HEIMDALL'S STONES AT VITEMÖLLA IN SE SWEDEN AND THE CHRONOLOGY AND STRATIGRAPHY OF THE SURROUNDINGS

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ABSTRACT. Heimdall's Stones at Vitemölla is an archaeological monument of stones arranged in circles and where sightlines can be identified of the sunrise and sunset at winter and summer solstices and spring and autumn equinoxes. Therefore, this stone monument is likely to have served as an archaeoastronomic observatory. It is founded in a fossil land surface now covered by half a metre of eolian sand. In order to date this sand drift, sediment coring was performed in the nearby Sandefloen bog. Seven levels were subjected to AMS C14 dating. The first sand drift, correlated with the sand drift covering Heimdall's Stones, was dated at 500–600 cal. BC. Consequently, the observatory has to date back to the Bronze Age, fitting well with its Sun cult and with the rock carvings recorded on the individual stones. At the seashore 500 m east of the observatory and the bog, we were able to reconstruct the sea-level changes. In conclusion, we combine the recorded sea-level changes with the C14-dated bog stratigraphy and the observed stratigraphy at Heimdall's Stones (covering an area of 500 × 500 m) into one unified picture. The chronostratigraphic position of Heimdall's Stones agrees well with the dating of the Kivik grave. The Vitemölla area is likely to have been an important cultural centre in the Bronze Age.

Key words: Bronze Age, archaeoastronomy, sightlines, rock-carving, sand drift, sea level changes, chronostratigraphy, SE Sweden.

Introduction

It is a well-known fact that the Sun was worshipped as a central deity in Scandinavia in the Bronze Age (e.g. Montelius 1911; Almgren 1926–1927; Bröndsted 1938; Kaul 1998). This is evident from rock carvings, ornaments on bronze tools and Sun-related sculptures and objects; not least the famous Sun chariot found in 1902 in the Trundholm bog in Denmark.

In recent years it has become apparent that there also exist huge sundials or archaeoastronomical observatories. The ship tumulus of Ales Stenar in southeastern-most Sweden was by one of us, Bob **G. Lind (BGL)**, shown to be a large observatory recording sunrise and sunset at summer solstice, winter solstice and at spring and autumn equinoxes besides star constellations like Cygnus (Lind 2004, 2005). Likewise, the ship tumulus at Stenshed and the dolmen at Haväng are carefully oriented with respect to the motions of the Sun (Lind 2004). In 2008, two more sites were added, namely the stone monuments of Heimdall's Stones and of Hafradal. In this paper we will present the findings and chronostratigraphy in association with Heimdall's Stones, which seems to occupy a key position for our understanding of Bronze Age culture in the region and distant trading overseas.

Heimdall's stones

In the 1930s some large blocks were observed on the flat glacifluvial terrace 1.2 km north of the village of Vitemölla (registered as "Ravlunda 169:1" in 1937). They were interpreted as gravestones belonging to the Iron Age. In 1998, they were preliminarily termed "Höga Stenar". The few stones registered in 1937 have now increased in number to 129 identified and mapped stones, and a more pertinent name of "Heimdall's Stones" has been proposed (Lind 2008).

One of us (BGL) had, in air photos, recorded that the stones were arranged in a circular form. Therefore, in the years 2007 to 2008, the area was subjected to detailed studies. Quite soon, Lind (2008) could show that the stones were carefully arranged in cir-

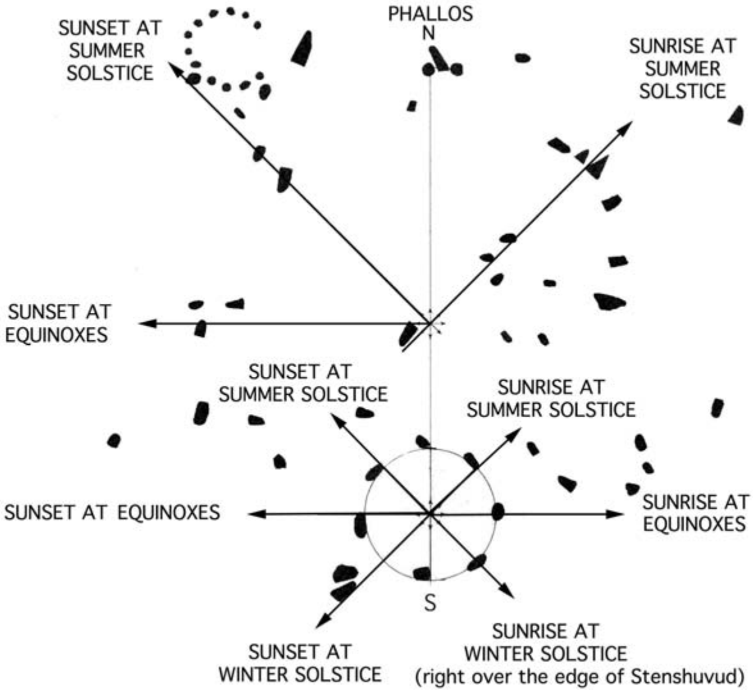

Fig. 1. Heimdall's Stones; a 30 m wide (from N to S) observatory from the Bronze Age with the main sightlines marked

Fig. 2. Sunrise at winter solstice on 21 December, 2008, from a point in the direct sightline as given in Fig. 1 (for further details, see Lind 2009). The Sun rises just at the notch in the eastern rising surface of Stenshuvud

cles; a main circle of 30 m diameter with a smaller circle in its south side and an open circle just outside in the NW (all recorded in Lind 2008). Sightlines were recorded, which coincide quite perfectly with the sunrise and the sunset at summer solstice, winter solstice and at the spring and autumn equinoxes (Fig. 1). Besides, there were some sightlines to stones further away in the ENE and WNW that were interpreted as marking important dates for agriculture. Recently, the sunrise at winter solstice was found to occur right over the well-pronounced shape of Stenshuvud (Fig. 2), when viewed from the centre over a marker stone in the circle of Heimdall's Stones (Figs 1 and 3). This sightline was found also to pass right across the 64 m long stone ship at Ängakåsen (Fig. 3). This can hardly be a coincidence, rather a very strictly oriented sightline by those who built the monument of Heimdall's Stones. Therefore, it seems quite logical to claim that we are dealing with an archaeoastronomic observatory (Fig. 1; cf. Lind 2008; Mörner and Lind 2009).

Besides, the stones of the Heimdall's Stones monument were found to be full of rock-carving symbols: cup marks, Sun symbols, a pyramid sign,

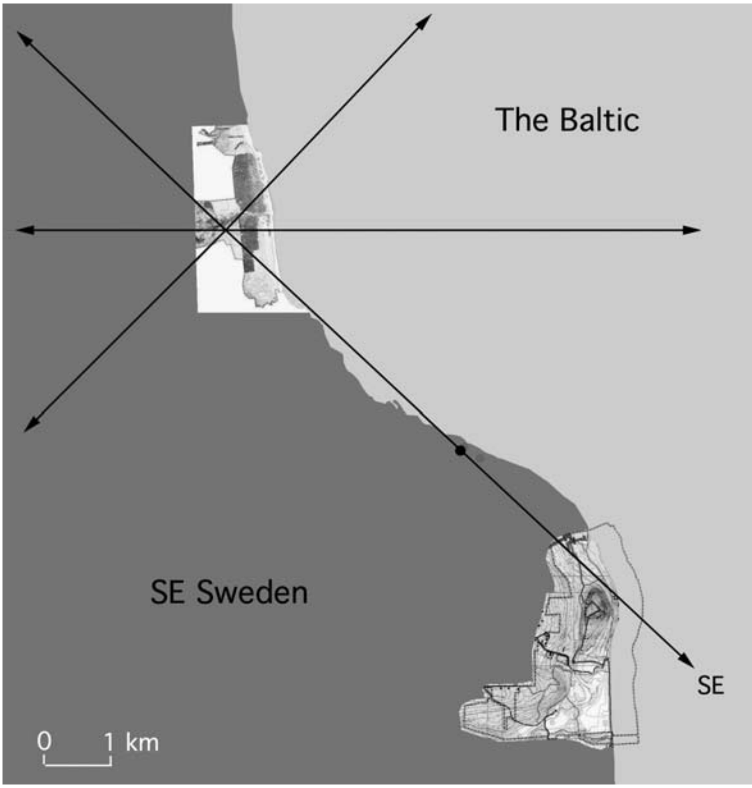

Fig. 3. Extended sightlines from the centre in Heimdall's Stones (Fig. 1). The sunrise at Winter solstice is precisely at the distinct notch marking the eastern rise of the bedrock hill of Stenshuvud (Fig. 2), 7.3 km to the SE. This line passes right across the stone ship at Ängakåsen (black dot). An opposed sightline was determined by Kaul (2005) from the Island of Bornholm to Stenshuvud, a distance of 70 km, at the sunset at summer solstice. Thin lines on the inserted map of Stenshuvud give 5 m counter-lines

Fig. 4. The boulders of Heimdall's Stones are full of rock carvings of typical Bronze Age type. This bolder has nine clear cup marks. The size is about 0.5 × 1.0 m

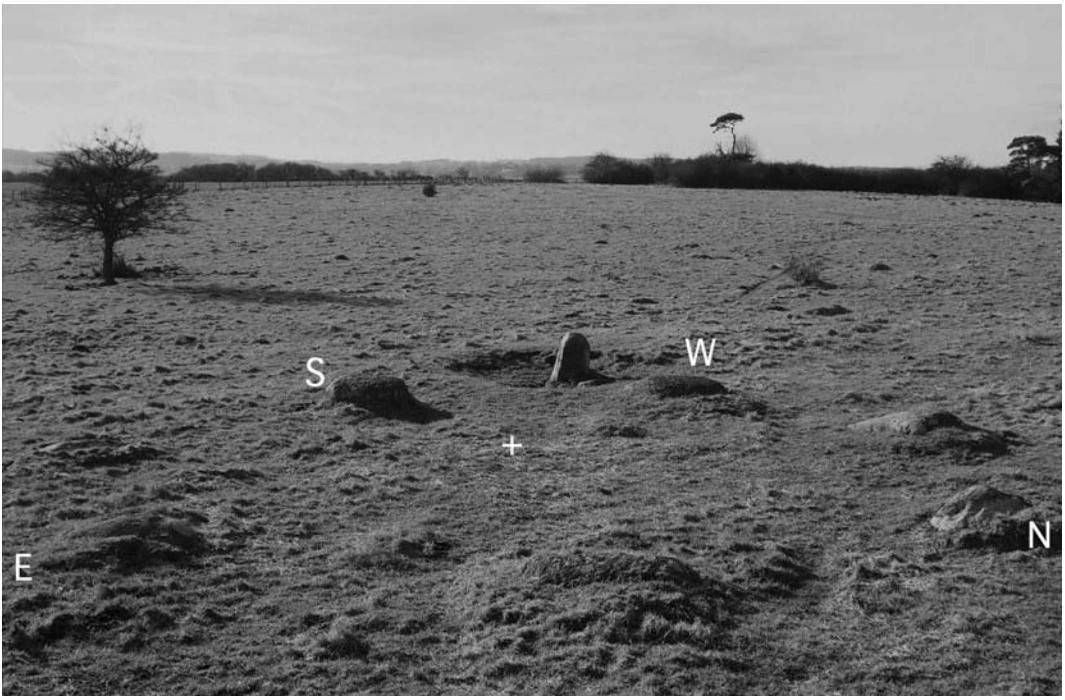

Fig. 5. View of the small stone circle in the south (cf. Fig. 1) as seen from the NE to the SW. Only the topmost parts of the boulders stick out of the surface, the rest is covered by sand. One digging and a number of corings have revealed a cover of about half a metre of eolian sand above a buried soil surface in which the boulders are rooted. The centre of the circle is marked by a + sign

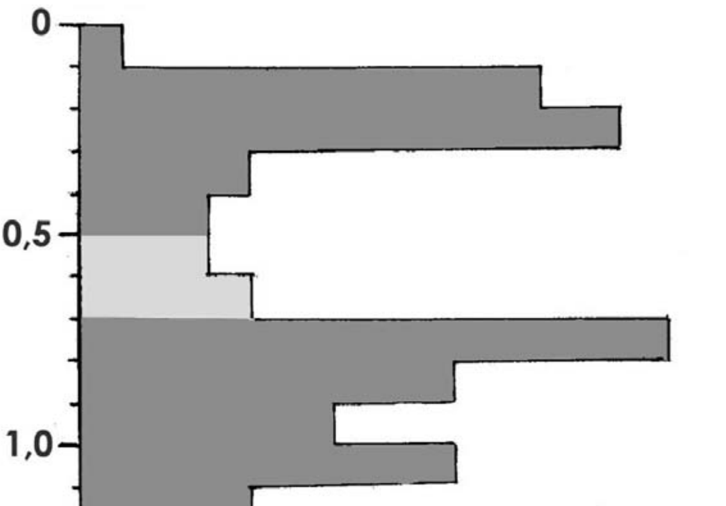

Fig. 6. Number of "objects" in the GPR measurements over the eastern part of Heimdall's Stones recording the double stratigraphy in full agreement with the observed stratigraphy in cores and one hole dug into the ground revealing a buried land surface covered by some 0.5 m eolian sand

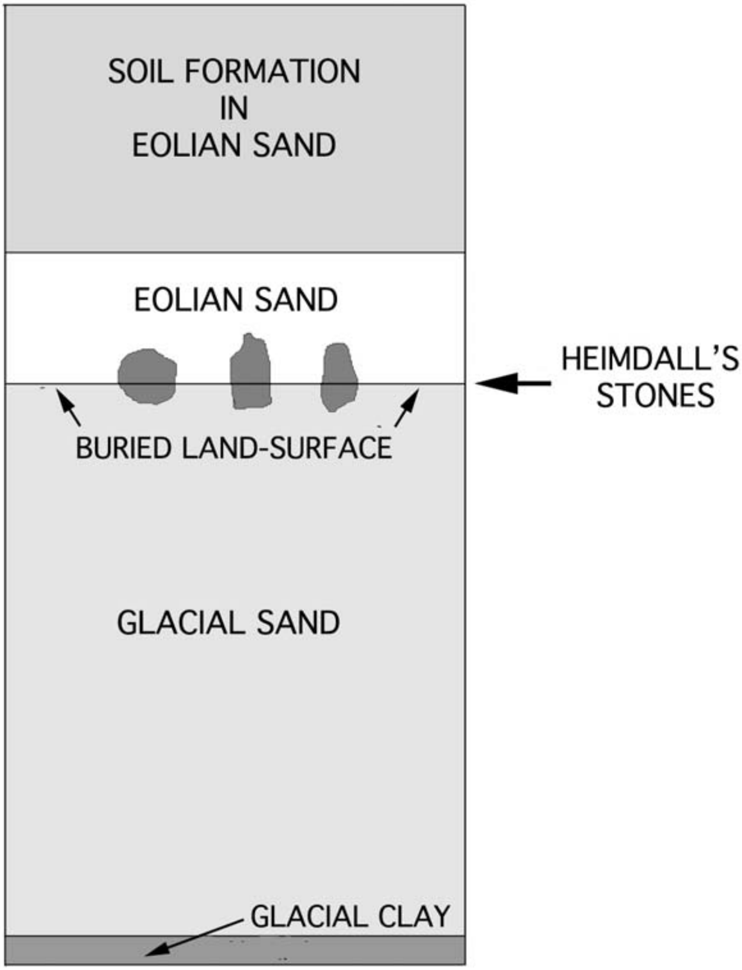

Fig. 7. The stratigraphy at Heimdall's Stones according to observations by coring and digging, and extensive geophysical measurements. The monument (Fig. 5) is founded in the buried land surface now covered by eolian sand. The stones of the monument project through the sand cover (Fig. 5)

a very clear omega sign and a number of other signs (Lind 2008; Mörner and Lind 2009). Hence, there were reasons to suspect an origin in the Bronze Age. Fig. 4 shows a boulder with nine cup marks.

At the same time, one of us, **Nils-Axel Mörner (NAM)** recorded that the monument was covered by half a metre of eolian sand (Fig. 5). Beneath this sand layer there was a buried ancient land surface (i.e. a soil horizon). The covering eolian sand had a soil profile suggesting subaerial exposure for quite a long time (some millennia). This double stratification is very well recorded in our **ground-penetrating radar GPR** measurements (Mörner 2008a), especially in the NE (Fig. 6). In addition, the magnetic survey (Schwarz 2008) showed structures in the subsurface "that must represent various forms of human activity in the past".

Therefore, the stratigraphy at Heimdall's Stones may be summarized as has been done in Fig. 7, where the age of the covering eolian sand probably represents the climatic change at the boundary between the Bronze and Iron Ages as well as the boundary between the Subboreal and the Subatlantic at 500 to 600 BC (Mörner 2008a).

The location of the tree sites discussed in this paper is given in Fig. 8.

After this paper was first written, we noted that Kaul (2005) had recorded that, on the Island of Bornholm, ships cut into the bedrock were oriented as if they were sailing right towards Stenshuvud, 70 km to the NW, where the Sun was setting at summer solstice. This sightline is directly opposed to the one from Heimdall's Stones to Stenshuvud at winter solstice, as is shown in Figs 2 and 3.

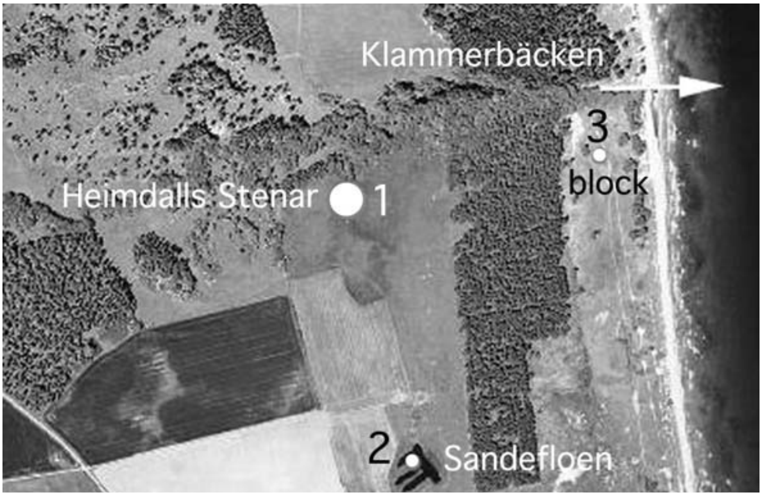

Fig. 8. The area around Heimdall's Stones: (1) the actual monument, now partly sand covered (written Heimdalls Stenar in Swedish), (2) Sandefloen where we took our C14 samples, (3) the big block on the shore that has a Sun symbol levelled at +2.97 m, and the Klammerbäcken brook

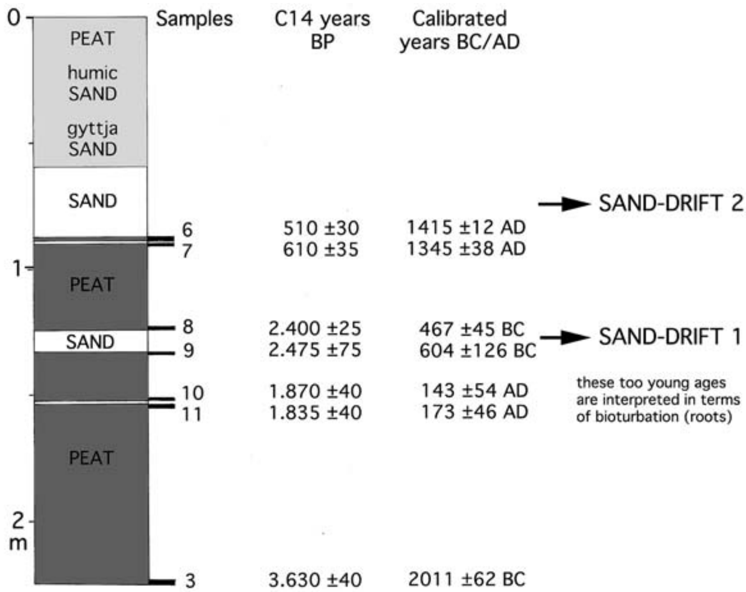

Fig. 9. Stratigraphy, position of the seven C14 samples dated, ages obtained in C14 years BP and in calibrated absolute years: cal. BC/AD. The first major sand drift started 500–600 cal. BC, that is, just at the Subboreal/Subatlantic (SB/SA) transition and the boundary between the Bronze and Iron Ages, and when the sea level had fallen and exposed large sand fields along the coast, which could feed active sand drift

The Sandefloen chronostratigraphy

In September 2008 we undertook a number of corings in the peat in the central part of the basin, which today consists of an irregular lake (from peat quarrying) and remaining peat (Fig. 8, point 2: Sandefloen). The base of the peat was reached at a depth of 2.25 m. The stratigraphy consists of alternating peat and sand layers (Fig. 9). A total of seven levels were sampled (some levels with duplicate or triplicate samples). The seven samples were C14 dated using the AMS technique at the Uppsala laboratory (by **Göran Possnert, GP**). The dates obtained were calibrated according to international standards into absolute ages in cal. BC/AD, which are given in Fig. 9.

Our C14 dates (samples 8 and 9) indicate that the first sand drift commenced – just as originally pro-

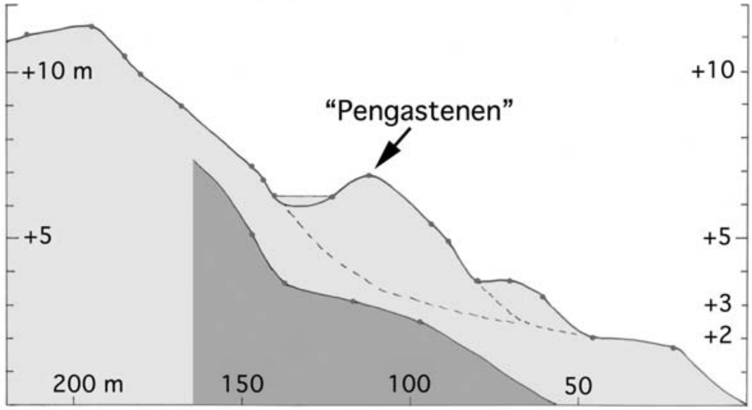

Fig. 10. The levelled shore profiles at Ängakåsen; the main profile with two beach ridges and the side profile with a distinct notch (dark) 200 m to the south

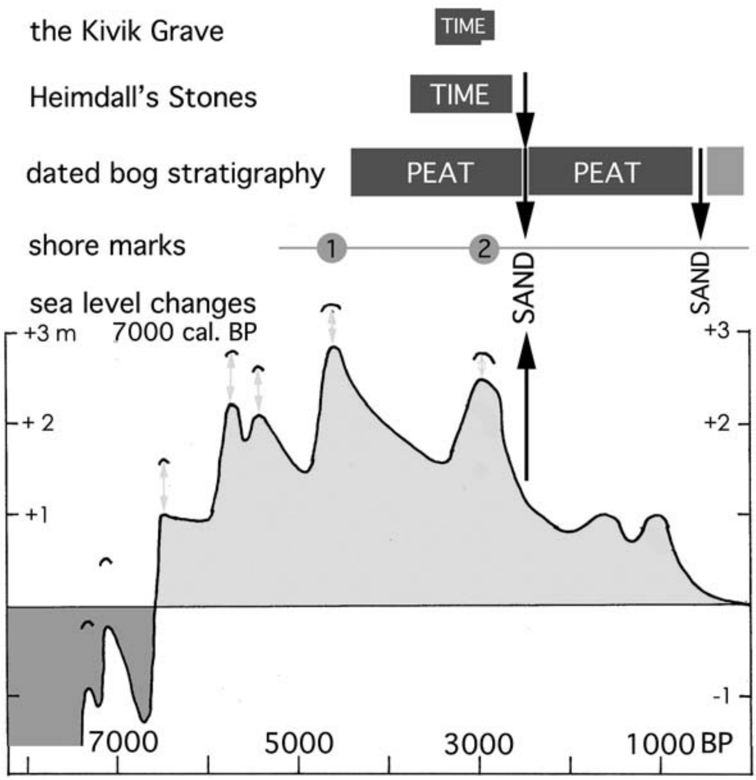

Fig. 11. Synthesis of chronology and stratigraphy at our three sites (Fig. 8): sea-level changes, C14 dates, stratigraphy at Sandefloen, and the sand cover and soil formation at Heimdall's Stones. Thanks to this, we are able to date the Heimdall's Stones monument to the Bronze Age. At the top, we add the date of the Kivik Grave. Obviously we are, in this region, dealing with an important cultural centre in the Bronze Age

posed (Mörner 2008a) – at the Subboreal/Subatlantic transition and the change from Bronze Age to Iron Age. This is the sand layer that covers parts of Heimdall's Stones. The age obtained harmonizes with the strong soil formation in the covering sand (Fig. 7).

Because the Heimdall's Stones monument must belong to the time before the sand drift, our new C14 dates (Fig. 9) imply that this archaeoastronomical observatory (at least the main part now covered by sand) must belong to the Bronze Age (the time before the sand drift) as was originally proposed (Mörner 2008a). Occasional stones may, of course, have been erected later. Our geophysical measurements (magnetometry and ground-penetrating radar) found no traces of any graves, however.

We can go one step further and integrate all the three sites we have been working at (Fig. 8), namely Heimdall's Stones, Sandefloen and the sea-level changes (Mörner 2008a). It is 500 m in between the three localities.

The sea-level changes

On the Holocene shore terrace in the east (Fig. 8, point 3), there is a big block with a Sun symbol cut into its upper part. The block has its base level at +2.35 m and the Sun symbol has a level of +2.97 m. When the symbol was cut into the block, the sea cannot have been higher than about +2.5 m. Because of this, we (NAM) undertook a closer analysis of the shore-level displacement.

At Ängakåsen close to the Kivik Grave there are excellent fossil shorelines preserved; namely a double beach ridge, which to the south goes over into a distinct notch with a terrace plane seaward. Two sections were levelled across those paleoshore indicators (Fig. 10). Two levels can be distinguished: one around +3.0–2.5 m and one around +2.0–2.5 m. On the upper beach ridge lies "Pengastenen" with its Sun-oriented surrounding stone circle.

Today's relative uplift is given as –0.4 mm/yr at this point. Because the sea, over the same time period of measurements, rose by 1.1 mm/yr (Mörner 1973), the absolute uplift must be put at +0.7 mm/yr (i.e. an uplift, not a subsidence).

By that, we can transform the well-established shore-level displacement curves from the Stockholm area and from the Swedish West Coast (recently discussed in Mörner 2008b) to this isobase latitude in the configuration of Swedish land uplift.

We then obtain a curve shown in Fig. 11. This curve has a Holocene maximum level at +2.8 m at 4800 cal. BP, followed by a second high level at +2.5 m at 3000 cal. BP. Those levels fit perfectly well with the shore profiles at Ängakåsen (Fig. 10).

Consequently, the Sun symbol in the big block may well have been cut during the Bronze Age, judging from the sea-level changes shown in Fig. 11.

We are now ready to summarize the chronostratigraphy of the area as given in Fig. 11.

Discussion and conclusions

From our chronostratigraphic analysis of the records in the area around Heimdall's Stones a congruent picture emerges (Fig. 11) with respect to the stratigraphy at the monument in question, the stratigraphy in the nearby peat basin (Sandefloen) and the sea-level changes. Consequently, the site Heimdall's Stones can now be dated at the Bronze Age, which fits well with the symbols cut into the stones and the astronomical observatory use the monument was obviously built for (Figs 1–5; Lind 2008, 2009).

We note that this timing fits very well with that recently obtained from the Kivi Grave by C14 dates (Goldhan 2005). This seems to indicate that the area around Vitemölla and Kivik was an active centre in the Bronze Age. Furthermore, from other criteria presented elsewhere (Mörner and Lind 2009), it even looks as though this area was visited by traders from the Eastern Mediterranean already in the Bronze Age (an interpretation already proposed by Nilsson in 1875).

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