The telltale potency of a simple milligram of charcoal found in a hearth left by Mesolithic reindeer hunters in the Norwegian mountains

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Abstract: The discovery and excavation of superimposed, information-rich Pre-Boreal hunting sites around the mountain lakes of Myrvatn and Fløyrlivatn in Southwest Norway have been the subject of archaeological debate. A brief review of research is presented here. In contrast to the well-preserved sites, settlement remains of a diametrically different order occur in the strongly water-eroded zone of the lakeshores: small, surface hearths in almost every stage of preservation, from evident hearths to diffuse and irregular scatters of fire-cracked stones. The latter category seems generally underestimated as a source of evidence. However, recent finds at Myrvatn demonstrate how even blurred, heavily eroded and almost intangible hearth remains, by the support of wood anatomical analysis, radiocarbon dating and intra-site comparison, may reveal concise, invaluable information both about the history of local use and regional landscape development.

Keywords: Myrvatn (SW Norway), Mesolithic sites, Unstructured hearths, Water erosion, Wood anatomy analysis, Radiocarbon dating, Vegetation development

Introduction

The 7 km long Store Myrvatn (literally: 'Great Bog Lake') is situated 610 m a.s.l. in the southwestern fringe of the Norwegian mountain range, ca. 50 km directly east of Stavanger. Due to hydro-electrical development resulting in varying lake levels, the former peat-covered beach lines of the lake have, over the last 85 years, been transgressed, dissolved, wave abraded, ice-pushed and wind eroded at accelerated rates (Fig. 1). Gradually the landscape has been transformed into a confusing patchwork of bare rock surfaces and denudated gravel terraces together with recent beach ridges of sand and gravel. Within isolated areas, mainly in the inner eastern end of the lake, the peat cover, nevertheless, still remains more or less preserved (Fig. 2).

Since 1984 an increasing number of middle and late Pre-Boreal Mesolithic campsites have been exposed by erosion. The sites in the former peat-covered zone are now partly denudated and the beach lines are in most cases recognised by restricted surface scatters or stray finds of flint and quartz artefacts. Some are evident as more or less blurred hearths or by rings of head-sized tent weight stones. However, in a few fortunate exceptions, thin cultural layers covered by bog have been discovered in vertical lake-side sections cut by erosion (Bang-Andersen 2003a, 2006a).

The *in situ* preserved deposits consist of lithic refuse and tool inventories which are integrated with well-preserved or partly distorted hearths and tent structures, compressed and blanketed between a substrate of glacial silt, sand and gravel and the lower part of deep bog. While sparse amounts of charcoal fragments and insect remains occur, organic material such as wood or bone artefacts or refuse has not been found. Myrvatn sites D and I, untouched by disturbance, have produced radiocarbon dates back to 9610 ± 90 and 9040 ± 120 years BP respectively, and thus are among the best preserved and earliest traces of human existence which are yet known in Norway (Bang-Andersen 2012). (The dates are, for simplicity reasons, generally reported in the text in radiocarbon years BP, as calibration of the dates does not alter the relative contemporaneity of the two hearths which are discussed, or their relation to the local vegetation development or other sites

in the area. Cf. col- location of both uncalibrated and calibrated values are given in the Appendix.)

The aim of this short contribution, however, is to consider the opposite end on the chain of inference by examining the potential information that exists in the denudated and eroded zone outside the bog covered areas. One particular category of archaeological evidence, unaligned surface hearths, is used as an example. First some additional background information will be provided.

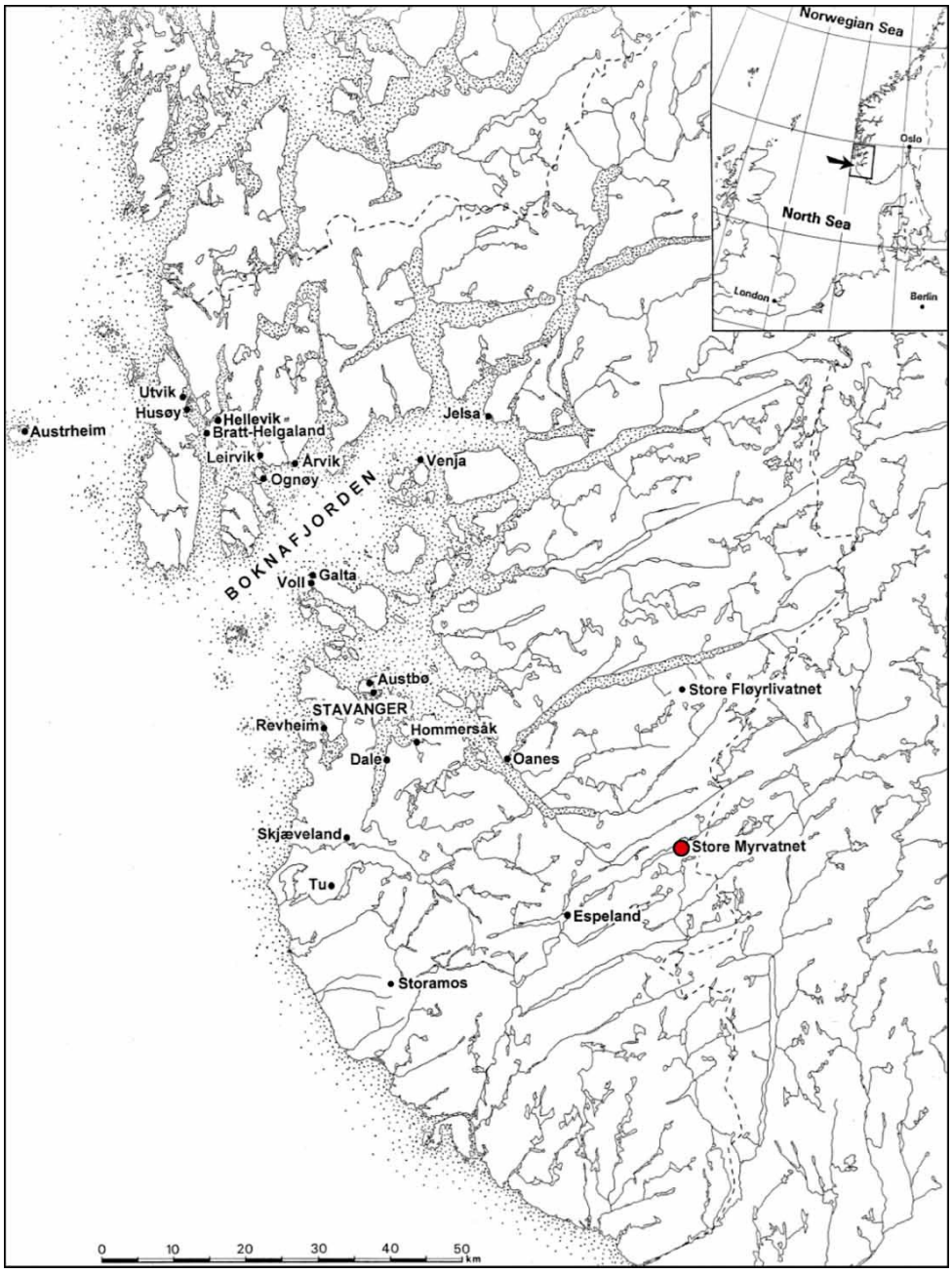

Figure 1 Map showing the position of Myrvatn together with other Pre-Boreal mountain, inland and coastal sites in Southwest Norway. Drawn by the author.

General status of research

The present knowledge about the early postglacial landscape development and the cultural history of Southwest Norway was established by Quaternary geological survey mapping as far back as 50 years ago

(Andersen 1960). This has been slightly modified by later archaeological and palynological field work, performed within the current area of interest over the years 1984–1989 (Bang-Andersen et al. 1986, Bang-Andersen 1990). This can be summarised under three categories.

Deglaciation

The edge of the Scandinavian inland ice during its late phase filled the lake Myrvatnet basin and neighbouring glacial valleys as parallel, east–west oriented lobes. After the 'Lysefjorden' advance, which appears to be contemporaneous with or a few hundred years later than the Younger Dryas 'Ra' main stage in Southeast Norway (Andersen 1960), the ice seems to have retreated from the area between 10 200 and 9800 years BP. Unfortunately, precise geological or palynologically related 14C dates of the local deglaciation are not available. On the other hand, radiocarbon dates of Stone Age sites at lake Fløyrlivatn (760 m a.s.l.) in the Lysefjord mountains reach back to 9750 years BP (Bang-Andersen 2003a, 2003b) and provide a terminus ante quem for the local ice recession. This result may be extended to lake Myrvatn which is lying only 20 km further south, and is also in distal position to the Lysefjord main moraine.

Figure 2 The eastern inlet area of Myrvatn in 1989 with the excavated bog-covered sites I and D to the left and the archaeologist's campsite on the opposite beach. Photo: Museum of Archaeology, University of Stavanger.

Pioneer inland utilisation

The hitherto earliest proved archaeological sites at Føyrlivatn and Myrvatn demonstrate that human groups started using these mountain lake areas between 100 and 200 years after local deglaciation. Not long before, the wild reindeer seem to have moved from earlier habitats on the coast to new permanent feeding and breeding grounds in typical peri-glacial environments. As there was no natural occurrence of anadrom fish and alternative large game species as red deer and elk had not invaded Norway (Lie 1988, Grøndahl *et al*. 2010), specialised reindeer hunting offers the only logical explanation for the pioneer inland use, although there is a total absence of osteological material to verify it (Bang-Andersen 2003a, 2003b).

The sites are without exception interpreted as the remains of short-term (seasonal) camps, used infrequently by small task groups with settlements on the sea coast, or in outer fjords, as points of departure (Bang-Andersen 1990, 1996, 2012). This human exploitation of higher-lying inland and mountain resources is earlier than hitherto proved anywhere else in Fennoscandia.

Vegetation development

Assessing the early postglacial vegetation in the interior of Norway is problematic, in particular within the southwest. The ice-recession history is only partly known. Also the gradual development of periglacial pioneer vegetation is more or less intraceable in the mountains bordering Lysefjord, due to a lack of reliable sedimentation basins. This is clearly expressed at Myrvatn, where a handful of kettlehole deposits, cored for pollen analysis, have proved to be either been eroded or inverted in the bottom.

Wood anatomy analyses of charcoal fragments found in hearths, or occurring within more diffuse areas of pyrotechnical activity, nevertheless demonstrate the pioneer vegetation in both mountain areas to have consisted mainly of a low and probably patchy shrub of *Salix* and *Betula*. Distinctive amounts of *Quercus* charcoal partly together with a few fragments of *Pinus* in as many as four Pre- Boreal sites at Fløyrlivatn, do, however, appear dubious and misleading. As oak trees only established in outer parts of the Norwegian coastal zone in the Early Holocene, their local existence in the mountains may be ruled out as explanation. Consequently, the occurrence of *Quercus* charcoal most probably simply reflects re-use of wood which has been transported into the mountains from lowland areas as tent poles, paddles or knife- or scraper handles, but later broke and was finally used as firewood (Bang-Andersen 2006b).

A significant landscape transformation started with the formation of humus which developed into deep peat bogs, and more or less completely covered the bare glacio-lacustrine terraces of sand and gravel along the lakeshore. Radiocarbon analysis of compressed peat collected as a 10-mm-thick slice from the lowermost part of the bog overlying the southwestern part of Myrvatn site D has been dated to 8680 ± 100 years BP. Material of such a kind will encompass an undetermined number of growth-years. In addition the actual sample may have been contaminated by microscopic charcoal from the Pre-Boreal cultural layer directly underneath. Accordingly, the date only provides an approximate minimum age of the start of the local soil formation. It nevertheless corresponds with earlier radiometric dates of the basal layer of bogs situated in comparable altitudes in Southwest Norway, for example in the lower part of Kvanndalen (680 m a.s.l.) in Suldal, ca. 100 km further NNE, where the formation started around 8450 ± 70 years BP (Prøsch-Danielsen 1990, 55–67). Some overlap exists of the calibrated ages between Myrvatn and Kvanndalen (8185–7540 and 7595–7355 cal BP, respectively).

It is a reasonable assumption that the blanketing of the cultural layer at Myrvatn site D reflects paludification due to generally wetter climatic conditions in the mountains in the mid-Boreal. The progressive formation of deep bogs made the beach lines more or less uninhabitable. Eventually, accelerated by social or economic changes in the coastal base areas of the seasonal reindeer hunters, or by a retreat of the reindeer population to grazing grounds in higher-lying eastern mountains, which were now ice-free, the Myrvatn area lost importance during the Boreal and finally was left unexploited by humans.

The significance of simple outdoor hearths

As has been stated earlier, numerous but far less legible remains of former Mesolithic activity at Myrvatn are spread out as stray finds, diffuse lithic scatters, hearths and (occasionally) tent rings (Fig. 3).

Unlike the eroded artefact assemblages which normally contain diagnostic typological elements proving a Pre-Boreal age, surface hearths will remain undated unless they are associated with datable artefacts or contain remains of charcoal *in situ*. Exposed as singular small, circular or oval shaped concentrations of fire-cracked, red-burnt fist-sized stones, the hearths have normally not been cut into the ground, paved in the bottom or been aligned by stones along the outer edge. The original width for well-preserved hearths normally ranges between 0.8 and 1.2 m (Fig. 4).

There are good reasons to expect that a majority of the hearths to be either of Pre-Boreal or early Boreal age

in the Myrvatn area. They were probably used no more than a few times within a restricted number of years and then abandoned before humus formation started on the lake-side gravel terraces. However, at least some hearths demonstrate human activity after AD 1930, when erosion of the bog covered shorelines probably started due to the hydro-electrical construction project. This can be clearly seen at the archaeological field campsite from 1989, at the eastern end of the lake – where the hearths (and tent weight stones) serving the daily evening activities of 25 years ago now appear as partly intact, genuine 'prehistoric' structures. Other hearths of recent age may exist elsewhere within the erosion zone. There are thus two possible periods to which these hearths may belong: before the peat formation started about 8700 y.BP, or after most of the peat had been eroded away over the last 40 years.

According to archaeological and ethnographic sources, and in the light of more recent examples, the use of fire to produce heat and light and for cooking and preservation methods during prehistoric times, is universally recognised as a human necessity, as is the role of the fire as a basic psychological factor and social instrument (cf. Odgaard 2007, 2010, Bentsen 2007). However simple and trivial it may appear com- pared with, for example, the elaborate hunting strategies, profound artistic expressions and/or intricate prehistoric grave-cults, the unaligned open hearth probably represents one of the most basic of all cultural traditions – irrespective of time, place or occasion. Shaped as simple, circular or oval indoor or outside surface features, with or without pebbles and cooking stones, hearths occur, or have originally existed, on practically all Stone Age settlement sites. Well known Late Palaeolithic and Early Mesolithic examples in Northwest Europe are Pinneberg (Rust 1958, 30–33) and Gönnersdorf (Terberger 1997), Star Carr (Clark 1971, 10–12) and Ulkestrup (Grøn 1995, 26–28). On other sites the hearths are now invisible, although still present as 'structures latente' and to be reconstructed by occurrence of severely burnt or over-heated lithic artefacts, or inferred from a wider range of data as has been demonstrated for example at the Belgian sites 'Verrebroek Dok 1' (Sergant *et al*. 2006) and 'Rekem 10' (De Bie *et al*. 2002).

In addition to potential high-resolution radiocarbon dates, charcoal preserved in hearths provides an indication of the palaeoenvironment of the actual site by means of wood anatomy analysis (Schweingruber 1978, Hather 2000, Bang-Andersen 2006b) which partly compensates for the lack of pollen data at Myrvatnet. An examination of 650 fragments of charred twigs and branches from sites I and D provides evidence of a typical pioneer, early Postglacial vegetation along the lake-sides consisting of *Salix* with minor amounts of *Betula*.

Structure id. no.162261 at lake Myrvatn

After putting the early natural and cultural history of the Myrvatn area into a wider context, one particular example will now be considered here in order to demonstrate the kind of information unstructured pre- historic hearths may contribute even though they appear in the most extreme cases of decay.

During an annual routine inspection of the erosion zone bordering the southern bank of the inlet area of Myrvatn in June 2012, a small and barely discernible agglomeration of fist-sized fire-cracked or red-burnt stones was discovered, located only 1.5 m outside a vertical cutting in the still preserved southwestern flank of the large bog which earlier blanketed sites D and I (Fig. 5). The cooking stones, distributed radially within a circular to oval spot about 1 m across, rested directly on the glacio-fluvial deposits. Upon closer examination very small, near invisible fragments of charcoal were observed in the surface within two small concentrations near the southwestern edge (Fig. 6). A bulk sample weighing 4.5 g was collected. There can be little doubt about the interpretation of the feature: the very last remains of an open unstructured surface hearth, almost totally disturbed by repeated water suspension, wave erosion and ice-push.

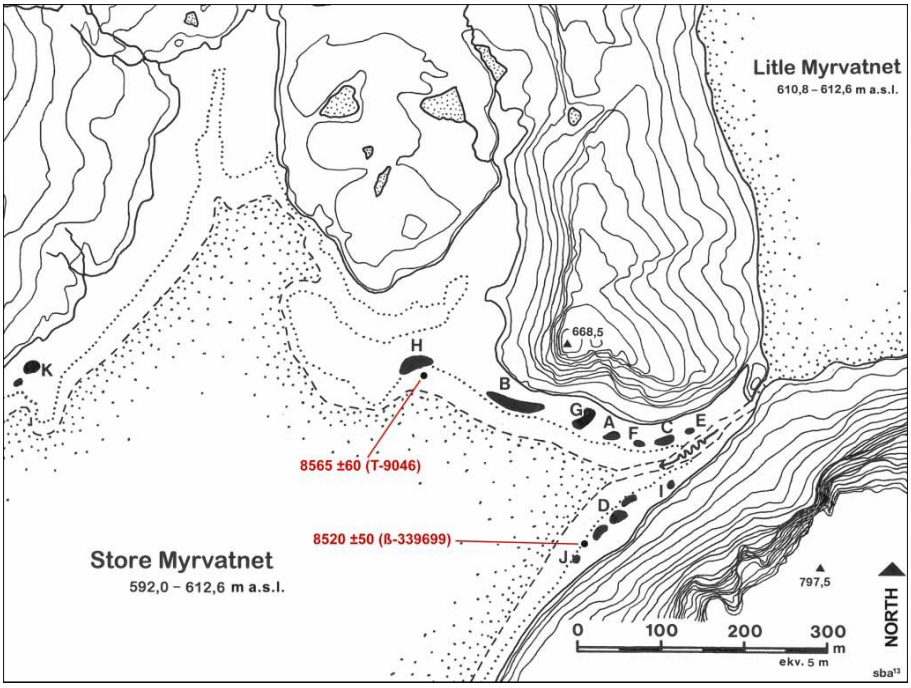

Figure 3 Map with all known Early Mesolithic sites at Myrvatn, eroded or bog-covered, shown as dark areas. Dates and dots indicate the two (of many) open hearths treated in the article. Drawn by the author.

As no lithic artefacts occurred in the charcoal spots or within the close surroundings of the hearth, there was no indication about its age or background story. With the glacial ground surface being exposed for as many as 8–10 years, the hearth may theoretically derive from modern-day fishing or camping activities – or, like the blurred hearths at the archaeological camp mentioned above, from scientific visits to the area. Alternatively, the hearth could have been used within the 1500-year long period of time between deglaciation and the first formation of bogs on the northern lakeshore. Radiocarbon dating of the feature will provide an exact age of human presence and activity in the area, provided that the hearth is not of modern date. The hearth will also present a more precise terminus post quem of the bog formation in the area compared to the basal layer of the bog superimposing site D with an approximate date to 8680 years BP.

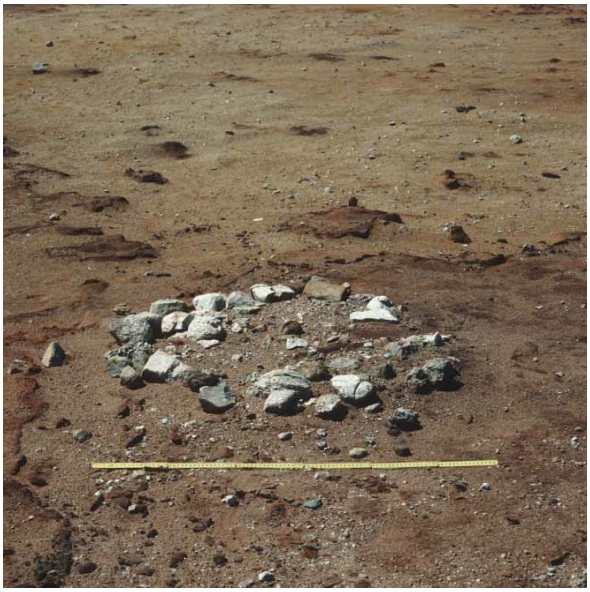

Figure 4 Overview of structure id. no. 162260, a 0·8 m wide Mesolithic unaligned surface hearth at Myrvatn as it appeared in 1988, almost perfectly preserved even after 58 years of annual erosion. Photo: Museum of Archaeology, University of Stavanger.

Figure 5 Overview of structure id. no. 162261, the extremely badly preserved remnants of a Mesolithic surface hearth at Myrvatn. A gradually retreating bog cutting is visible in the background. Photo: Museum of Archaeology, University of Stavanger.

Figure 6 Close-up photo of structure id. no. 162261 (cf. Figure 5) with patches of macroscopic charcoal visible on the eroded surface indicated by cross-hair symbols. Photo: Museum of Archaeology, University of Stavanger.

After sand and modern root and bark fragments had been removed in the museum laboratory, the size of the sample from Myrvatn structure id. no. 162261 was reduced to only 6.3 mg. The 0.5 to 1.5-mm-diameter charcoal particles derived from twigs or very thin branches. An analysis by reflected light microscopy determined the wood to consist of 'deciduous, probably short-lived species other than *Betula*, *Alnus* and *Quercus*' (Amundsen 2012). Consequently the sample appears to be ideal for accelerator mass spectrometry (AMS) dating. Of the cleansed sample (6.3 mg), 1.1 mg was utilised by the dating laboratory after pre-treatment and determined to an age of 8520 ± 50 years BP (ß-339699). (Report of radiocarbon analysis, dated 14 January, 2013. Beta Analytic Inc., Miami, FL, USA).

The radiocarbon date confirms that the hearth actually is a genuine prehistoric cultural remain, protected by the Norwegian cultural heritage act. It demonstrates that tiny macroscopic charcoal fragments may survive *in situ* over several years in the surface of hearth structures, in spite of wind action and repeated, water suspension and the impact of other erosive agents. The hearth represents the first proof of repeated human activity of some kind on the southern bank of the inlet of Myrvatn after the pioneer phase. It is suggested that this activity is also represented by a surface hearth less than 300 m away on the opposite bank dated to 8565 ± 60 years BP (Fig. 3). The calibrated age range indicates that the hearths may have been contemporaneous (dating to 7600–7520 and 7720–7520 cal BC). The two hearths may, actually, have been used by one and the same party of Mesolithic hunters.

The last found hearth further provides a precise maximum age (8520 ± 50 years BP) for humus formation and the development of deep bogs surrounding the lake which possibly ended, or at least radically altered, the human utilisation of the area.

The main conclusion of the research suggests that Mesolithic surface hearths can survive and provide important archaeological information despite poor preservation of the actual structure itself or the amount of charcoal that is preserved.

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Appendix – List of ^{14}C dates

9750 ± 80 y.BP – Cal.BC 9305–9125/8990–8910 (ß-141301). AMS dating of 0.1 g charcoal (*Salix* + *Betula*) found in concentration at site 6, Fløyrlivatn.

9610 ± 90 y.BP – Cal.BC 9250–8650 (T-8295). Conv. dating of 3.6 g charcoal (*Salix* + *Betula*) from hearth at site D, Myrvatn.

9570 ± 70 y.BP – Cal.BC 9220–8740 (T-7141). Conv. dating of 4.1 g charcoal (*Betula* + *Salix*) found in concentration at site D, Myrvatn.

9460 ± 80 y.BP – Cal.BC 9150–8450 (T-8294). Conv. dating of 3.1 g charcoal (Salix) from hearth at site D, Myrvatn.

9440 ± 50 y.BP – Cal.BC 9150–8950/8900–8550 (T-8293). Conv. dating of 4.7 g charcoal (*Salix*) from hearth at site D, Myrvatn.

9420 ± 80 y.BP – Cal.BC 9150–9035 (T-8296). Conv. dating of 3.5 g charcoal *(Betula* + *Salix*) from hearth at site D, Myrvatn.

9040 ± 130 y.BP – Cal.BC 8600–7750 (T-7994). Conv. dating of 2.2 g charcoal (*Betula*) found in concentration at site I, Myrvatn.

9040 ± 120 y.BP – Cal.BC 8600–7800 (T-6489). Conv. dating of 2.6 g charcoal (*Betula* + *Salix*) found in concentration at site I, Myrvatn.

8680 ± 100 y.BP – Cal.BC 8185–7540 (T-8292). Conv. dating of 16.6 g humus from base of bog super- imposing the cultural layer of site D, Myrvatn.

8565 ± 60 y.BP – Cal.BC 7720–7520 (T-9046). Conv. dating of 4.1 g charcoal (*Salix* + *Betula*) from well-preserved hearth in the foreground of site H, Myrvatn.

8520 ± 50 y.BP – Cal.BC 7600–7520 (ß-339699). AMS dating of 1.1 mg charcoal (deciduous) from disturbed hearth structure 162261 in the periphery of site D, Myrvatn.

8450 ± 70 y.BP – Cal.BC 7595–7355 (T-5739). Conv. dating of unspec. amount of humus from base of bog at Hidlerberget, Kvanndalen, Suldal.

Dates in y.BP are given with one standard deviation (68% probability) and calibrated dates with two standard deviations (95% probability) according to atmospheric data from Stuiver *et al.* (1998) proceeded in OxCal v.3.3 (Bronk-Ramsey 1999). T = datings by Nasjonallaboratoriet for C-14 datering, Trondheim, Norway. ß = datings by Beta Analytic Inc., FL, USA.

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