all equally and easily recognized. The intention of the present article is therefore to define the different sub-types of bipolar cores present in southern Norway as well as discuss general problems associated with the classification of bipolar material. The chronological delimitations of the individual sub-types will be dealt with and the geographical distribution of bipolar cores in Scandinavia will be discussed.

RESEARCH HISTORY WITH AN EMPHASIS ON SCANDINAVIA

The bipolar core was recognized as a morphological type relatively early this century (Bardon and Bouyssonie 1906), but the function of the type has been a focus of discussion until fairly recently. Bardon and Bouyssonie termed the artefacts *outils écaillés* which, with variations, has been the common name of the type until the mid-1960's; the

term explicitly interprets the pieces as tools (*scaled tools*). In Noel Broadbent's research history of the bipolar core he sums up how the artefact type over time has been interpreted as tools as different as chisels, adzes, retouching tools, fabricators or wedges (Broadbent 1979, 108f).

In Scandinavia 'scaled tools' have been described in association with, for example, the north Norwegian Komsa settlements (Bøe and Nummedal 1936), the Swedish Pitted Ware settlement Siretorp (Kjellmark 1939) as well as the Stone Age sites of Småland, Sweden (Kjellmark 1944), but in Scandinavia no-one dealt seriously with the artefact until C.J. Becker published his investigations of Maglemose settlements on the Danish island of Bornholm in the Baltic Sea (Fig. 1) ('*skælhuggede flintstykker*'/*pieces with scaled retouch*) (Becker 1952a).

Although Becker at several occasions in his article uses the term 'scaled flint-tools', it is evident that the function of the type at the time was subject to a vigorous international debate; eventually, the more neutral term 'scaled pieces' became generally accepted. This process was mainly due to Jacques Tixier's important typological work on the north African Mesolithic in which he presented the term *pièces esquillées* (Tixier 1963); a few years later this term was introduced in Scandinavian Stone Age research via Erik Brinch Petersen's French Maglemose typology (Brinch Petersen 1967).

Unfortunately, this international agreement on the general use of a nomenclature did not mean full agreement on the substance of the concept, and the concept was diluted; in the archaeological literature of the late 1960's practically all lithics with scaled reduction scars or scaled retouch were referred to as 'skælhuggede stykker' or 'pièces esquillées' (e.g. Brinch Petersen 1967, Fig. 61)¹. Consensus on the substance of the concept was established with Peter White's description of the pieces in context in present-day Stone Age New Guinea, as it was beyond doubt that the New Guinea pieces were refuse, i.e. cores, and not tools (White 1968). White suggested to rename the artefact type *scalar cores* and described its main attributes.

In the 1970's and 1980's several quartz-rich settlements from Middle and North Sweden were investigated, and in this connection the scalar cores received special attention. Broadbent gave the artefact

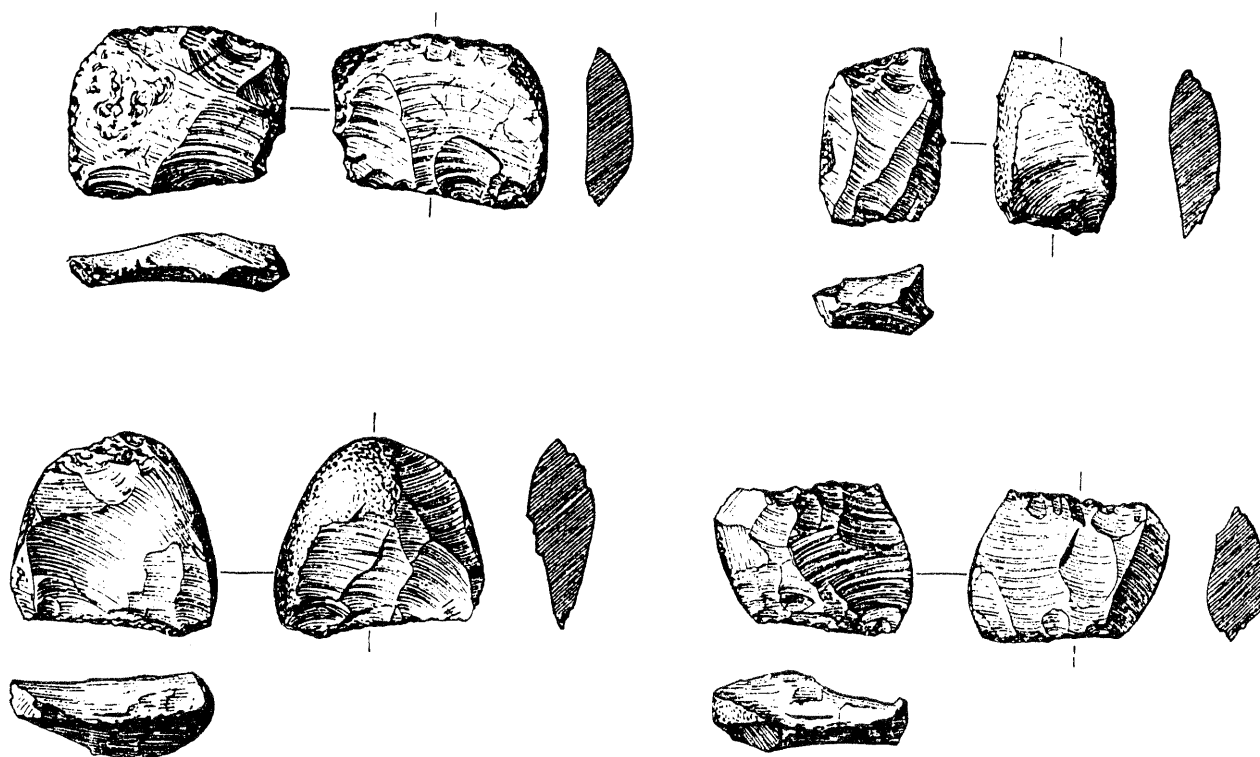


Fig. 1. Bipolar cores from the Baltic island of Bornholm, Denmark (Becker 1952a, 127). Scale 2:3.

type (*splintered piece cores*) a detailed description and explained the bipolar technology as an integral part of a normal reduction strategy (Broadbent 1979, 111, 115).

Several Swedish articles from the mid-1980's use the expression *stötkantkärnor* as being synonymous with the term *bipolar cores* (Thorsberg 1985; Knutsson 1986), but for two reasons this expression cannot be supported: 1) The expression is a derivation of Knut Kjellmarks term *stötkantredskaper* (i.e. -tools) (Kjellmark 1939, 89), therefore allowing future misunderstandings, and 2) at this point of time the term *bipolar cores* had more or less been established and generally accepted internationally.

In Norwegian archaeology the term *bipolar cores* was introduced with Helskog *et al.*'s 'Morfologisk klassifisering av slätte steinartefakter' (1976) ('Morphological Classification of Knapped Lithic Artefacts'), but the expression was not securely established until Hein Bjerck's works on West-Norwegian Mesolithic chronology (Bjerck 1983; 1986). Today, the bipolar core is an integral part of all North-Scandinavian classification systems (Andersson *et al.* 1978; Callahan 1987, 65; Ballin 1996).

BIPOLAR CORES AND THE STONE AGE CHRONOLOGY OF SOUTHERN NORWAY²

In Bjerck's works from the mid-1980's bipolar cores are indicated as a core type diagnostic of the Late Mesolithic and the Neolithic (Bjerck 1983; 1986), a claim, which today has been proven incorrect. As part of the above-mentioned research project (Ballin *in prep.*), no less than 14 site assemblages from the Middle Mesolithic to the Middle Neolithic were investigated (re-classified), and in all assemblages bipolar cores made up a considerable part of the core group (Fig. 2).

In the Middle Mesolithic bipolar cores constitute c. 45-65% of the total bipolar cores and platform cores, whereas bipolar cores in the Late Mesolithic (LM A) constitute c. 65-85% and in the Neolithic c. 70-95%. In the assemblage of the site Gjolstad R33 (Akershus County, south-east Norway) from the last part of the Late Mesolithic (LM B), there are only 12% bipolar cores; this was at first seen as a random statistical fluctuation, but such low percentages were also recognized in the younger Late Mesolithic sites from the Halden Project (Østfold County, south-east Norway) (Inge Lindblom, *pers. comm.*) and therefore had to be seen as diagnostic for this particular phase

(5600-5200 BP). In the Late Neolithic, blade production proper ceased, and the percentage of bipolar cores rose to c. 100% (see the description of Lundevågen R35, Vest-Agder County, south-west Norway, in Ballin and Lass Jensen 1995, 206ff). Investigations of west Norwegian assemblages have shown that bipolar cores are also present in the Early Mesolithic of southern Norway (Nærøy 1994, 20f).

Probably, the increase in the use of bipolar technology in the earlier part of the Mesolithic constitutes the Norwegian pioneer settlers gradual adaptation to a new raw-material situation (having migrated from flint-rich southern Scandinavia). The restricted use of bipolar technology in the younger Late Mesolithic of southern Norway can not be explained at present. The total dominance of bipolar technology in the Late Neolithic probably illustrates the implementation of bifacial lithic technology (and later metal technology) with blade technology being phased out as a result.

CLASSIFICATION OF BIPOLAR MATERIAL

Sub-types of bipolar cores

As mentioned above, the author has identified a number of different sub-types of bipolar cores in southern Norway, diagnostic of different periods or phases; each of these sub-types is the end-product of a specific reduction strategy. Before defining the sub-types of the bipolar core it is necessary to produce a definition of the classic bipolar core. In Southern Norway the bipolar core has been defined as: '... a core on which all negative flake-scars run from two opposed ends. The ends lack platforms. Both the transverse section and the longitudinal section are approximately pointed oval. Both ends are crushed (Fig. 3) (Helskog *et al.* 1976, 21; translated by the author)

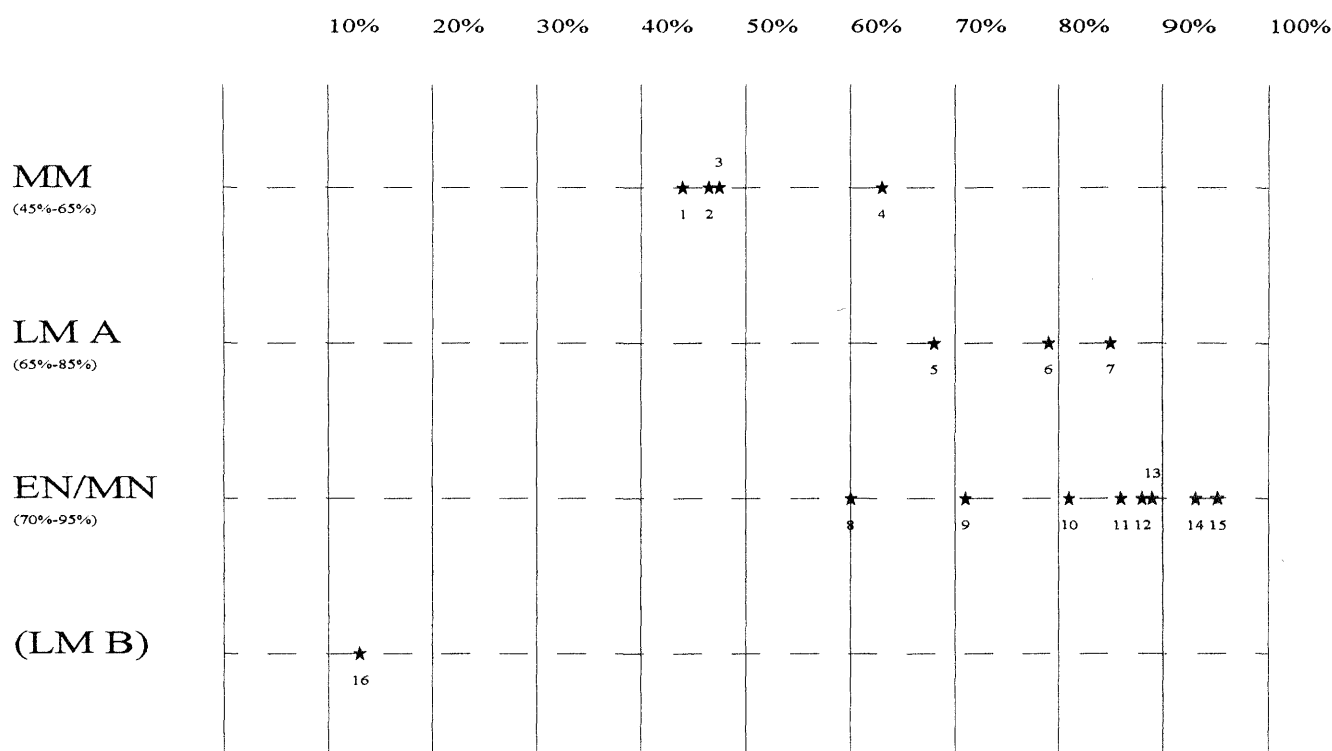


Fig. 2. Bipolar cores in percent of the total of bipolar cores and platform cores - rhyolite cores are not included. 1) Lundevågen R21/22 (Vest-Agder County), 2) Båtevik II (Sogn and Fjordane County), 3) Tørkop (Østfold County), 4) Lundevågen R17 (Vest-Agder County), 5) Frebergsvik IIb/IV (Vestfold County), 6) Lundevågen R23 (Vest-Agder County), 7) Vindenes 55 (Hordaland County), 8) Eg (Vest-Agder County), 9) Lundevågen R3-TN (Vest-Agder County), 10) Austvik III (Hordaland County), 11) Sluppan (Telemark County), 12) Lundevågen R9 (Vest-Agder County), 13) Langneset I (Vest-Agder County), 14) Austvik IV (Hordaland County), 15) Skaffjellåsen IV (Vestfold County), and 16) Gjølstad R33 (Akershus County).

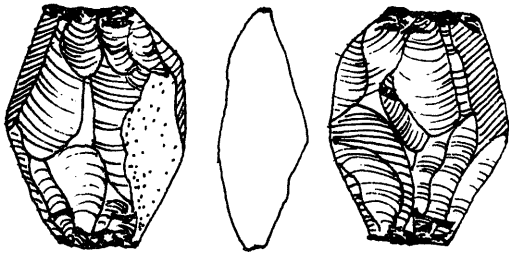


Fig. 3. Bipolar core as illustrated in Helskog et al. (1976, 21). Scale 1:1.

This picture of the classic bipolar core is strongly idealised and should be adjusted. The problem being that a bipolar core goes through a staged metamorphosis from acquisition of the raw-material to finally discarding the exhausted core. If for example a bipolar core is discarded at an early stage of the reduction sequence it might only have flake scars on one side with obvious consequences for its two sections and the outline – or it might only have one clearly crushed end. At the other extreme, a heavily used bipolar core might have three or even four crushed ends, if the flintknapper has chosen to re-orientate the core in order to adjust its form.

The classic bipolar core appears throughout all of the Stone Age in southern Norway, as this form is the natural end-product of any bipolar reduction process where a core has been struck repeatedly. It is of no importance for the final form of this type what starting point the bipolar reduction sequence had, as long as this sequence was extensive. Therefore, in discussion of bipolar core sub-types, cores discarded at an early time during the bipolar reduction sequence remain features of the blank (pebble, other core, blade/flake)³. Looking at such bipolar cores, it is possible to distinguish four sub-types (there are probably more), namely:

1. Bipolar cores based on pebbles.
2. Bipolar cores based on single-platform cores.
3. Bipolar cores based on slender, cylindrical cores.
4. Bipolar cores based on fragments of large, robust blades.

A certain number of bipolar cores will always be manufactured on irregular cores (with many or no platforms), but these are difficult to distinguish as

they take the form of classic bipolar cores after only a few strikes with the hammerstone.

Type 1 cores appear throughout the entire Stone Age of southern Norway, but they are particularly frequent in the Early and Middle Neolithic. As can be seen from Figure 2, the percentage of bipolar cores increases steadily through the Late Mesolithic and the Neolithic, and in the Neolithic of southernmost Norway this increase is obviously due to an intensification of the collection of beach pebbles⁴; on the Mesolithic sites of Lundevågen (Vest-Agder County, south-west Norway) collected beach pebbles amount to c. 10% of the core group, whereas on the Neolithic sites they account for 20%. Contrary to this, there are hardly any beach pebbles stored on Stone Age sites of the Inner Oslofjord (cf. artefact lists in Ballin and Lass Jensen 1995 and Ballin 1998), which might be due to the narrowness of this part of the fjord preventing deposition of flint from drift ice (Johansen 1957).

If collection of beach pebbles in the Stone Age was undertaken to acquire suitable nodules for the dominating reduction strategy of the time, the intensified collection of beach pebbles for Neolithic bipolar cores should be paralleled by diminishing sizes of the collected pebbles from the Mesolithic to the Neolithic, but this is not the case. As can be seen in Figure 4, the stored pebbles of the Middle Mesolithic site Lundevågen R21/22 (large conical cores/few bipolar cores) are exactly of the same size as the stored pebbles of the Neolithic site Lundevågen R3 (medium-sized opposed-platform cores/numerous bipolar cores) – the average length x width of the pebbles is 4.1 x 3.1 cm and 4.0 x 3.0 cm, respectively. In other words, collection of beach pebbles was not done selectively – one collected what one came across, and the two identical samples in Figure 4 instead illustrate the choice of the nearby beach⁵. Among bipolar cores of type 1 (Fig. 8), cores with only one crushed end or one flaked surface are frequent. On the latter, the unflaked surface will be cortex-covered.

Type 2 cores are to be found in the Mesolithic, and in the Middle Mesolithic assemblages from Lundevågen (Vest-Agder County, south-west Norway) quite a few of the bipolar cores are clearly based on discarded conical cores (Ballin and Lass Jensen 1995, 68). Bipolar cores of type 2 have a tendency to become more elongated than classic bipolar cores, and from time to time they have preserved negative blade scars from the original microblade production. These scars from the cores' former 'life' as platform-cores have added to the misunderstanding that microblade production can be based on bipolar technology, which it cannot; the

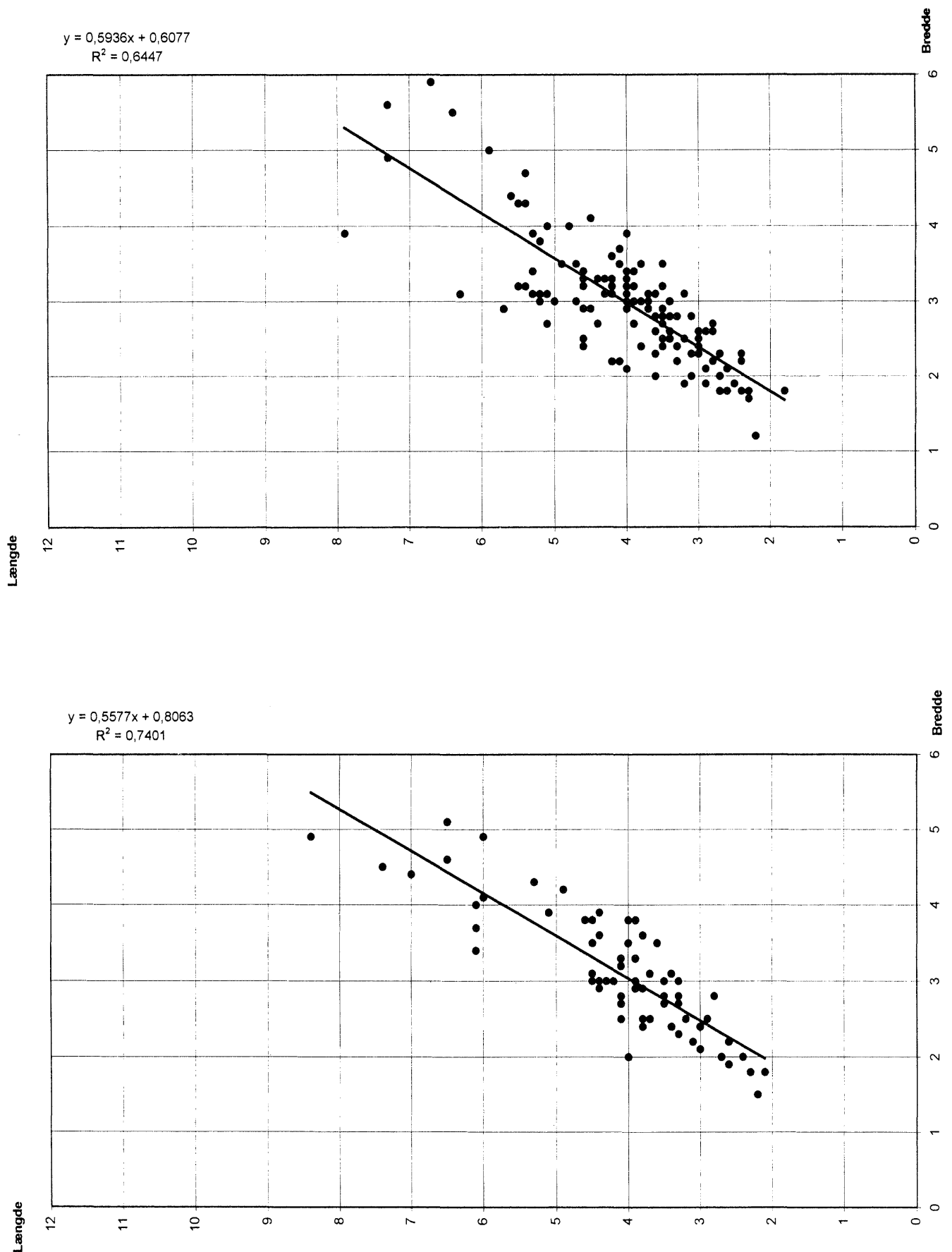


Fig. 4. The dimensions of the stored pebbles on 1) Lundevågen R21/22 (Mesolithic), and 2) Lundevågen R3 (Neolithic), Vest-Agder county. A regression-line has been added.

bipolar technology is too coarse and uncontrollable for manufacturing regular standard products such as microblades with parallel sides and parallel dorsal ridges (see below).

Type 3 cores are primarily diagnostic of the Late Middle Neolithic (MN B), but they are introduced along with the slender cylindrical cores around 4200 BP, i.e. the end of the previous phase (MN A). These bipolar cores are characterized by being long and slender (Fig. 5), and bipolar cores based on slender cylindrical cores tend not to achieve the classic form as frequently as the sub-types 1 and 2. Very often bipolar cores of type 3 take on a form similar to Southern Scandinavian moraine-crushed flint (Fig. 6.2, 6.4-5).

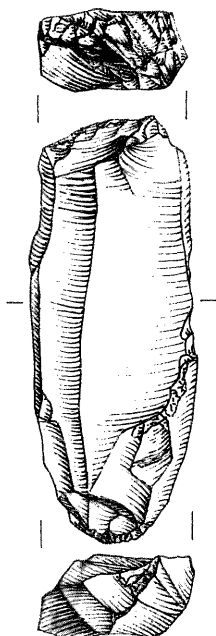


Fig. 5. Type 3 core from the late Middle Neolithic site Sluppan, Telemark county (artist: Tone Strenger, The University Museum of Antiquities, Oslo). Scale 1:1.

One might imagine, that this type was also to be found in west Norwegian Early Neolithic assemblages, as the cores here are slender and cylindrical contrary to the contemporary opposed-platform cores of eastern and southernmost Norway which tend to be plump and sub-cylindrical, but this is not the case. The reason for this is the use of rhyolite in west Norwegian Early Neolithic blade production, whereas the raw-material for blade production in eastern and southernmost Norway is flint, and rhyolite is obviously not suited for bipolar production. This is demonstrated by the flint:rhyolite ratio among bipolar cores, which on the site Austvik

III (Hordaland County, west Norway) is 83:17%, whereas the general flint:rhyolite ratio of the site is 34:66% (Ballin *in prep.*). It must be assumed, that rhyolite is either too soft or too brittle for the rough hammer-and-anvil technology.

Type 4 cores have so far only been distinguished in the part of MN B which is characterized by the presence of tanged points of Becker's type B2 and C (Becker 1951), i.e. c. 4000-3800 BP, which is slightly later than type 3 cores (c. 4200-3800 BP). The basis of these bipolar cores is the elegant and very large macroblades which constitute the 'swan song' of blade technology; during the late Middle Neolithic, the blades develop from relatively small and irregular macroblades to exceedingly large, regular macroblades after which blade technology is given up at the transition Middle/Late Neolithic (c. 3800 BP). These last macroblades have dimensions that make fragments (primarily medial fragments) suitable as blanks for bipolar production (Fig. 7). As MN-B-blades, despite their general size, have a limited thickness, type 4 cores are usually discarded after a relatively short reduction sequence, and the original blank can be determined without difficulty.

Chronologically this type of bipolar core and the large, elegant MN-B-blades coincide with, and have their basis in, a marked raise in the import of flint from Denmark (mainly Jutland). Production of the characteristic MN-B-blades could not have been based on small, local beach pebbles with internal cracks after years in the tidal zone; they are based on imported axes and axe-roughouts (Becker 1952b).

Bipolar cores and bipolar flakes

One of the major problems associated with bipolar cores, is to separate them without doubt from their complementary parts, the bipolar flakes. This has been clearly demonstrated in connection with the classification of finds from the more recent archaeological projects of Southern Norway (eg the *Farsund Project* and the *Oslofjordforbindelsen Project*; Ballin and Lass Jensen 1995; Ballin 1998; *in prep.*). The problem in this case is, that the definitions associated with platform-cores and their flakes are not applied too well on the bipolar material, which is clearly demonstrated in the following definition of a bipolar flake:

A bipolar flake exhibits some combination, but not necessarily all, of several very distinctive attributes. These include shattered or pointed platforms with little or no surface area; evidence of force having been applied at opposite ends of the flake; an angular, polyhedral transverse cross section with steep lateral edge angles; the lack of a definite positive bulb of force; very pronounced ripple marks;

and the lack of distinction between dorsal and ventral flaked faces (Ahler 1989, 210, quoted in Kuijt *et al.* 1995, 119).

As part of a research project following the Farsund Project a four-part flint nodule was refitted; all of these parts were classified as bipolar cores (Fig. 8). If the nodule had been reduced applying platform technique, one would have seen flakes as well as cores, as any single act of reduction in this technology will leave two complementary pieces - one piece with a concave surface and a concave bulb (core) and one piece with a convex surface and a convex bulb (flake). This classification problem means, that when cataloguing an assemblage containing bipolar material, the result will always be an estimate, and the ratio flakes:cores and platform cores:bipolar cores will vary substantially depending on the skills and experience of the cataloguer.

One particular detail in Ahler's definition ought to be corrected, namely the application of the term *platform* when describing the ends of the bipolar core. This expression should be used only in association with plane striking surfaces that meet the reduction front in an approximately right angle (c. 70°-105°). As said in the definition of Helskog *et al.* (1976, 21):

A bipolar core has no platforms, it has crushed ends.

Finally, it has been claimed that bipolar technology was used in the manufacture of the vast number of microblades seen in Late Mesolithic assemblages in southern Norway. The background of this postulate is an analysis of west Norwegian blades, in which large numbers of microblades without platform remnants are interpreted as the result of bipolar technology (Bjerck 1983, 87). Unfortunately the observation was due to a flawed definition, describing 'without platform remnant' as 'a platform remnant with a depth of less than 0.5 mm' (Bjerck 1983, 65). In reality, the presence of a platform remnant (platform being defined as above), no matter how small this may be, is a sign of the application of classic platform technology, and microblades defined as flakes with a length at least twice their width and with parallel sides and parallel dorsal ridges (Ballin 1996, 9) will only occur randomly during the bipolar reduction sequence. Normally, bipolar 'microblades' will have no platform remnants whatsoever, the sides will be slightly convex, and the dorsal ridges will point in all directions and only rarely be parallel (compare with Ahler's definition of bipolar flakes above).

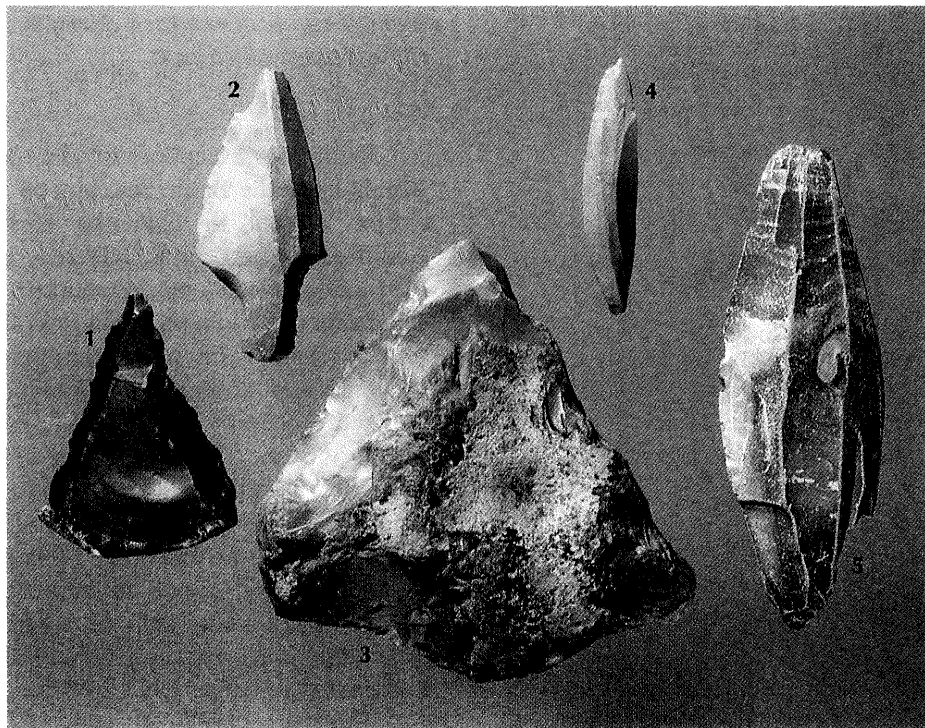


Fig. 6. Moraine-crushed flint (Vang Petersen 1993, 39ff). Vang Petersens no. 2, 4 and 5 have striking similarities to bipolar cores but are only 'geo-facts'.

THE DISTRIBUTION OF BIPOLAR CORES IN SCANDINAVIA AND THE REASONS FOR THE APPLICATION OF BIPOLAR TECHNOLOGY

As stated above, bipolar cores appear throughout the Stone Age in southern Norway, but whether this core type is limited to the Stone Age or is still to be seen through the rest of stone-using time (thus including Bronze Age and Pre-Roman Iron Age) is not yet known. Geographically, bipolar cores are found all over southern Norway. The artefact-type is abundant in northern Norway (Bøe and Nummedal 1936) as well as in northern and middle Sweden (Broadbent 1979; Callahan 1987; Knutsson 1988), where it has been seen as a result of work in coarser lithics (non-flint). In these areas bipolar technology has been applied on chert but mainly on quartz and quartzite.

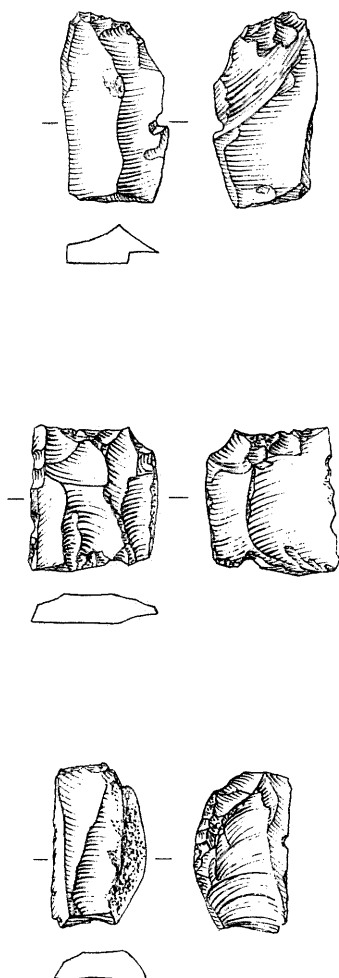


Fig. 7. Type 4 cores from the late Middle Neolithic site Sluppan, Telemark county (artist: Tone Strenger, The University Museum of Antiquities, Oslo). Scale 1:1.

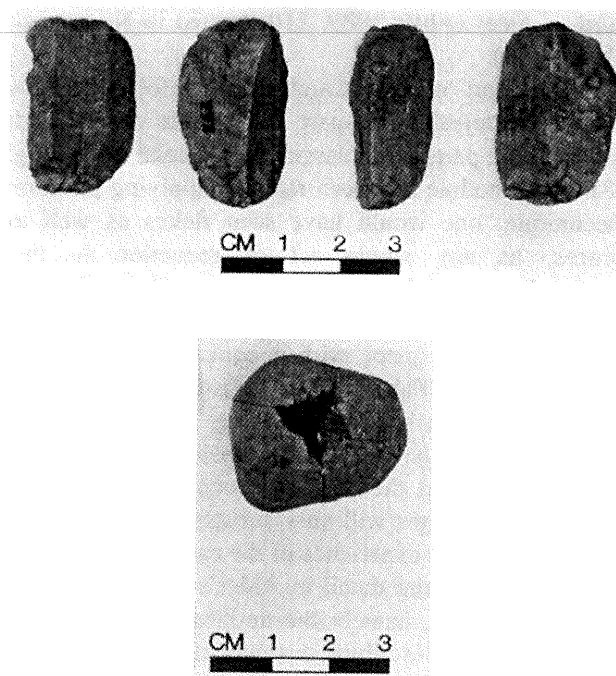


Fig. 8. Refitted pebble composed of four bipolar cores - from Lundevågen R9, Vest-Agder county: 1) Refitted, and 2) exploded pebble (photo: Torben Bjarke Ballin). From the first core a flake was struck, whereas the other three 'cores' did not result in any blanks in spite of repeated attempts. All four artefacts show clear crushed ends.

With the exception of the Danish island of Bornholm in the Baltic Sea, bipolar cores seem to be entirely absent in both the Mesolithic and the Neolithic of southern Scandinavia. In a short survey of bipolar technology in southern Sweden, Kalle Thorsberg (1985) presents a series of settlements with bipolar cores in the counties of Småland, Västergötland, northernmost Scania and Gotland, but these cores seem to be lacking in central and southern Scania. As the border between areas with bipolar technology (northern Scandinavia) and areas without bipolar technology (southern Scandinavia) very clearly coincides with the border between areas without and with access to fresh flint in Cretaceous Chalk, it is obvious that the application of bipolar technology must somehow be related to raw-material resources (Kuijt *et al.* 1995, 117).

Thorsberg (1985, 10) suggests three causes for the application of bipolar technology:

- 1) Adaptation to raw-material in small nodules (i.e. beach pebbles, gravel deposits).
- 2) Adaptation to sparse resources.
- 3) Habits.

The first cause is exemplified by the assemblage from the settlement Melsted (Bornholm), in which bipolar cores constitute 10% of all worked flint (Brinch Petersen 1967, 171), and where roughly 90% of the worked flint comes from local beach pebbles with the largest dimension fluctuating between 4-6 cm (Becker 1952b, 116). Approximately 10% of the flint from Melsted is Kristianstad-flint, which Becker describes as '...a rather poor raw-material' (Becker 1952b, 113; translated by the author); this is rejected by Bo Madsen, who emphasizes the application of this flint-type in the production of small, regular microblades as well as large four-sided Neolithic axes (Madsen 1984, 86f). Cause no. 1 can be associated with the production of the Southern Norwegian type-1-cores.

The second cause may be proved probable via negative arguments, in the sense that bipolar technology, as mentioned above, is not applied in southern Scandinavia, and by showing that quite a few of the southern Norwegian bipolar cores have had an earlier existence as platform-cores. This second cause thus explains the southern Norwegian type 2, 3 and 4 cores. If, for example, the core material of a southern Scandinavian Pitted Ware settlement is compared with the core material of a contemporary southern Norwegian MN-B-settlement, with the spectrum of core and tool types being roughly the same on these two sites, there will be several 10-15 cm long cylindrical cores lying about on the surface of the southern Scandinavian settlement, whereas on the southern Norwegian settlement there will be practically none; on the southern Norwegian settlement these large cylindrical cores will have been present (this can be deducted from the long, regular blades and the core preparation/rejuvenation flakes of these sites) but they have been totally reduced by continuing blank production in bipolar technology.

The third cause is slightly more problematic. The argument used in favour of this is, that bipolar technology has been applied on quartz and similar raw-material when visiting the interior of southern Norway, where flint is absent, and then, when returning to the coastal zone, the use of bipolar technology has been extended to flint as well. It can be proven, though, that this cause cannot be decisive in the choice of technology, as, for example, on Bornholm bipolar technology is applied even though flint is the only raw-material available.

CONCLUSION

Through the comprehensive analysis of Stone Age material from southern Norway it has been possible to reach the following conclusions:

1. Bipolar material is difficult to classify, as the

violent hammer-and-anvil technology results in flaking patterns different to those of platform technology. It may be difficult to distinguish between bipolar cores and flakes, and there may be cases where the detailed classification of bipolar material must be based on personal judgement.

2. The bipolar cores of southern Norway can be subdivided into a series of sub-types of which several are chronologically significant (diagnostic) making it possible to date an assemblage within time-intervals of c. 400 years (type 3 cores) and c. 200 years (type 4 cores). The morphology of these sub-types is determined by the choice of blank and the duration of the bipolar reduction sequence: an extensive bipolar reduction sequence will almost always result in the production of a classic bipolar core.

3. In Scandinavia the application of bipolar technology is limited to areas outside the region of Cretaceous Chalk with abundant flint resources, and it must be assumed that bipolar technology is an adaptation to i) raw-material in small nodules and ii) sparse resources.

Mesolithic and Neolithic Great Britain is characterized by a situation similar to the Scandinavian with a core region of Cretaceous Chalk and abundant flint resources (south-east England) but apparently no or limited use of bipolar technology, whereas areas outside the chalk/flint zone are characterized by comprehensive application of bipolar technology.

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Notes

¹ At this place it must be stressed that S.H. Andersens *skælhuggede skiver* (i.e. scalar flakes) are not bipolar cores but a specialized core type used to produce bi-convex flakes for transverse arrowheads (Andersen 1979). Internationally this method is known as the *Kombewa*-method, and the resulting bi-convex flakes are known as *Janus*-flakes (Tixier *et al.* 1992, 57ff).

² The phase abbreviations refer to the chronological framework in Ballin *in prep*. The dates of the Stone Age phases of Southern Norway are as follows:

Early Mesolithic (EM) — 10,000-9,000 BP
 Middle Mesolithic A (MM A) — 9,000-8,400 BP
 Middle Mesolithic B (MM B) — 8,400-7,500 BP
 Late Mesolithic A (LM A) — 7,500-5,600 BP
 Late Mesolithic B (LM B) — 5,600-5,200 BP
 Early Neolithic (EN) — 5,200-4,700 BP
 Middle Neolithic A (MN A) — 4,700-4,000 BP
 Middle Neolithic B (MN B) — 4,000-3,800 BP
 Late Neolithic (LN) — 3,800-3,500 BP

³ In an experimental study of the bipolar technology Migal has proven that the final shape of a bipolar core is influenced not only by the shape of the blank (pebble, exhausted core, etc.) but also raw-material and type of hammer and anvil (Migal 1987).

⁴ In southern Norway natural flint is found on the beaches, and it is generally believed that these pebbles arrived from Denmark in floating icebergs and floes (Johansen 1957).

⁵ At the same time, the two identical samples show that flint had not become any more scarce in the Middle Neolithic than it was in the Middle Mesolithic. An exhaustion of the local flint resources would have resulted in a smaller average pebble size in the stores, as well.