



Dating of rock art and the effect of human activity on vegetation: The complementary use of archaeological and scientific methods



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ABSTRACT

One of the main aims of Scandinavian rock art research in recent years has been to identify the culture or society responsible for the imagery. This is of mutual importance, as studies of material culture can shed light on the rock art, while the iconography can be used to understand the contemporary material remains. A major challenge however, has been to determine the exact age of the images, as there are no direct dating materials. In order to overcome this challenge archaeological excavations and palynological analyses have been carried out at Vingen in Western Norway, one of Scandinavia's largest rock art areas. The archaeological and palynological data achieved, as well as loss-on-ignition are independent means for the dating of human activity. Since these methods provided similar results, an indirect connection to the rock art production activity may be inferred. Dates from archaeological contexts indicate a peak of activity between 6900 and 6300 cal. BP, with a potential start 7350 cal. BP and a culmination 6100 cal. BP. Palynological data from three different types of basins have documented forest disturbance in the same time period. Local vegetation reconstructions using the Landscape Reconstruction Algorithm has proved useful to identify anthropogenic-induced land cover changes in the Mesolithic period and a marked reforestation at the transition to the Neolithic period. The applied methods have helped to considerably improve our understanding of past activity and the environment, and demonstrates the potential of archaeological excavations and palynological studies for dating of rock art.

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1. Introduction

Scandinavia is renowned for its many sites with engraved, pecked or polished rock art, which is also separated into two different traditions, termed *hunters'* and *agrarian* rock art, or lately the *Northern* and *Southern Traditions*. The Northern Tradition is associated with hunter-gather-fisher populations, and normally dated to the Mesolithic and Neolithic time periods. Its iconography is characterised by wild animals, such as red deer, reindeer, elk, bear, and sea mammals, but also anthropomorphic images. The presence of wild animals have led most researchers to associate the Northern Tradition sites in Scandinavia to hunting strategies. However, detailed studies of the iconography at most Northern Tradition sites with anthropomorphic images have shown that these have a number of features that are characteristic for skeletons. It therefore seems more likely that the Northern Tradition

rock art was related to mortuary practices, and that the represented wild animals were associated with mortuary or death beliefs (Lødøen, 2014, 2015). During the Late Mesolithic, subsistence along the Norwegian coast seems to have been heavily based on fish and marine resources, which led habitation sites to be concentrated around tidal currents (Bjerck, 2008). This marks a contrast to most of the rock art sites of the Northern Tradition which are located further inland, along fjord systems or at the head of fjords (Lødøen, 2015). Its location thus emphasises a mortuary and perhaps esoteric character for the rock art. The Southern Tradition has been strongly associated with agricultural societies, dated to the Late Neolithic, the Bronze Age and even the Early Iron Age. It is characterised by ship images, domesticated animals, anthropomorphic images, concentric ring figures, spirals, and cup-marks, and could also be associated with mortuary practices, death beliefs and tradition in later periods (Goldhahn, 2016; Lødøen, 2015).

In recent years, Scandinavian rock art research has been occupied with the contemporary context associated with the rock images. Studies of human deposits, occupation and other associated patterns can help to shed light on the rock art, while the rock

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imagery, often seen as narratives, can be used to gain a better understanding of the contemporary archaeological remains. However, the dating of both traditions has always been a challenge, since no direct methods are available, and the indirect methods are all associated with a number of uncertainties generally applying to rock art (e.g. Aubert, 2012; Bednarik, 2001; Whitley, 2005). The prevailing dating method for the Northern tradition has been shoreline displacements and the assumption that the rock art was produced on clean surfaces, close to former shorelines. Following this, geological studies of post-glacial land-uplift have provided a *terminus post quem* dating of previously shore-bound rock art – which in rock art studies far too often is regarded as the real date. The close connection between the rock art and past shorelines has been legitimized by comparisons with the inland locations, where most rock art is found in the close vicinity of water tables of lakes and rivers (Mikkelsen, 1977). It has been argued that the coastal rock art originally had a similar close connection, and therefore that dating the levels of past shorelines will give a convincing dating of rock art at the same altitude. This approach has several weaknesses since variations in the levels chosen for the rock art, due to factors such as wave action or sea splash, may have occurred. Consequently, the dating may vary by hundreds or even thousands of years. In recent years, archaeological excavations in the immediate vicinity of rock art panels have been carried out more frequently, to try to define the age of rock art through dated cultural layers and artefacts. This has been particularly revealing in helping to document the character of the activity at the rock art sites, but we are still left with challenges in terms of contemporaneity: the excavated material could still pre- or post-date the rock art. By carrying out palynological investigations in the vicinity of rock art sites, independent data of activity can be obtained. The palynological and archaeological data can then be unified in order to obtain more accurate datings of the activity associated with the rock art. A pollen diagram may document activity periods and also periods with low or no human impact on the vegetation which can aid to identify the character and frequency of past activity. The challenge posed by this method is being able to separate human activity from natural causes of vegetation change. Traditionally, anthropogenic indicators (Behre, 1981) have been used to identify human activity in pollen diagrams, but activity that does not include animal husbandry or cultivation does not necessarily cause changes in the vegetation that are traceable by pollen analysis. The Landscape Reconstruction Algorithm (LRA) (Sugita, 2007a, 2007b) is an approach that converts pollen percentage data into vegetation cover by taking pollen productivity and dispersal into account. This has been used to reconstruct land-cover changes over time on different spatial scales (e.g. Fyfe et al., 2013; Hultberg et al., 2015; Nielsen and Odgaard, 2010; Nielsen et al., 2012; Marquer et al., 2014; Mehl and Hjelle, 2015; Mehl et al., 2015). By using LRA, a higher degree of vegetation openness has generally been estimated than the openness indicated by pollen percentage data (*op. cit.*). Of special interest for local studies is that LRA makes it possible to differ between locally produced and long-distance transported pollen. This opens the way to identifying anthropogenic-induced land-cover changes in the past, and may be a fruitful approach for time periods when there are few traditional anthropogenic indicators. As with excavations, the direct link between activity identified in a diagram and the rock art is missing, but one advantage is that a pollen diagram reflects longer time spans and a larger area than a test excavation.

The present paper deals with methodological challenges in the process of dating open rock art sites. Its focus is rock art of the *Northern Tradition*, at the site of Vingen in Western Norway (Figs. 1 and 2). The site contains one of the largest concentrations of rock art in Norway, whose dating has been the subject of debate since its

discovery a century ago (Bakka, 1973; Bøe, 1932; Hallström, 1938; Lødøen, 2013). Stylistic comparison with motifs at other sites, and studies of superimpositions and relationships with past shorelines have previously concluded that the rock art was produced in the Early and Middle Neolithic, after 5950 cal. BP, potentially as early as in the Late Mesolithic (Bakka, 1973, 1979).

In order to provide a more detailed chronological framework for the rock art, we present radiocarbon dates from archaeological excavations in the vicinity of rock art panels in combination with palynological investigations. Pollen analyses from two sites within the rock art area and one site just outside the main activity area, have been carried out. Additionally, loss-on-ignition, which gives indications of erosion and, indirectly, human activity, has been measured. The main patterns in the vegetation development have been revealed through ordinations, and land-cover reconstructions have been connected to loss-on-ignition and dates from archaeological contexts. Based on the evidence from these investigations, a solid chronological framework is suggested for the Vingen rock art complex.

2. Material and methods

2.1. Study area and previous investigations

The Vingen area is located in the Bremanger municipality in the county of Sogn og Fjordane (Fig. 1). A narrow west-east oriented fjord, Vingepollen, separates the main rock art area on the southern side of the fjord from the smaller area of Vingeneset to the north. The usable land for habitation and activity is restricted by the sea at one end, and by steep mountain slopes on the other. In the surrounding area there are several tidal current channels which have attracted habitation in most periods of prehistory due to their marine resources. Vingen, located at a distance to these more resource-rich areas, was inhabited in modern times from the 16th century until the 1930s (Lødøen and Mandt, 2012). In recent decades, Vingen has been used as pastureland for sheep and goats, and a semi-open vegetation of birch, grasslands and heather dominates the area today.

Vingen became officially known as a rock art site in 1912, when the first paper was published (Bing, 1912), and has since then been the subject of detailed documentation (e.g. Bakka, 1973, 1979; Bøe, 1932; Hallström, 1938; Lødøen, 2003, 2013; Lødøen and Mandt, 2012). The area is characterised by a number of east-west oriented ledges, with north- and south-facing rock panels. More than 2200 images are documented on rock panels, boulders and smaller stones (Lødøen and Mandt, 2012). The most common motifs are red deer, animal-headed staffs, and anthropomorphic figures (Fig. 2). The presence of red deer images led earlier researchers to conclude that the site was associated with hunting. More thorough investigations have documented a number of skeleton images at the site, and also a clear distribution of the images, where red deer images are portrayed moving eastward on south facing panels, while red deer and skeletons are depicted as if they were moving westward on the north facing panels. This seems to have been a main, structuring narrative for the area, and also seems likely to be associated with cosmology – and probably mortuary practices – and not exclusively, or at all, to hunting (Lødøen, 2015).

The main focus throughout most of the 20th century has been the character and the distribution of the iconography. A few minor excavations were made in the 1970s, but since the 1990s more methodical approaches have been chosen by prospecting the whole area with systematic test excavations, excavations in the immediate vicinity of rock art panels, including dwelling depressions, and palynological studies (Fig. 1). Three areas of Vingen are included in the palynological study: a small hollow at the *Vingen terrace*

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