Masters of Water and Stone

Exploring the Role of Rock Art Carvers in Nordic Bronze Age Societies

Julián Moyano Di Carlo



SWEDISH ROCK ART RESEARCH SERIES 11

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OXBOW | books
Oxford & Philadelphia

Published in the United Kingdom in 2027 by
OXBOW BOOKS
81 St Clements, Oxford OX4 1AW

and in the United States by
OXBOW BOOKS
1950 Lawrence Road, Havertown, PA 19083

© Oxbow Books and the author 2027

Paperback Edition: ISBN 979-8-88857-304-4
Digital Edition: ISBN 979-8-88857-308-2

A CIP record for this book is available from the British Library

Library of Congress Control Number: 2026947424

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Printed in the United Kingdom by Halstan & Co Ltd.
Typeset in India by DiTech Publishing Services

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Front cover image: Edited photo of Skee 614:1 (after Wilhelm Otnes 1980). SHFA, accessed 8 May 2026 at https://shfa.dh.gu.se/image/112018 (CC BY 4.0)
Back cover image: Human figure from the rock art panel Tanum 120:1. Tracing by Julián Moyano Di Carlo, 2025

This book was published in Open Access with the financial support of Lennart J. Hägglunds stiftelse för arkeologisk forskning och utbildning.

The Publisher's authorised representative in the EU for product safety is Authorised Rep Compliance Ltd., Ground Floor, 71 Lower Baggot Street, Dublin D02 P593, Ireland.
www.arccompliance.com

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Acknowledgments

It was a sunny summer afternoon in Andalusia in 2017 when I finally set my nerves aside and wrote an email. The day before, I had read about a session at the EAA 23rd Annual Meeting in Maastricht. Its title captured everything that fascinated me then, and still does today: ships, seafaring, and social complexity. Since I could not afford to travel to the Netherlands, I reached out to the session organizer to express my interest in the topics they were studying. His name was Johan Ling. Johan not only replied but, without knowing me and covering all expenses, invited me to the "Long Distance Maritime Exchange and Social Complexity Conference" he was organizing the following year in Gothenburg with Richard Chacon, Yamilette Chacon, and Bettina Schulz Paulsson. After a day of inspiring presentations, Johan told me over dinner that I should do my PhD in Sweden and exclaimed, "Himilco!"—the Carthaginian navigator who sailed from Iberia to Northern Europe following Tartessian routes, and who, according to him, had to be the subject of my thesis. Although we have not *yet* dealt with Himilco, that dinner is the reason I am writing these acknowledgments today in Gothenburg, 12,500 kilometers away from my birthplace, Mar del Plata. Such a journey would not have been possible without the help of many people. Although I do not forget them, the following lines are dedicated to those who have most directly helped me complete this work.

This book is the outcome of a doctoral dissertation carried out in the Department of Historical Studies at the University of Gothenburg within the project "Tracing Carvers on the Rocks" (DIGARV 2020-03817). My first thanks go therefore to the members of this project: Johan Ling, Christian Horn, Mark Peternell, Cecilia Lindhé, Ellen Meijer, Lars Strid, Ashely Green, Rich Potter, and Carina Liebl. Thank you for your collaboration, your availability, and your willingness to help whenever needed. Christian and Johan, my supervisors, deserve special gratitude for their constant support, guidance, and the freedom they gave me to shape my project. I also owe a great deal to Ashely Green, whose infinite patience was crucial in resolving the technical issues that arose throughout the project. Many of the analyses presented in the thesis would not have been possible without her help. I am also very grateful to Gerhard Milstreu and Ellen Meijer for guiding me in Tanum and for making Underslös feel like a second home during fieldwork days.

This project would not have been possible without the economic and logistical support of several institutions. My thanks go to the Swedish Research Council, Riksbankens Jubileumsfond, and Kungl. Vitterhetsakademien for funding the project, and to Länsstyrelsen Västra Götaland, Länsstyrelsen Skåne, Länsstyrelsen

Östergötland, and private landowners for granting permission to document rock art panels. I think it is also important to thank all the institutions that have documented rock art in Bohuslän and made it accessible for everyone, especially Riksantikvarieämbetet, Underslös Museum, Svenskt Hällristningsforskningsarkiv, Vitlycke Museum, and Stiftelsen för dokumentation av Bohusläns hällristningar. My gratitude is also extended to The Karl Langenskiöld Memorial Foundation, Erasmus+ Program, and Donationsnämndens stipendier for supporting me through scholarships. And to Lennart J. Hägglunds stiftelse för arkeologisk forskning och utbildning for financing the publication of this book in Open Access.

I am deeply grateful to the colleagues who served as opponents in several seminars held at the University of Gothenburg: Staffan von Arbin, Serena Sabatini, Nicoline Schjerven, and Philip Riris. My thanks also go to Felix Riede for hosting me in Aarhus during my Erasmus+ traineeship, for involving me in a stimulating research environment, and for providing feedback on my project that has clearly influenced some of the interpretations presented here.

Thank you to those who gave up their valuable time to discuss certain aspects of my thesis, particularly Helene Agerskov Rose, Matteo Tomasini, Giacomo Bilotti, Pedro Sosa, Elena Miu, Maria Coto-Sarmiento, Tom Brughmans, Christian Isendahl, Nils Müller-Scheeßel, and Fredrik Dahlberg. Thanks also to Jacob Albå for helping me during my trip to Norrköping and for his annotations during our (failed) attempt to analyze workshops using machine learning algorithms. I am also indebted to the staff of the Unit for Academic Language (ASK) at the University of Gothenburg, especially Richard La Bontee and Jenny Mattson, for all the writing seminars and retreats that not only improved my writing in ways I could never have developed on my own but also made the research process much more efficient. As part of the collaboration with ASK, Emma Maltin, Ditte Kvist Johnson, Paulina Blaesild, Yannick de Raaff, and I created a little secret writing society. Much of the text of this book was written during the Friday sessions that we regularly had in the department. Thank you for the advice, laughter, *fika*, and emotional support. You are the best thing I take away from this whole experience.

Of course, none of this would have been possible without the support of my family. My warmest thanks go to my Danish in-laws for making me feel like part of their family from the first day and for always looking out for me (even when I cannot speak more than three words in Danish). To my brother and his family, for hosting us every time we visit Barcelona. And, of course, to my parents. Without them, this would never have happened. Thank you for putting my well-being and future above your own, for your financial and emotional support, and above all, for your love. Not even a hundred books could repay what you have given me, but I hope this makes up for it a little. *¡Gracias infinitas!*

Finally, my greatest thanks go to Ditte. She has been my partner, my best friend, and my home for the past five years. She was there to celebrate my successes, stood by my

side when challenges arose, and believed in me every time my confidence abandoned me. Thank you for the unwavering support, immense love, and constant patience (especially for the patience). This would have been much more difficult without your help. As if that were not enough, you also read, reviewed, and proofread every page of this book. This is, therefore, a bit yours too.

To all of you, and to anyone I may have forgotten, thank you!

Gothenburg
March 12, 2026

Abstract

For over two centuries, Nordic Bronze Age rock art (*c.* 1700–500 BC) has shaped debates on religion, mythology, ideology, warfare, and economy in prehistoric Scandinavia. However, scholars have paid far less attention to the carvers themselves. As a result, we still know little about how these individuals acquired, performed, and transmitted their social role. These three questions form the core of this book. Through their examination, the study offers new insights into the relationship between social organization and rock art, emphasizing that carvers cannot be separated from the social context of their time.

To address these issues, the book integrates social theory with digital technologies. It draws on role theory and behavioral archaeology to conceptualize how artistic roles operate in chiefdom-like societies and how we can infer them archaeologically. These theoretical models are then linked to the carvings through quantitative analysis of four dimensions of variability: formal, spatial, quantitative, and associational. These analyses are supported by high-resolution 3D documentation of panels at Aspeberget (Tanum), legacy data from rock art panels in Bohuslän, and univariate, bivariate, and multivariate statistical methods to identify patterns in the data.

The results suggest that rock art in Bohuslän developed gradually and remained strongly conservative, likely rooted in ancestral norms and traditions. These traditions shaped both the type of figures depicted and their placement in the landscape, typically near water and on rocks with favorable geological properties. Such rocks served at least two distinct purposes: small panels scattered across the region were likely associated with rituals surrounding the construction and launching of boats, while large and complex panels may have been created during maritime congregations that brought together people from different parts of Bohuslän or even wider Scandinavia. By promoting mobility and interaction, these gatherings may have fostered a consistent style among carvers of different parts of the region. Carvers seem to have gained the knowledge needed to perform in these social settings through apprenticeship systems guided by experienced peers. These systems allowed them to develop sophisticated technical skills but also limited their individual creativity, reinforcing the conservative nature of the tradition.

Taken together, these findings suggest that rock art production in Bohuslän was overseen by master carvers operating within ritual sodalities that formed political networks across Scandinavia. These specialists likely controlled the technical and ritual knowledge associated with carving and its transmission to future generations. As guardians of this knowledge, carvers were able to mediate between secular and ritual spheres, using the figures not only for symbolic expression but also to exert political influence within their societies.

Chapter 1

Introduction: who were the carvers?

In 1627, the Norwegian clerk Peder Alfssøn was traveling through Bohuslän when he decided to document a series of ships, humans, and animals carved on the rocks of Backa in Brastad. His watercolor painting of the site became the earliest record of Nordic Bronze Age rock art (1700–1300 BC) and marked the beginning of a long inquiry into the meaning and creators of these enigmatic figures (Bertilsson 2015b, 6–7). During Alfssøn's time, local people attributed the figures to the work of furious giants or evil elves (Jensen 2002, 321–324). Four hundred years later, we know these carvings were made by human beings, yet their identities and social roles remain unclear. Understanding their role is crucial because the carvers were the link between the figures and the reasons that compelled these societies to inscribe themselves and other beings on the rocks. Therefore, to grasp the social function of rock art in the Nordic Bronze Age, we must first discern who the carvers were and how they acquired, performed, and transmitted their role in society. That is the aim of this book.

The carvers in the background

The interest in identifying carvers on the rocks dates back at least to Nordén (1925, 143–145) and his definition of carving "schools" ("*skolas*") in Östergötland. Although many scholars have followed his lead and shown interest in the subject, the carvers have typically been mentioned only in passing, sidetracked by topics such as chronology, landscape position, and visual narratives. Therefore, reconstructing how the field has envisioned them requires piecing together isolated mentions of their age and sex, specialization, and social position.

When individuals assumed the role of carver is still an enigma. Coles (2005, 11) suggested that rock art was managed by elders, but he did not specify when these elders became carvers. Other scholars have argued that children made rock art as part of initiation rites (*e.g.*, Fuglestvedt 1999, 35–36; Ling 2008, 219; Horn 2015b, 39; Nyland and Stebergløkken 2021, 14; Smedberg 2024, 41). This argument is often supported by children-sized foot stencils on many panels (*e.g.*, Hauptman Wahlgren 2002, 226–277; Goldhahn 2012, 21). However, these stencils do not necessarily show that children made the carvings themselves, so the age at which they became carvers remains uncertain.

Their sex is as elusive as their age. Carvers have mainly been perceived as men based on the predominant depiction of masculine activities, the lack of figures with female attributes, and ethnographic comparisons (*e.g.*, Goldhahn 2007, 106; Bevan 2015; Horn 2017). However, many figures have ambiguous sex attributes, and some features used to classify human figures as women—such as "ponytails" or "breasts"—often appear in human figures with phalluses (Skogstrand 2008; Horn 2017). Therefore, the sex of the carvers remains contested.

More consensus seems to exist around the idea that carving was a specialized activity (*e.g.*, Nordén 1925, 143–145; Marstrander 1963, 74–75; Bertilsson 1987, 185; Coles 2000, 101; Bengtsson 2004, 85; Tilley 2021, 99). Yet scholars still debate what this specialization entails. While Marstrander (1963, 74–75) argued that small panels, and perhaps even large ones, were the work of single individuals, Hauptman Wahlgren (2002, 247) and Stebergløkken (2017, 55–56) contended that the carvings should be understood as the collective visual expression of different groups. Who integrated these groups, however, remains unclear. Some proposed that carving knowledge was esoteric (*e.g.*, Bengtsson 2004, 99–100; Goldhahn 2007, 105–106; Ling 2008, 219; Kjeldsen 2017, 101) and perhaps controlled by elitist institutions (Ling *et al.* 2018a), while others argued that the open-air nature of the panels made rock art inherently difficult to regulate (Earle 2013, 358; Horn 2022a, 139). Between these two views, Fredell (2003, 272) suggested that access to panels shifted from an elitist practice during Period Ib to a more popular phenomenon in the Late Bronze Age.

The uncertainty about who accessed carving practices has produced a wide range of interpretations about carvers' identities and social positions. Initially, they were compared to Iron Age rune makers—professional stonemasons commissioned to work on rocks (Nordén 1925, 143–145). Later, they were imagined as farmers who combined carving with agricultural tasks around their farms (Toreld 2016, 78); as sailors or shipbuilders involved in seafaring (Earle 2013, 358; Ling *et al.* 2022, 63; 2024b, 793); as bronzesmiths who applied their skills in stone technology to carve figures on the rocks (Goldhahn 2007, 314); and even as chariot builders (Tilley 2021, 189). They have also been portrayed as ritual specialists: as "griots" or "druids" who guarded, interpreted, and transmitted the histories of the group (Bengtsson 2004, 101; Coles 2005, 120); as "shamans" who performed rituals for the community (Coles 2005, 12; Chacon *et al.* 2025, 124–125); as "sorcerers" or "priests" who used the carvings to perform rituals (Kaul 1998, 16–20); and as diviners who used the carvings for hydromantic practices (Fahlander 2024, 130–131). Additionally, they were portrayed as "chiefs" carving figures while traveling around the region (Kristiansen 2002, 68); as members of secret societies creating rock art to transmit knowledge to the group (Ling *et al.* 2018a, 2020, 2022); and as young elite warriors carving rocks as part of initiation rites (Smedberg 2024).

Despite these mentions, little is known about how carvers acquired and developed their skills, how they transmitted them across generations, or how their roles intersected with broader social structures, such as kinship, labor divisions,

and political institutions. Because previous research prioritized the symbolic meaning of the carvings and adopted theoretical frameworks designed for such interpretations, the nuanced dynamics that shaped the social role of carvers have been overlooked (Goldhahn 2007 is a notable exception). This study shifts the focus by placing carvers at the center of the analysis.

It also shifts the methodological approach. Dominated by qualitative studies, the subject lacks comprehensive, multi-scale quantitative analyses that characterize the role of the carver and the changes it underwent throughout the Bronze Age. The first systematic quantitative studies focused on chronology and typological variation rather than on defining the carver's role (*e.g.*, Mandt 1972; Burenhult 1980; Malmer 1981; Bertilsson 1987). Experimental studies examined tools and carving techniques but were not designed to understand how carvers gained and transmitted their skills (*e.g.*, von Arbin *et al.* 1995; Vourc'h 2011; Lødøen 2015; Liebl *et al.* 2023; Strifeldt Arntzen 2023). And the few explicit attempts at identifying individual carvers were limited in scope and difficult to generalize (Bengtsson 2002; Toreld 2016). Recent advancements in 3D documentation and statistical modeling offer new possibilities for detailed, large-scale analysis of the phenomenon. However, they have been applied only in a few panels (e.g., Horn and Potter 2018) and on single scales of analysis (e.g., Nimura 2016). This study fills these gaps by integrating quantitative methods across multiple scales of analysis.

The carvers to the forefront

Studying the role of carvers will advance our understanding of the relationship between social context and rock art because their work reflects not only who they were but also the society in which they worked (Raphael 1945; Hauser 1958). By focusing on their role, this study seeks to distinguish between the proximate and ultimate causes of the phenomenon: between the individual motivations for selecting specific figures and the collective reasons that compelled Nordic Bronze Age communities to carve figures on rocks.

Furthermore, carvers seem to have possessed at least two distinct forms of knowledge: technical knowledge, comprising the skills, tools, and techniques needed to carve the figures, and ritual knowledge, rooted in the symbolic meanings and ritual practices that gave the activity its social significance. Understanding their role, therefore, offers a way to explore the intersection between the ritual and secular spheres of Bronze Age societies (Goldhahn 2007).

To address these issues, the study examines three interrelated aspects of the role of carver: how it was *acquired*, how it was *performed*, and how it was *transmitted*. Acquisition concerns who had access to carving knowledge and how they gained this knowledge. Performance focuses on the social expectations associated with the role and the sociopolitical contexts in which the role was performed. Finally, transmission explores how carving knowledge was passed within and between

generations, shaping shared styles and techniques and influencing the historical development of the role.

These questions primarily concern *who* created the carvings and *how* they did so, ultimately helping to explain why Nordic Bronze Age societies carved figures into the bedrock of southern Scandinavia.

A multi-scale approach

The archaeological analysis of the carvers' role is challenging. Lacking written sources and given the usual dissociation between rock art and other archaeological contexts, the analysis relies solely on the carvings. Nonetheless, this study contends that their role can be approached by applying theoretical models that explain how roles operate in chiefdom-like societies—societies with social organizations similar to those proposed for the Nordic Bronze Age (Horn *et al.* 2024)—and how such roles can be inferred archaeologically. This inference is built by integrating role theory with the epistemological framework of behavioral archaeology (see Chapter 2).

Role theory holds that roles are bundles of normative behaviors that can be anticipated when the social expectations attached to particular social positions are understood (Thomas and Biddle 1966c; Banton 1969; Turner 2001). Because these behaviors shape how people create, use, and discard objects, roles influence the "life history" of objects (Schiffer 2016, 22–25) and, therefore, the four "dimensions of variability" of the archaeological record: formal, spatial, quantitative, and associational (Rathje and Schiffer 1982, 64–65). To detect this variability, the study combines high-resolution 3D models from a case study with regional legacy data. The resulting dataset was then systematized in a geodatabase and analyzed using exploratory data analysis (see Chapter 2).

The exploration was conducted across multiple temporal and spatial scales, enabling both landscape analysis of panels and archaeometric characterization of individual figures (*cf.* Barnett *et al.* 2024; Ling *et al.* 2024a). For this purpose, Nordic Bronze Age rock art provides exceptional information: the number of carvings is in the tens of thousands, their spatial positions have remained unchanged, their preservation is generally good, and their chronology is fairly accurate. Few archaeological materials offer similar advantages.

Aspeberget as a test bench

This study focuses on the rock art at Aspeberget, a small hill at the center of the Tanum World Heritage Site in Bohuslän, western Sweden (Fig. 1.1). The site has attracted scholarly attention since at least the second half of the 19th century (Holmberg 1848; Brunius 1868; Montelius 1877; Baltzer 1881) and has been the focus of numerous surveys, documentation campaigns, and conservation efforts (Bahn and Hygen 1996; Milstreu and Prøhl 1996; Bertilsson *et al.* 2014). Given this long-standing

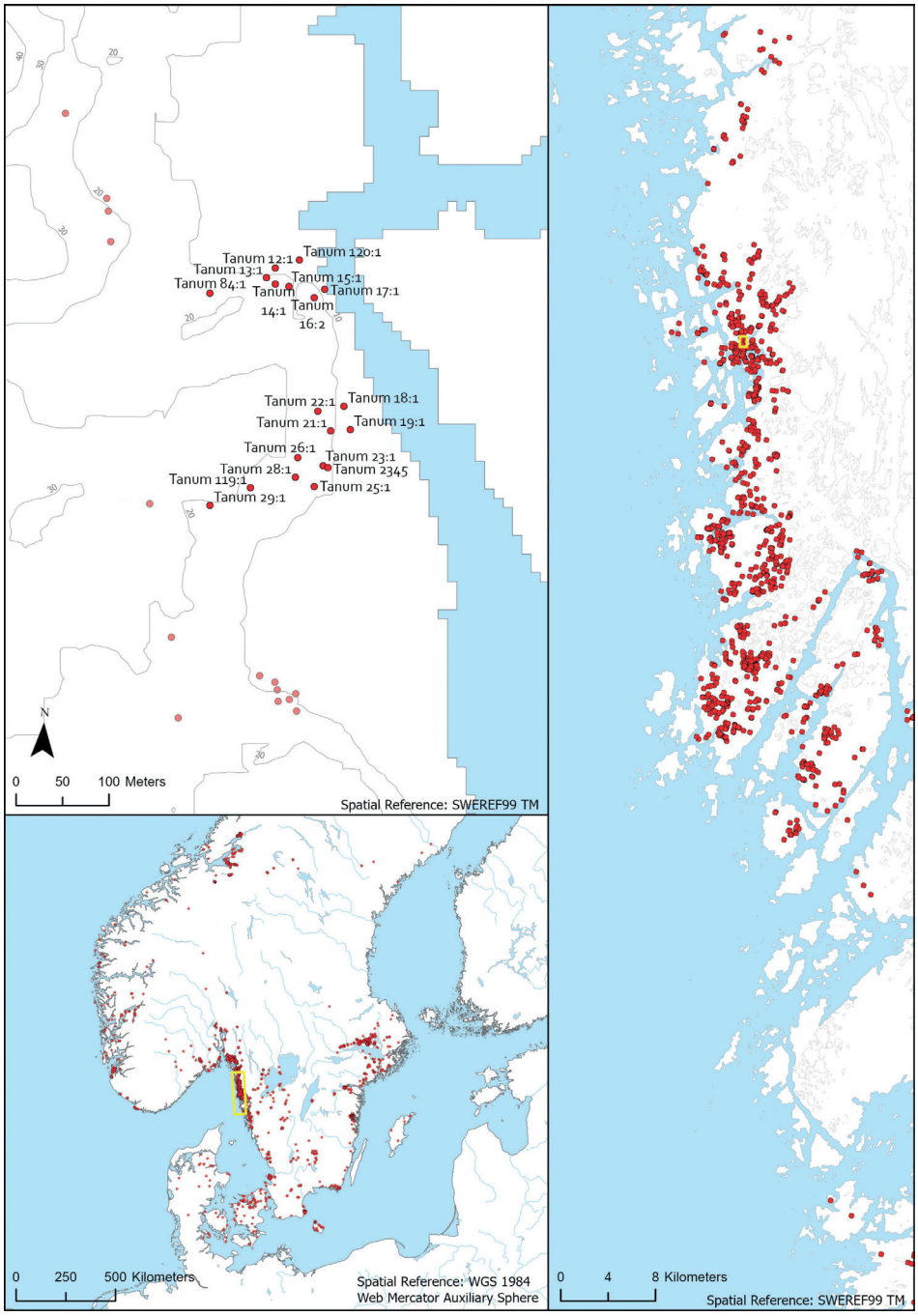


Fig. 1.1. Location of Aspeberget. Red dots represent Bronze Age rock art panels with figurative motifs. Data extracted from Riksantikvarieämbetet (Sweden), Fund og Fortidsminder (Denmark), and Askeladden (Norway). Shoreline estimated for c. 3300 BP (Ashely Green, GU).

and intensive scrutiny, Aspeberget is one of the richest rock art sites in the region, with 27 panels and 1,235 figures (based on my documentation of the panels and on previous documentation held at the Swedish Rock Art Research Archives). Several reasons make Aspeberget an ideal case study: a) the topography of the hill creates a natural boundary for the figures, allowing us to analyze them as a cluster; b) the hill features both small and large panels with different compositions; and c) the number and diversity of figures depicted allows for an in-depth statistical analysis of most of the topics currently discussed in the field, such as chronology, superimpositions, and updates.

Unfortunately, the hill's geographic extent provides a limited view of the phenomenon at the regional scale. To address this limitation, the analysis is complemented with legacy data from panels across Bohuslän for comparison and contextual analysis. This information comes from tracings of panels made by Stiftelsen för dokumentation av Bohusläns hällristningar (https://hallristning.se/) and from the information provided by Riksantikvarieämbetet's search service Fornsök (https://app.raa.se/open/fornsok/). Since panels are regularly added to Fornsök, data collection concluded in 2023 when new data were redundant, the process became counterproductive, and theoretical categories could no longer be refined significantly (sensu Saunders *et al.* 2018). As stated on Riksantikvarieämbetet's website, the quality of this data is not always fully guaranteed, so the regional analysis should be treated with caution. Nonetheless, the dataset is valuable for identifying general patterns in the region and for measuring how much Aspeberget deviates from such patterns.

The analysis of the figures focuses on the Bronze Age (*c.* 1700–500 BC), building upon the periodization developed by Oscar Montelius and its subsequent revisions (Montelius 1885; Vandkilde 1996) (Table 1.1). Since Aspeberget depicts figures that could be attributed to the preceding Late Neolithic II (*c.* 1950–1700 BC) and the following Early pre-Roman Iron Age (*c.* 500–300 BC), these two periods are also discussed. However, the primary goal of this study is not to analyze these periods or the transitions to and from the Bronze Age.

Table 1.1. Periodization of the Nordic Bronze Age.

Period	*Chronology*	*Phase*
Bronze Age Period Ia	*c.* 1700–1600 BC	Early Bronze Age (*c.* 1700–1100 BC)
Bronze Age Period Ib	*c* 1600–1500 BC	
Bronze Age Period II	*c.* 1500–1300 BC	
Bronze Age Period III	*c.* 1300–1100 BC	
Bronze Age Period IV	*c.* 1100–900 BC	Late Bronze Age (*c.* 1100–500 BC)
Bronze Age Period V	*c.* 900–700 BC	
Bronze Age Period VI	*c.* 700–500 BC	

Outline of the book

This book addresses an overarching research question through several topic-specific chapters. Each chapter summarizes prior research on the topic, presents the results of the analyses conducted, and offers a preliminary discussion. Following this structure, the book is organized into nine chapters, including this introduction.

Chapter 2 outlines the theoretical, epistemological, and methodological foundations of the study. It draws on role theory to explain how roles are acquired, performed, and transmitted; applies behavioral archaeology to explore how roles can be identified in the archaeological record; and employs exploratory data analysis to detect these roles in the material under analysis. The chapter introduces only the concepts needed to analyze Bronze Age carving practices and, for brevity, limits its discussion of statistical methods to their core principles. Full technical details and procedures appear in the supplementary information (see below).

Chapter 3 establishes the study's chronological framework by introducing a multi-proxy model. Building on existing chronological proposals, the model combines superimpositions and feature associations to define the most likely date range for the carvings at Aspeberget. The analysis prioritizes consistency over chronological resolution and focuses on identifying phases and tracing transitions between them.

Chapter 4 examines carving events, superimpositions, and updates to show how successive generations of carvers worked on the panels and engaged with earlier figures. It traces their relationship to cultural heritage and traditions and clarifies how different panels at Aspeberget were used throughout the Bronze Age. Due to time constraints, the analysis varies in detail: resolution decreases as the scale increases. Nonetheless, the selected examples capture the most relevant patterns at Aspeberget.

Chapter 5 investigates why carvers chose the hill and specific rock surfaces. It addresses this question by evaluating physical, topographic, and landscape factors, including geology, slope, visibility, and wetness. The results provide insights into the geological knowledge carvers possessed and the rules that guided figure placement. Examining sound as one of these rules is beyond the scope of this study. Except for panels like Tanum 120:1 and perhaps Tanum 12:1, the low slope of the panels at Aspeberget suggests they were unlikely to produce any acoustic effects, such as echoes (*cf.* Lahelma 2010). Alternatively, the hill's height may have provided a favorable position for sound projection when playing instruments (*cf.* Tilley 2021), but this has limited relevance to rock art in general, as many panels lie at low elevations.

Chapter 6 situates Aspeberget within a regional framework by comparing it with other panels in western Bohuslän. It uses ecological metrics and cluster analysis to examine spatial patterns, clarifying the distribution of panels and how carvers organized their activities across the landscape. Due to methodological constraints, the chapter excludes scenes from the similarity analysis and therefore does not address the narrative or semiotic dimensions emphasized in other approaches to rock art (*e.g.*, Nordbladh 1980; Ranta *et al.* 2019).

Chapter 7 applies the concept of communities of practice to examine how carvers learned to carve, developed their skills, and exchanged knowledge. It draws on morphometric analyses of ship figures to assess carvers' creativity and the social conventions that shaped their work. The chapter focuses on inter- and intra-group variation rather than on identifying specific tools or techniques, so it offers limited new insight into carving technology. Nevertheless, the topic is addressed by the project "Tracing Carvers on the Rocks" (DIGARV 2020-03817), within which this study is embedded (Liebl *et al.* 2023).

Chapter 8 synthesizes findings from the preceding chapters to define the status and role of carvers in Nordic Bronze Age society. Drawing on these results, the chapter argues that carvers operated within ritual institutions, outlines their positions within those institutions, and examines their roles in the sociopolitical organization of the Nordic Bronze Age.

Finally, Chapter 9 concludes the book by evaluating the study's overall contribution and suggesting directions for future research.

Supplementary information

The Appendix at the end of the book presents a catalog of the panels documented and analyzed at Aspeberget. To download high-resolution versions of these tracings, visit https://shfa.dh.gu.se/ and search for "Moyano Di Carlo".

The 3D models generated in this study can be viewed at https://shfa.dh.gu.se/ under the tag "Moyano Di Carlo". To obtain the meshes, contact the Swedish Rock Art Research Archives (SHFA).

Some chapters (especially Chapter 5) draw on documentation from over 1,000 panels in Bohuslän. Since this material is too extensive to reproduce in this book, the figures included were selected and designed to support the main arguments. Readers who want to explore specific panels in greater detail can access the complete documentation at https://shfa.dh.gu.se/ or https://www.hallristning.se/ by searching for their RAÄ numbers (*e.g.*, Tanum 1:1).

Finally, all data, code, and technical explanations needed to reproduce the results are available at https://doi.org/10.5281/zenodo.17390199.

Chapter 2

Framing the role of artists in prehistory

The study of Nordic Bronze Age rock art has been approached from a wide range of theoretical perspectives, such as cosmology (*e.g.*, Kaul 1998), phenomenology (*e.g.*, Tilley 2021), semiotics (*e.g.*, Nordbladh 1980), cultural landscape (*e.g.*, Bradley 2020), political economy (*e.g.*, Ling *et al.* 2018b), narratology (*e.g.*, Ranta *et al.* 2019), and material agency (*e.g.*, Fahlander 2024). While some of these perspectives have provided useful insights into the role of carvers, they usually fall short in explaining how these roles were acquired, performed, and transmitted. To tackle this issue, this chapter proposes an analytical framework that combines theoretical concepts from role theory, the epistemology of behavioral archaeology, and the statistical methods of exploratory data analysis to examine how artistic roles function in chiefdom-like societies and how they can be inferred archaeologically.

Status and role

Role theory examines the individual and collective organization of human behavior by analyzing the expectations attached to particular social positions (Banton 1969; Biddle 2000; Turner 2001). These expectations have been approached through two main schools of thought: the functionalist school that used roles to analyze the collective aspects of social systems (*e.g.*, Linton 1936; Parsons 1937), and the symbolic interactionist school that viewed roles as the set of adaptive social strategies developed by individuals when interacting with others (*e.g.*, Mead 1934).

Both schools are grounded in two key concepts: status and role. A status is usually defined as the position an individual occupies within society as recognized by others (Linton 1936, 113)—for example, a person in the Bronze Age could have been a farmer, a warrior, or a carver. They can be further subdivided into ascribed and achieved statuses (Linton 1936, 115). Ascribed statuses are assigned at birth or gained automatically later in life. They are typically grounded in attributes such as sex, age, and kinship, and hence form the basic structure of any society. Common examples include gender, adulthood, and ethnicity. Achieved statuses, by contrast, are acquired throughout life and usually require progressive acquisition of knowledge. Professions are the clearest example. While ascribed statuses typically operate on a broad societal level, achieved statuses tend to be attached to particular positions in

specific groups or organizations (Turner 2001, 242). Importantly, individuals occupy several statuses simultaneously, which together form what Merton (1957) called "status-set". Therefore, returning to the previous example, a person in the Bronze Age could have been a farmer, a warrior, *and* a carver.

Every status has a role attached to it, understood as the formally assigned or informally assumed set of expectations held by society regarding how individuals should behave when occupying a given status (Scott 2015). These expectations shape roles into bundles of normative behaviors—sets of rights and duties that are perceived as interconnected (Turner 2001). But these perceptions are not shared uniformly across society. People might have different expectations about how the same individual should behave. The set of expectations held by different people about a *single* role is known as the "role-set" (Merton 1957).

Role theory centers on how individuals manage their status and role sets. As an individual's status set expands, reconciling the demands of new and existing statuses becomes increasingly difficult. Some statuses may even be incompatible; for example, certain religious contexts forbid a priest from also being a husband. Therefore, individuals must weigh how statuses interact before they assume them (Merton 1957; Banton 1969; Turner 1978). Moreover, each additional status introduces a new role-set that must be balanced. The larger and more complex the role-set, the more likely the risk of role "conflict" or "strain": a situation in which one cannot satisfy others' expectations simultaneously or with equal intensity (Merton 1957; Goode 1960).

Role theorists have debated extensively about the implications of role conflict. While some have argued that it constitutes a major source of social stress, potentially undermining social integration (Parsons 1951, 280–283; Merton 1957; Goode 1960), others have proposed that the benefits of occupying multiple statuses can outweigh potential drawbacks—for example, by providing more rights than obligations, networks of social support, knowledge that can be transferred to other statuses, or valuable social attributes like prestige or esteem (Sieber 1974; Turner 2001, 240). In practice, such conflicts are often mitigated because not everyone expects a role to be performed with the same intensity, and because statuses have different degrees of social exposure (Merton 1957, 114–116).

These definitions reveal an obvious yet crucial implication for understanding the role of Bronze Age carvers: they were not just carvers. As members of the Nordic Bronze Age society, the individuals who *acted as carvers* occupied different statuses simultaneously, each with its own set of roles. Since roles shape personal identity (Mead 1934, 152–155) and are often enacted in contexts for which they were not originally intended (Turner 1978), carvers infused rock art activities with cultural dispositions generated in other roles and brought back to society those dispositions that may have emerged during such activities. Therefore, the work of the carvers cannot be detached from the characteristics of the society in which they lived (sensu Hauser 1958). In other words, rock art is not just an expression of who they were as carvers but also of who they were as members of Nordic Bronze Age society.

The structural and dynamic aspects of roles

A persistent tension divides those who view roles as mechanisms for maintaining social equilibrium and those who see them as drivers of change. Building on Durkheim's legacy, functionalist thinkers have argued that roles reduce conflict and stabilize social systems (*e.g.*, Linton 1936; Parsons 1937). This stability stems from the structural relationships between roles. Most roles exist in pairs or sets linked through distinctive role relationships—the role of teacher presupposes that of student, the role of leader that of follower, and so on (Turner 2001, 235). Therefore, role performance is always constrained by pre-existing roles and their mutual reinforcement or potential incompatibility (Parsons and Shils 1951, 208–221; Turner 1990). For example, ascribed statuses often prescribe optional, obligatory, and forbidden behaviors, limiting access to certain positions and social interactions (Banton 1969, 39). These prescriptions derive from a broader social consensus on how roles should be performed, which ones should be prioritized, and who should perform them (Turner 1978, 2001).

Individuals learn this consensus from childhood, when socialization prepares them to participate in complex social activities and to understand social expectations and norms (Mead 1934, 152–155; Turner 1956, 321–323). But how do these norms emerge and persist? Many role theorists argue that conformity to norms is induced through internalization or by sanctioning deviant behavior through distrust, social avoidance, ostracism, or other punitive responses (Biddle 1986, 78–82; Turner 2001, 246–247). Since the capacity to sanction or normalize behavior is tightly linked to power, some scholars recognized that powerful individuals and groups can shape roles and norms more than those with less power (Turner 2001, 240).

Contrary to this emphasis on normalization, symbolic interactionists contend that individuals use roles as adaptive social strategies that keep societies dynamic (*e.g.*, Mead 1934; Moreno 1953; Goffman 1956; Turner 1962). People often understand how taking part in one status affects their involvement in others, and can use different strategies to navigate and master potential role conflicts (Atkinson 2023). They can prioritize certain expectations, delegate tasks, seek support from peers, ignore certain demands, end relationships, or even disrupt the role (Goode 1960). They can also control others' perceptions by adjusting behavior, appearance, or speech (Goffman 1956). Ultimately, role performance reflects the tension between individual impulses for change and the structural conditions that enable or constrain them (Turner 1990).

This last point resonates with anthropological debates on art in traditional societies and offers a useful framework for exploring the role of artists in the Bronze Age. Art objects activate social sensibilities by conveying ideas, experiences, and cultural values (Geertz 1976; Forge 1979; Gell 1998). In chiefdom-like societies, these objects permeate nearly every aspect of life: from everyday activities to complex social, cultural, and political affairs (Linton 1941; Firth 1951, 1992; Steward and Faron 1959; Biebuyck 1969; Layton 1991; Gell 1994). Mediated by traditional norms, these affairs shape artistic work because artists often share cultural values with their audience (Biebuyck 1969, 10; Firth 1992, 173). Yet artists are not mere transmitters of artistic

traditions; they seek to impress their audience by producing innovative and virtuous artistic performances (Boas 1927, 17–18; Stout 1956, 32; Gell 1994, 46; Hayden *et al.* 2023, 88). Therefore, as with roles in general, the role of artist in chiefdom-like societies lies between compliance with norms and the individual impetus for change (Forge 1967, 120). And from this interplay between social structure and artists' creativity derives the *variation* of art in these societies (Firth 1951, 170).

Role transmission and change

Since most anthropological and sociological research has focused on short-term studies of living societies, the intergenerational transmission of roles has received little attention. But this is crucial in a long-term archaeological study like the one pursued here (Riede *et al.* 2019). As previously argued, roles are bundles of normative behavior which, in turn, are composed of sets of cultural traits. To examine how these traits are passed down over time and what this entails for long-term changes in roles, this section draws on concepts from cultural evolution theory, focusing on how role traits are transmitted, where that transmission occurs, and who mediates the process.

Role traits change depending on how practitioners transmit the knowledge and practices associated with their roles to future generations. Cavalli-Sforza and Feldman (1981) analyzed these processes through the "modes of cultural transmission", defined by the direction of transmission and the numerical balance between transmitters and learners. Cultural traits can be transmitted vertically from parents to children, horizontally between members of the same generation, and obliquely from non-parental individuals to members of the next generation. Vertical transmission produces slow cultural change, low variability between generations, and high variability within generations. In contrast, horizontal and oblique transmission foster generational homogeneity and accelerate intergenerational change. Transmission also varies by ratio: many-to-one, one-to-many, and other intermediate configurations, such as one-to-one, few-to-one, or few-to-few. As transmitters outnumber learners, cultural change becomes slower and less variable.

Role changes also depend on the characteristics of role practitioners, as individuals often seek role models to learn how to perform their roles (Turner 2001, 251). Boyd and Richerson (1985, 2024) have argued that this learning is shaped by cultural "biases": rules of thumb that guide what to learn and from whom. These biases are typically divided into three categories: content-based, frequency-based, and model-based. Content-based bias favors traits with appealing content or a favorable cost-benefit balance. Frequency-based bias depends on the prevalence of a trait and includes conformist bias, in which individuals follow the majority, and novelty bias, in which they adopt novel traits. Model-based bias, in contrast, relies on the attributes of those displaying the trait. The most studied are prestige bias (learning from high-status individuals), success bias (learning from those who achieved desirable outcomes), and similarity bias (learning from those who resemble oneself).

With roles, these biases operate with *clusters* of traits. Role traits depend on one another or conflict with the traits of other roles, so they are transmitted as interconnected sets. Roles also form structural networks, meaning a change in one role often triggers adjustments in related roles and in those who perform them (Turner 1990, 88). When these structural links are strong, roles persist even as individuals change (Turner 2001, 241). Therefore, individuals can only alter or add role traits under certain preexisting constraints (*cf.* Buskell *et al.* 2019, 6–7).

In non-literate societies, these constraints—that is, the social conventions about how roles must be performed—are typically established through ritual and ceremony (Thomas and Biddle 1966b, 54). Given the clear association between rock art and the ritual world (Whitley 2024), understanding how rituals shaped artists' roles in prehistory is therefore crucial. Rituals can be understood as high-fidelity copying practices that play a key function in shaping and stabilizing group behavior, particularly by fostering in-group commitment, conformity to norms, and identity fusion among ritual practitioners (Henrich 2009; Whitehouse 2025). Such effects stem from the nature of the rituals themselves: because they are causally opaque, follow arbitrary procedures, and often lack any immediate material benefit, people engage with rituals primarily to gain affiliation with the group performing them. Moreover, individuals imitate the ritual behaviors they observe because they assume their meaning is unknown or represents the proper way of doing things. This, in turn, diminishes critical reflection on the reasons behind ritual practices and makes ritual practitioners more likely to accept the norms and directives established by ritual leaders (Whitehouse 2025, 610).

In this sense, rituals not only transmit cultural information; they become instruments of social power. Leaders can monopolize ritual knowledge and deploy ritual practices to secure acceptance or acquiescence to specific norms and ideologies that support their self-aggrandizing ambitions (Hayden 2018, 18–21). Yet other sectors of society can use rituals to level social inequalities, dismantle hierarchies, or experiment with alternative social arrangements (Graeber and Wengrow 2022, 115–117). Whether used to reinforce power or to challenge it, rituals play a central role in shaping social norms and roles. Consequently, the more rituals are employed in performing a role, the greater the readjustment individuals must make when that role changes (Banton 1969, 125–126).

Once established, roles only change through broader shifts in what Turner (1990, 90) called their "accommodation": different combinations of internalized beliefs, effectiveness, coercion, and lack of alternatives. Several circumstances can threaten this accommodation, such as environmental changes, economic needs, political impositions, or shifts in cultural trends. Such situations can make roles dysfunctional when their intended effect is lost, symbolically unacceptable when their image becomes unfavorable, or untenable when their cost outweighs their benefits (Turner 1990). Under the constant pressure of these circumstances, roles are bound to change.

Roles and objects

Although role theory rarely focused on material culture, some proponents acknowledged the importance of certain objects—such as uniforms—in signaling some statuses (Goffman 1956, 13–19; Thomas and Biddle 1966a, 49; Banton 1969, 68–92). Objects matter because social positions are seldom announced verbally, making them sometimes the primary markers of status. But their signaling capacity captures only part of the phenomenon. These objects do more than signal roles; they are integral to the economic, political, and identity domains of social practice. For example, they enable subsistence and labor, materialize ideologies through rituals and ceremonies, and shape personal identity (Earle and Kristiansen 2010a, 10–15). Since all practices operate through roles, every role is linked to objects.

This link is well exemplified by the Aron Arabai mask of the Temne people in northern Sierra Leone (Hart 1986; Layton 1991, 87–88). The mask embodies the chiefdom spirit (*kärfi*) and is worn by a person who serves as the chief's alter ego, following the same taboos and retiring upon the chief's death. As the mask ages, its bearer may gain prestige and become a judge and peacemaker who can sanction new laws and officiate at social events. The mask is therefore much more than a cue of the role; the mask *is* the role. The bearer has symbolic and ritual authority only because he wears the mask; without it, his role loses meaning. For this authority to hold, objects must operate under regulated norms, much like humans. In other words, roles prescribe social expectations about people's behavior *and* the objects linked to such behavior.

Studying the role of carvers archaeologically, therefore, implies examining the formally assigned or informally assumed set of expectations regarding when, where, and how rock art figures should be created, used, maintained, and abandoned. This definition carries an archaeological implication: since every role fosters recurrent patterns of behavior, and these behaviors involve the creation and use of objects, the repeated performance of roles generates patterns of material culture. When preserved, archaeologists can explore such patterns to approximate prehistoric roles and their changes. The focus, therefore, must rest on the analysis of rock art *patterns* and the behavior of different carvers acting within shared social norms. Individual variations *within* these patterns show the variability of the role, but only against a general pattern do they gain social meaning. However, patterns *alone* offer limited insight into past behavior (Schiffer 2016, 26–28). To infer past behavior from patterns, we need an inferential strategy.

Inferring roles from material culture

To infer social roles from the archaeological record, this study draws on the epistemological framework of behavioral archaeology. Behavioral archaeology is a research program designed to infer causal relationships between human behavior and material culture in all times and places (Reid *et al.* 1975; Schiffer 2016). The study of these relationships is achieved through four key strategies. Strategy 1 employs material culture from the past to answer historical questions about past societies. Strategy 2 examines material culture

and related processes in the present to build general inferences about material culture in the past. Strategy 3 draws on the material culture of the past to resolve general questions about contemporary human behavior. And Strategy 4 uses modern material culture to shed light on modern human behavior. While Strategies 2 and 3 address *general* questions, Strategies 1 and 4 explore *specific* historical issues.

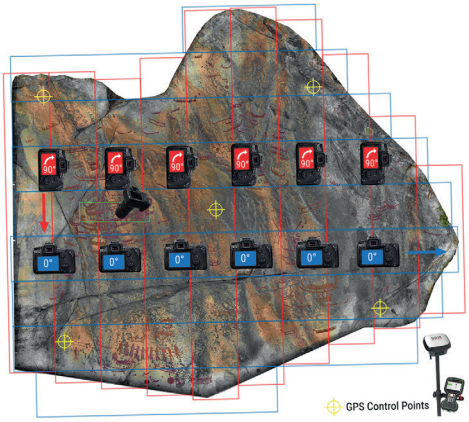
Behavioral archaeology defines inference as "a statement about past behavior supported by relevant evidence and relevant generalizations" (Schiffer 2016, 19), and it grounds its empirical analysis in the four "dimensions of variability" of the archaeological record: formal, spatial, quantitative, and associational (Rathje and Schiffer 1982, 64–65). Formal variability encompasses the measurable physical and chemical properties of an artifact. Spatial variability refers to the location of an artifact. Quantitative variability is the frequency of an artifact within a particular spatial unit. And associational variability denotes patterns of artifact co-occurrence within or among spatial units. The epistemological foundation of this study rests on the analysis of these *four* variabilities and their change over time.

To infer past behavior from these variabilities, we must first distinguish systemic from archaeological context (Schiffer 1972). A systemic context describes how artifacts or places were created and used before becoming part of the archaeological record, and an archaeological context represents situations in which artifacts interact only with the natural environment and/or the decay byproducts of other artifacts. Within these contexts, artifacts undergo successive cultural and natural transformations (Schiffer 1975). Cultural transformations, or "c-transforms", are intentional and unintentional behaviors in the life history of an object—procurement, manufacture, use, reuse, maintenance, and/or discard—which transform material from the systemic context to the archaeological context (Schiffer 1972, 1975). Natural transformations, or "n-transforms", are the interaction between culturally deposited materials and features of the environment in which those materials were deposited (Schiffer 1975).

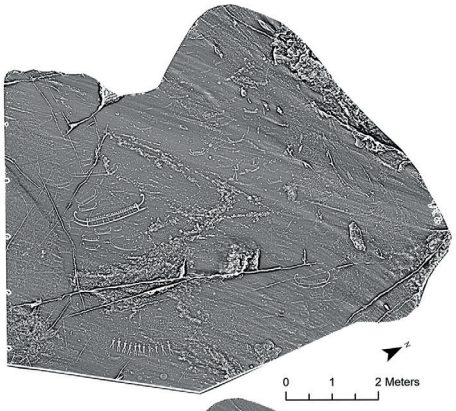
Evaluating these transformations is essential for studying the role of carvers for two reasons. Cultural transformation processes explain how their role operated at *different* stages of rock art production: rock choice, thematic selection, figure placement, and crafting (see Chapter 7). In contrast, natural transformation processes matter for practical reasons: because part of the inference relies on *formal* and *quantitative* variability, we must determine how much weathering affects those variabilities. Our team addressed this through geological characterization of rock art panels (Liebl *et al.* 2023; Lieb *et al.*, forthcoming). Results show that the rocks are less weathered than expected, so natural transformations have had little influence on the figures' shape, depth, and frequency (Chapter 5).

A digital approach to rock art documentation

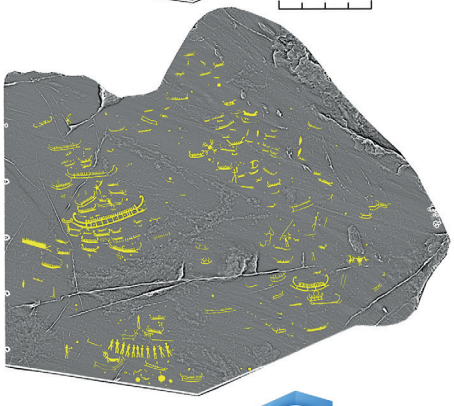
Since the epistemological foundation of this study rests on the analysis of four dimensions of variability, the methodological approach was designed to capture these variabilities accurately (Fig. 2.1). Entire rock art panels and figures of interest



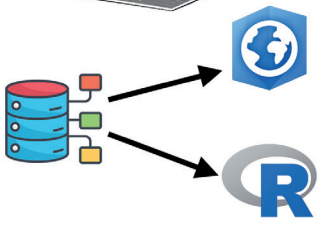
Documentation
The panel is cleaned and fully documented using photogrammetry. Photos are captured linearly, at two subsequent angles, at a distance of about one meter, and with a 60–70% overlap.
Figures of interest are documented with close-ranged SfM.
At least three coordinate points are taken with an RTK GPS system.



Visualization
A digital elevation model is created from the georeferenced 3D model.
The DEM is then visually enhanced with Local Relief Models. Several iterations are performed until the best overall visualization is found.
Figures of interest are computed separately using Local Relief Models and vRTI.



Segmentation
Each individual figure is segmented using drawing tools and polygons in ArcGIS Pro (v3.1+). Each polygon represents a unique feature with x, y, and z coordinates.



Annotation and analysis
The figures are integrated into a geodatabase in ArcGIS Pro (v3.1+). Each figure is assigned a unique ten hexadecimal digit ID. Qualitative and quantitative information is added to each figure. Data is used to perform statistical analysis in ArcGIS Pro (v3.1+) and R (v4.0+).

Fig. 2.1. Summary of the methodological workflow employed in this study. Images created by the author.

were documented in 3D using Structure from Motion (SfM), an image-based photogrammetric technique that creates three-dimensional models by using pixel recognition in several photos (De Reu *et al.* 2013). The photos were taken with DSLR cameras, and the 3D models were processed in Agisoft Metashape (v1.8+). These 3D models were georeferenced and scaled using at least three GPS control points taken with a Leica GS18T GNSS RTK GPS with millimeter accuracy.

Once georeferenced, models were visually enhanced using a Local Relief Model (Horn *et al.* 2022b; Green *et al.* 2025) and *virtual* RTI (Mudge *et al.* 2010). Local Relief Models use depth maps and focal statistics to isolate local depth variation around rock art from the global curvature of rock surfaces. The output is then subtracted from the initial depth map, highlighting the local depth variations. RTI, instead, is a photographic method that captures an object's shape and color by combining flash photographs taken from multiple angles. Virtual RTI emulates the RTI technique in a virtual environment by creating a collection of orthophotos from a 3D model, each with a single artificial light source, and by combining them in the RTI software to produce an enhanced visualization of the surface.

The figures detected in the enhanced visualizations were segmented and integrated into a geodatabase in ArcGIS Pro (v3.1+). The segmentation entailed manually creating a polygon feature for each figure in the panel. Figures were identified by unique ID, and panels by their find registration number (*lämningsnummer*) provided by Riksantikvarieämbetet. The figures were further annotated with spatial metrics—such as altitude, area, volume, orientation, and directionality—and 21 categorical types: animal, circle, cross, cupmark, fibula, foot/shoe sole, house, human, indeterminate, ingot, net, paw print, plow, pole, ship, spiral, sun, sun-disc holder, tree, weapon, and wheeled transport (Table 2.1). Other categories such as "warrior", "adorant", or "acrobat" are not included in the statistical analysis because they are not mutually exclusive—for example, some acrobats are depicted carrying weapons, and some warriors are displayed in an adorant position.

An exploratory approach to rock art analysis

To assess the four dimensions of variability described above, data were analyzed with exploratory data analysis (EDA). The primary goal of EDA is to simplify and scrutinize a dataset in search of patterns and anomalies (Tukey 1977). This occurs in a cyclical process, where each round of analysis gets closer to an appropriate description of the data (Behrens 1997, 140). It is a heuristic process used to refine research questions, generate new and better working hypotheses, and reveal unexpected phenomena (Good 1983; Behrens 1997; Haig 2018).

EDA makes no assumptions about the underlying population; the data is viewed as numbers to be explored. The exploration rests in a wide range of graphical and arithmetical techniques that follow three basic principles: a) the visualization of the behavior and structure of the data, with an emphasis on graphical displays; b) the simplification of the data by finding the most appropriate scale; and c) the

Table 2.1. Number of figures per type at Aspeberget.

RAA number	*Animal*	*Circle*	*Cupmark*	*Foot/Shoe sole*	*House*	*Human*	*Indeterminate*	*Plow*	*Ship*	*Spiral*	*Sun*	*Weapon*	*Wheeled transport*
Tanum 119:1	2	–	8	-	-	-	2	-	6	-	-	-	-
Tanum 119:2	-	-	2	-	-	-	-	-	-	-	-	-	-
Tanum 120:1	5	4	68	1	-	24	13	3	12	1	-	3	2
Tanum 129:1	-	-	2	-	-	-	-	-	-	-	-	-	-
Tanum 12:1	30	7	84	3	-	33	13	1	114	-	2	-	1
Tanum 13:1	-	-	3	1	-	-	1	-	2	-	-	-	-
Tanum 14:1	-	-	28	1	-	2	1	-	-	-	-	-	-
Tanum 14:2	-	-	3	-	-	-	-	-	-	-	-	-	-
Tanum 15:1	-	-	-	-	-	-	-	-	6	-	-	-	-
Tanum 16:1	-	-	-	-	-	2	-	-	-	-	-	-	-
Tanum 16:2	-	-	3	-	-	-	-	-	1	-	-	-	-
Tanum 17:1	-	-	1	-	-	-	-	-	1	-	-	-	-
Tanum 17:2	-	-	2	-	-	-	-	-	-	-	-	-	-
Tanum 18:1	11	2	101	-	2	24	10	1	62	5	-	-	1

(*Continued*)

Table 2.1. Number of figures per type at Aspeberget. (Continued)

RAA number	*Animal*	*Circle*	*Cupmark*	*Foot/Shoe sole*	*House*	*Human*	*Indeterminate*	*Plow*	*Ship*	*Spiral*	*Sun*	*Weapon*	*Wheeled transport*
Tanum 19:1	3	1	20	2	-	1	-	-	1	-	-	-	-
Tanum 21:1	-	-	2	-	-	-	1	-	1	-	-	-	-
Tanum 22:1	-	-	-	1	-	5	-	-	4	-	-	-	-
Tanum 2338	-	-	3	-	-	-	-	-	-	-	-	-	-
Tanum 2345	-	-	20	-	-	-	-	-	1	-	-	-	-
Tanum 23:1	-	-	2	-	-	-	-	-	3	-	-	-	-
Tanum 24:1	-	-	1	-	-	-	-	-	-	-	-	-	-
Tanum 25:1	24	1	125	-	-	35	25	1	111	-	1	1	-
Tanum 26:1	1	-	2	-	-	1	-	-	5	-	-	-	-
Tanum 28:1	2	2	41	-	-	11	11	-	22	-	-	-	-
Tanum 29:1	-	-	7	-	-	7	1	-	-	-	-	-	-
Tanum 84:1	-	1	-	-	-	-	-	-	-	-	-	-	-
Tanum 883:1	-	-	2	-	-	-	-	-	-	-	-	-	-

identification of general patterns using statistics that are less sensitive to outliers and residuals analysis (Behrens 1997; Hoaglin *et al.* 2000).

Unfortunately, the exploration does not reveal the cause of the patterns discovered. Statistical models represent associations between variables rather than causal relationships, so they may be consistent with different causal models (McElreath 2020, 1–7). To define the causal relationship between the archaeological record and past social behavior, behavioral archaeology employs "correlates": generalizations about the interactions between people, artifacts, and environmental phenomena that generate observable patterns in the archaeological record (Schiffer 1975, 2016). Given that the archaeological record alone tells us little about these interactions without analogies (Gándara 1990, 45–51; Schiffer 2016, 26–28), behavioral archaeologists have typically relied on ethnoarchaeology and experimental archaeology to develop these generalizations. Experimental archaeology has been employed by our team to identify the techniques and tools used by the carvers (Liebl *et al.* 2023), and this study employs cross-cultural comparisons.

Cross-cultural comparisons

Although ethnographic sources have shaped our interpretation of prehistoric rock art (Taçon and Chippindale 1998), there have been both positive and critical responses to their use. Critics have pointed out that the approach ignores the historical context of prehistoric communities and that prehistoric data usually lack the quality needed for such comparisons (Bednarik 2011). However, as Whitley (2005, 86) has argued, "while there is no reason to assume that every prehistoric example will necessarily conform to the origin and meaning of the ethnographic cases, a starting place for analysis is the assumption that a prehistoric case should be reasonably close to the known range of variation in the ethnography".

Cross-cultural comparisons should not be used to find solutions to the problems presented by the archaeological record, but to generate non-Eurocentric theoretical models about the relationship between humans and objects (Schiffer 2009, 821–822; Skibo 2009, 47; Politis 2015, 706–705; González-Ruibal 2016, 4; Kamp and Whittaker 2016, 674; Chacon *et al.* 2020, 75). These models act as *baselines* against which the archaeological record can be measured and compared (Arnold III 2006). In other words, cross-cultural comparisons are not used as a method to provide answers but as an approach to develop theoretical questions.

To build these theoretical questions, this study employs a "systematic comparative method", in which a feature of interest is compared across a wide range of societies (Smith and Peregrine 2011, 7–9). In particular, it examines the role of artists in a sample of chiefdom-like societies from the Americas, Africa, East Asia, and Oceania. Given that the *role* of artists in these societies is shaped more by their position in broader social structures than by the material characteristics of specific art expressions, the analysis considered multiple forms of artistic production. The emphasis, therefore, is less on the particular examples of individual societies and more on identifying cross-cultural *regularities* in the social position of artists (sensu Steward 1955, 3–4; Trigger 2003, 16–19). These regularities provide the basis for comparing the quantitative analysis of the carvings.

Chapter 3

Going beyond Montelius

In the late twentieth century, Flemming Kaul (1998, 87) wrote that "a careful chronological approach is essential if we are to understand the changes in, and appreciate the role of, the ship in the Bronze Age". Establishing a reliable chronology is key not only for ship figures but also for tracing how rock art knowledge was transmitted across generations and how it shaped the historical development of the carver's role. This chapter combines several relative dating proxies to provide an updated, more consistent chronology for figures at Aspeberget, laying the foundation for understanding how carving traditions developed over time.

Introduction

Scandinavian researchers have long sought to develop a reliable rock art chronology (*e.g.*, Ekholm 1921; Glob 1969; Mandt 1972; Rostholm 1972; Burenhult 1980; Kaul 1998; Ling 2008, 2013; Dodd 2010; Skoglund 2016). Their models have mostly revolved around the six-period system developed by Hans Hildebrand and Oscar Montelius, formalized by the latter at the end of the nineteenth century through analysis of bronze objects (Montelius 1885). However, this periodization has sparked controversy. Some scholars argued that using figures rendered on bronzes to date rock art motifs simply confirms Montelius' typology and subordinates the chronology of rock art to that of bronze objects (Nordenborg Myhre 2004, 169–171; Bengtsson 2013, 253; Skoglund 2016, 11–13). Others have used new ^{14}C dates of graves and metalwork to challenge the boundaries of some of his periods (*e.g.*, Olsen *et al.* 2011; Hornstrup *et al.* 2012; Vandkilde *et al.* 2021; Rose and Meadows 2024).

These new dates do not invalidate Montelius' system but expose its limits for classifying rock art *consistently*. Many figures display features that may be attributed to two successive periods. Scholars often resolve this problem by adding qualitative labels such as "late Period II" or "transition to Period III". These labels, however, resist operationalization and hinder quantitative classification. To overcome this, I replace Montelius' periods with a *phase-based* chronology—similar to Skoglund's (2016) approach in Scania. A phase-based system will provide a more consistent and flexible framework to integrate chronologies based on Montelius' system with new

absolute dates from recent research on boats, wagons, or metalwork (*e.g.,* Vandkilde *et al.* 2021; Ling *et al.* 2024a).

The dating of these phases draws on two main sources: archaeological contexts and shoreline dating. Archaeological context is the chronological information inferred from figures rendered on bronzes, figures depicted inside graves, and dated metalwork. Shoreline dating is the use of glacio-isostatic uplift of the bedrock (isostasy) and global changes in sea level (eustacy) to estimate the paleoshoreline during the Bronze Age. It provides the terminus post quem of figures placed on rocks that emerged to the surface during the Bronze Age (Ling 2008, 47–57).

This chapter confirms or changes the dates provided by shoreline dating and archaeological contexts by checking superimpositions between figures with known chronology and associations between chronological features *within* a single figure. The analysis of superimpositions assumes that the deeper figure in a superimposition was carved later. It confirms dates by checking that later figures were not carved under earlier ones—for example, that an Early Bronze Age ship was not placed on top of a Late Bronze Age ship or weapon—and provides the terminus post quem or ante quem for some figures with an unknown chronology. Associations, in contrast, validate dates by checking that a figure does not display attributes belonging to different periods (unless one of these features was an intentional update)—for example, a warrior carrying weapons from different periods. As with superimpositions, the association between features allows us to infer the date of features with unknown chronology when they appear alongside dated ones. It follows the assumption that if two features were *systematically* depicted together, they should belong to the same chronological phase.

The information obtained was used to define the *most likely* time range of the features depicted on Aspeberget. Since the dates were verified by a very substantial number of panels in central and northern Bohuslän, the model could be applied with caution to other panels in the region. However, it should not be used to date figures outside Bohuslän without further verification. The result is a five-phase chronological model for Aspeberget that slightly changes earlier chronological proposals: Phase 1 (*c.* 1700–1400 BC), Phase 2 (*c.* 1400–1100 BC), Phase 3 (*c.* 1100–900 BC), Phase 4 (*c.* 900–600 BC), and Phase 5 (*c.* 600–300 BC).

A Late Neolithic phase?

Before turning to the Bronze Age phases, the potential presence of Late Neolithic figures at Aspeberget merits attention. Melheim and Ling (2017, 72–73) argued that Aspeberget depicts "Krabbestig/Nag" ships, a type of "square" ship regularly found along the Norwegian coast. These ships are typically symmetrical, featuring a rectangular hull segmented by vertical and/or horizontal lines, vertical prow extensions with everted endings, and, occasionally, a protuberance at the end of the keel (Fig. 3.1a). The Krabbestig type, first depicted in western Norway, usually

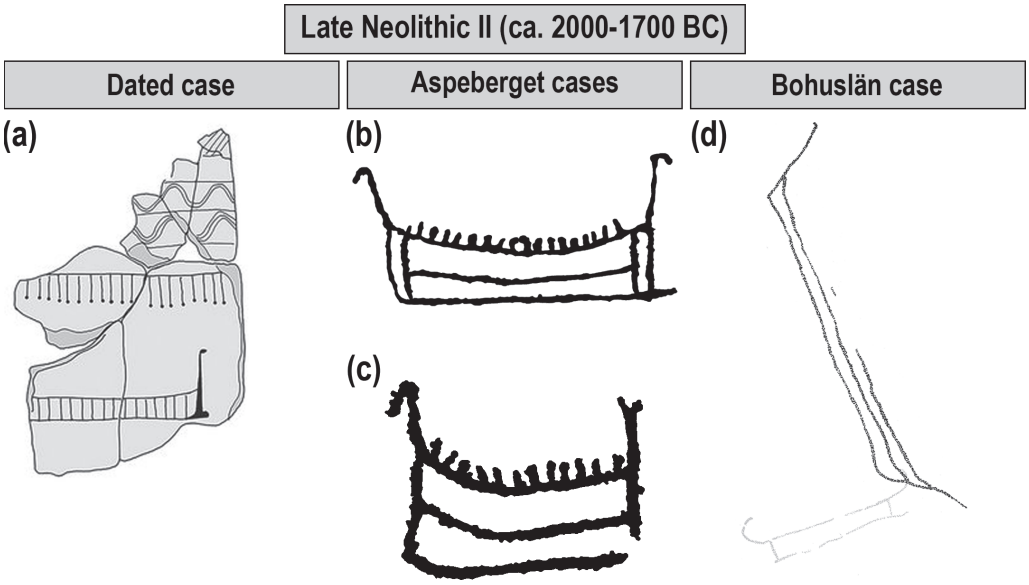


Fig. 3.1. Selected cases with chronological attributes from the Late Neolithic II. A) Mjeltehaugen grave (Sand-Eriksen 2015, 39), B) Tanum 21:1, C) Tanum 15:1, D) Brastad 26:3 (after Andersson and Toreld 2009a). Images not referenced were produced by the author.

shows hulls with vertical lines, while the Nag type, named after an eponymous site in Rogaland, tends to display horizontal lines. At Aspeberget, Nag ships can be found on Tanum 15:1 and Tanum 21:1 (Fig. 3.1b and 3.1c), and in Bohuslän, at least 15 figures resemble this type of ship.[1]

The dating of these ships remains unclear. Fett and Fett (1941, 137) proposed that Nag ships were carved from the Early Stone Age to the end of the Early Bronze Age. The Krabbestig ships, instead, appear inside the Mjeltehaugen grave, narrowing their date to the Late Neolithic or the Early Bronze Age (Melheim and Sand-Eriksen 2020, 92). The ships documented at Aspeberget were dated to the Late Neolithic because of their high altitude (Ling 2008, 108; Melheim and Ling 2017, 72): *c.* 26 and 27.5 meters above the current sea level for the ones on Tanum 21:1 and Tanum 15:1. However, many Bronze Age figures appear at equal or higher altitudes on Tanum 13:1, Tanum 22:1, Tanum 26:1, Tanum 28:1, Tanum 29:1, and Tanum 119:1. Furthermore, a Nag ship cuts a Period I or early Period II ship on Brastad 26:3, proving the type was carved during or after Period I (Fig. 3.1d). This can be read in two ways: either the depiction of these ships in Bohuslän started in the Neolithic and lasted at least until the Early Bronze Age, or they belonged only to the Bronze Age. In any case, neither their altitude nor their typological characteristics confirms a Late Neolithic dating.

Beyond these boats, no other figures can be certainly dated to the Neolithic. Aspeberget lacks any of the Late Neolithic weapons carved in other parts of

Scandinavia (*e.g.*, Burenhult 1980, 73–78; Skoglund 2016, 27; Horn 2021, 48–49). Rock art figures were *painted* in Bohuslän at least since the Early or Middle Neolithic (Gjerde 2010, 178; Schulz Paulsson *et al.* 2019, 412), but the link between the two traditions remains unclear. And some cupmarks may date back to the Neolithic, but their dating is challenging (Horn 2015b, 29–32; Iversen *et al.* 2022).

Phase 1 (*c.* 1700–1400 BC)

The first phase at Aspeberget features ships with inturned prow extensions, warriors holding shaft-hole axes, and bulls.

The ships appear on Tanum 12:1, Tanum 16:2, Tanum 17:1, Tanum 18:1, Tanum 22:1, Tanum 25:1, Tanum 28:1, Tanum 119:1, and Tanum 120:1. They stand out for their inturned prow extensions and, in some cases, straight keel extensions. The inturned prow extension dates early, as shown on the Rørby sword from Period Ib (Kaul 1998, 73–74), the Kivik grave from Period Ib-II (Bertilsson *et al.* 2017, 303), and the Truehøjgård grave from Period I (Rostholm 1972, 20; Kaul 1998, 88) (Fig. 3.2a, 3.2d, and 3.2f). Similarly, the earliest examples of horizontal keel extensions occur on the Rørby sword and one ship from Truehøjgård, but their depiction is rare. Aspeberget depicts three examples (all on Tanum 12:1) and Bohuslän only four[2] (Fig. 3.2e and 3.2c).

Ships from this phase often show slightly raised keel extensions, straight or oval stabilizers, paired crew lines, and hooked lines above the crew (*cf.* Ling 2008, 102–105) (Fig. 3.2a and 3.2b). These features, however, characterize the Early Bronze Age rather than Phase 1 alone. Slightly raised keel extensions, oval stabilizers, and paired crew lines appear on slab nos. 4, 32, and 34 of the Sagaholm grave, dated to Period II–III (Goldhahn 1999a, 141–150). The hook lines resemble the horns depicted in the Kivik grave (Fig. 3.2i), but they may represent simplified depictions of lurs (Sognnes 2017, 27), so they could also belong to the late Early Bronze Age. Some ships also feature locking planks (usually at the stern)—a trait seen on the Truehøjgård ships (Fig. 3.2d and 3.2e) but also on Late Bronze Age ships.[3]

This phase also features warriors holding shaft-hole axes, like the four at the center of Tanum 12:1[4] (Fig. 3.2l). Bronze shaft-hole axes were used in Scandinavia only during Period I–II (*cf.* Montelius 1917; Vandkilde 1996), but *stone* versions occur throughout the Bronze Age (Baudou 1960). Since two Period II–III ships cut one of the warriors on Tanum 12:1 (Fig. 3.2m), it seems reasonable to place these warriors in this phase.

A similar chronology applies to the bulls depicted on Tanum 12:1, Tanum 18:1, and Tanum 25:1. Bulls often accompany Period I–II ships (Ling and Rowlands 2015, 96) and sometimes appear superimposed on them, as on Tanum 1:1 or Tanum 12:1 (Fig. 3.2o and 3.2p). In contrast, I found no evidence of bulls superimposed on Late Bronze Age figures, which reinforces their attribution to Period I–II.

Other figures from this phase are the semi-oval shapes depicted on the upper part of Tanum 18:1 (Fig. 3.2k). Bertilsson and colleagues (2017, 295) interpreted them as metal hats, as with some figures depicted in the Kivik grave (*cf.* Toreld and Andersson

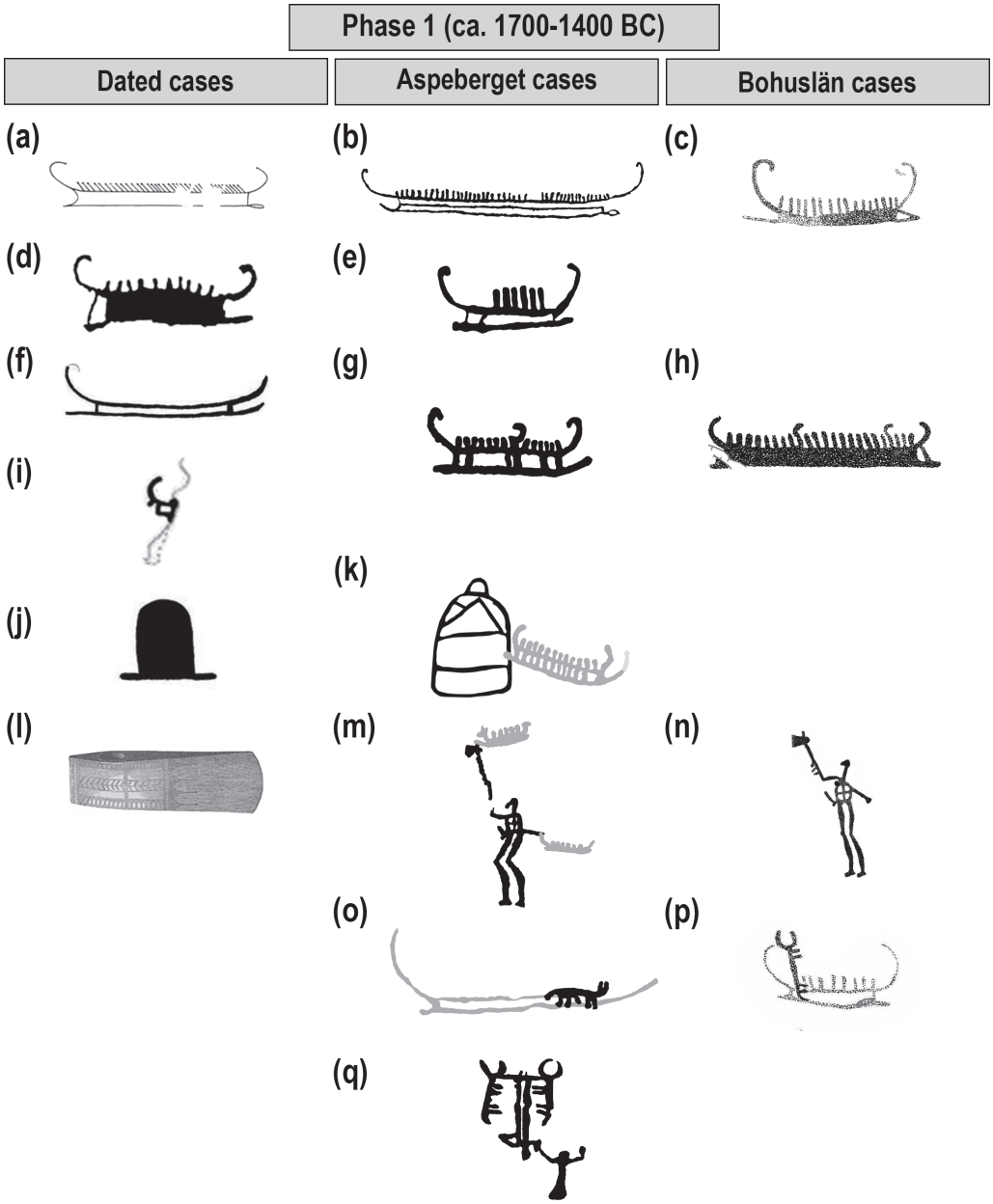


Fig. 3.2. Selected cases with chronological attributes from Phase 1. A) Rørby sword (after National Museum of Denmark), B) Tanum 22:1, C) Lyse 614:1 (Toreld and Andersson 2019b), D) Truehøjgård grave (Kaul 1998, 53.15), E) Tanum 12:1, F) Kivik grave (after Toreld and Andersson 2015, 16), G) Tanum 18:1, H) Tanum 462:1 (Andersson and Toreld 2014), I–J) Kivik grave (after Toreld and Andersson 2015, 16), K) Tanum 18:1, L) Kville (Montelius 1917, no. 815), M) Tanum 12.1, N) Tanum 1:1 (Andersson and Toreld 2015b), O) Tanum 12:1, P) Tanum 1:1 (Andersson and Toreld 2015b), Q) Tanum 120:1. Images not referenced were produced by the author.

2015, 19; Bertilsson *et al.* 2017, 294–295) (Fig. 3.2j). But given their strong association with ships and parallels in prehistoric Iberian rock art, I argued elsewhere that the motif may represent an abstract boathouse (Moyano Di Carlo 2019, 44–45)—similar to the Iron Age boathouses documented in northern Scandinavia (*e.g.*, Wickler and Nilsen 2005, 2012). Regardless of the classification, Bertilsson and colleagues dated these figures to Period V–VI. However, the one farther south is cut by a ship with inturned prows, an oval stabilizer, and a long (probably updated) keel extension—features typical of Period I–II. Therefore, the figure could not have been carved later than Period II.

Finally, six plows appear on Tanum 12:1, Tanum 18:1, Tanum 25:1, and Tanum 120:1—four as standalone figures and two held by humans and pulled by animals. Skoglund (2008) proposed that crock ards in Scandinavia were depicted during the Neolithic and the Early Bronze Age, while composite ards entered the rock art repertoire around 800 BC. This view led Rédei and colleagues (2019, 5) to date one plow on Tanum 12:1 to late Period V or Period VI. However, distinguishing crock from composite ards based on carvings is risky. For example, the one depicted on Tanum 12:1 resembles the Lavagnone plough found in Italy and dated around 2000 BC (Grassi *et al.* 2014). Since the plows on Tanum 12:1 and Tanum 120:1 are pulled by bulls or oxen (Fig 3.2q), I place them in Phase 1 to be consistent with the bull chronology proposed above. Nonetheless, some standalone plows could have been carved during the Late Bronze Age.

Phase 2 (*c.* 1400–1100 BC)

The main chronological markers of Phase 2 are ships with horse figureheads and open prow extensions, Skogstorp axes, conical chapes, and Nipperwiese shields.

Ships with horse figureheads appear on Tanum 12:1, Tanum 15:1, Tanum 18:1, Tanum 25:1, Tanum 28:1, and Tanum 120:1. Based on the dating of razors with horse-head handles, these figureheads may have been introduced around 1400 BC and gained popularity during Period III (Randsborg and Christensen 2006; Kaul 2013). The razors from Gärdslösa in Sweden and Darup in Denmark are good examples (Montelius 1917, no. 930; Broholm 1943, 14, no. 9) (Fig. 3.3a). Notably, ships with horse figureheads overlay ships with Rørby features, but never the reverse. For example, on Tanum 12:1 and Tanum 28:1, two of these ships cut through Phase 1 ships (Fig. 3.3b).

Horse figures likely appeared alongside horse figureheads in Period II—an idea supported by a horse superimposed by a Period III–IV ship on Skee 608:1 (Fig. 3.3c). Aspeberget depicts horses on Tanum 12:1, Tanum 18:1, Tanum 19:1, Tanum 25:1, Tanum 26:1, and Tanum 28:1. The horses of this phase, however, are simpler than those of the Late Bronze Age, mirroring changes in horse depictions on bronzes (Kaul 1998).

This phase also introduced other changes in ship design, including more open prow extensions, longer keel extensions, and sometimes anthropomorphic crew holding weapons or horns (Ling 2008, 102–105) (Fig. 3.3g). They also share with Phase 1 ships

the occasional presence of oval stabilizers and locking planks. These ships are depicted in the Sagaholm grave (Goldhahn 1999a, 141–150) and rendered on the Wismar horn (Horn 2022a, 137), both dated to Period II–III. Moreover, shoreline dating provides a terminus post quem of 1400 BC for a similar ship on Tanum 311:1 (Ling 2008, 91) (Fig. 3.3d, 3.3e, 3.3f, and 3.3h). Like ships with horse figureheads, ships with open prow extensions but *without* horse figureheads cut Phase 1 figures, never the reverse. For instance, Tanum 12:1 shows such a ship superimposed on a Phase 1 warrior[5] (Fig. 3.2m).

This phase also features warriors carrying Skogstorp axes, like those on board a long ship on Tanum 18:1 (Fig. 3.3k). Montelius (1917, no. 883–884) dated Skogstorp axes to Period II (Fig. 3.3m), and Broholm (1943, pl. 28) dated similar axes to Period III. These axes closely resemble those depicted on the Vestrup razor and the Grevensvænge statuettes, both dated to around Period V (Vandkilde *et al.* 2021, 7). However, Vestrup axes typically appear alongside horned helmets and/or winged chapes—for example, on Kville 124:1, Skee 1539:1, Torp 120:1, Tanum 356:1, and Tossene 32:1. The superimpositions and associations in Tanum suggest that the examples from Aspeberget date to Period II–III. On Tanum 1:1, for example, two warriors holding Skogstorp axes are superimposed by a Period IV ship (Fig. 3.3l).

Ling and Bertilsson (2016, 64) identified Skogstorp axes on Tanum 255:1 in combination with sheathed swords with conical chape (▽). This chape resembles the one on a sheath from Läderslida, Sweden, dated to Period III (Montelius 1917, no. 1007) (Fig. 3.3n). Similar chapes appear on the two warriors on Tanum 1:1 mentioned above, who are superimposed by a Period IV ship (Fig. 3.3l). At Aspeberget, they seem to occur on Tanum 12:1 and 120:1 (Fig. 3.3o).

Another chronological marker of this phase is a shield with concentric circles carried by two spearmen on Tanum 12:1 and Tanum 18:1 (Fig. 3.3s). The motif, also depicted on the Wismar horn and other rock art panels (Horn and Potter 2018, 375), may represent a Nipperwiese bronze shield dated to Period II–III (Uckelmann 2012) (Fig. 3.3q, 3.3r, and 3.3t). Although the figure could also represent earlier leather shields—like those found in the British Isles (Horn 2019, 49)—the Aspeberget examples are associated with Period II–III features. For example, on Tanum 120:1, the shield was carved next to a warrior carrying a sheathed sword with conic chape and possibly a Skogstorp axe (Fig. 3.3o).

The last figure of this phase is the sun motif, with two examples on Tanum 12:1 and one on Tanum 25:1. On Tanum 12:1, one sun is depicted as a large circle held by two possible female figures and surrounded by adorants. The other two show smaller circles and more abstract adorants. This motif appears on the Wismar horn and is being pulled by a horse on Tanum 450:1, confirming its depiction during Period II–III (Fig. 3.3v and 3.3y). Although Kaul (1998, 200) argued that most sun horses on bronzes date to Period V, I see no reason to exclude a comparison with the Trundholm Sun Chariot, dated to Period II (Kaul 1998, 31) (Fig. 3.3w). Furthermore, the sun motif on Tanum 25:1 is superimposed on a Phase 1 ship[6] and is surrounded mainly by Early Bronze Age figures (Fig. 3.3x), so it is more plausible that it was carved during this phase.

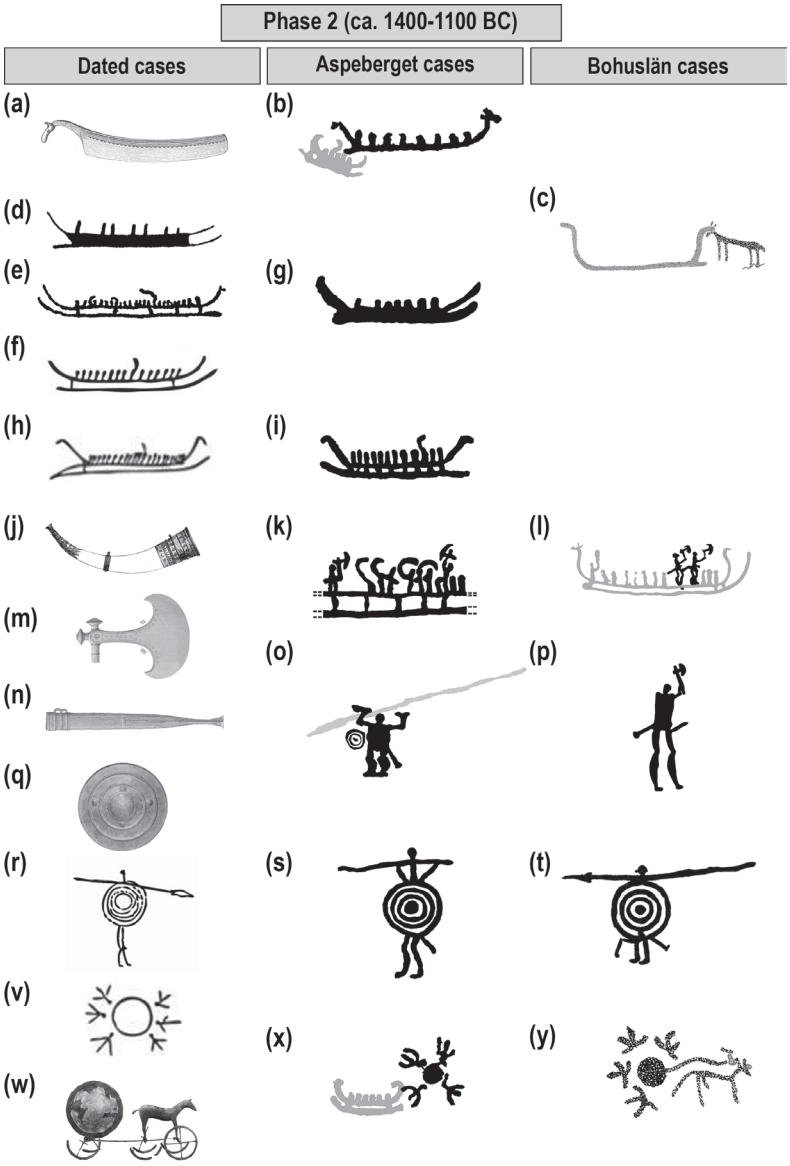


Fig. 3.3. Selected cases with chronological attributes from Phase 2. A) Gärdslösa (Montelius 1917, no. 930), B) Tanum 28:1, C) Skee 608:1 (Toreld and Andersson 2019b), D) Slab no. 26 in Sagaholm (after Bengtsson n.d.), E) Tanum 311:1, F) Wismar horn (after Ward 1897, 29), G) Tanum 12:1, H) Wismar horn (after Ward 1897, 29), I) Tanum 18:1, J) Wismar horn (after Ward 1897, 29), K) Tanum 18:1, L) Tanum 1:1, M) Skogstorp (Montelius 1917, nos. 883–884), N) Läderslida (Montelius 1917, no. 1007), O) Tanum 120:1, P) Tanum 255:1, Q) Long Wittenham (Uckelmann 2012, Tafel 10), R) Wismar horn (after Ward 1897, 29), S) Tanum 18:1, T) Tanum 89:1 (after Horn et al. *2018b), V) Wismar horn (after Ward 1897, 29), W) Trundholm Sun Chariot (The National Museum of Denmark), X) Tanum 25:1, Y) Tanum 450:1 (Andersson and Toreld 2016a). Images not referenced were produced by the author.*

Phase 3 (*c.* 1100–900 BC)

The main chronological markers of Phase 3 are bird figures and ships with aquatic bird figureheads.

The aquatic bird motif seems to have been imported into Scandinavia from Central Europe during the second part of the Bronze Age (Kaul 1998, 53; Goldhahn 2019, 102–105). Early examples include the bird handle on the Tönnersjö razor (Montelius 1917, no. 1015) and the birds of the Skallerup cauldron (Hornstrup *et al.* 2012, 25)—both dated to Period III (Fig. 3.4a and 3.4b). And later in Period IV, bird heads adorned a large number of razor handles (*e.g.*, Broholm 1946, pl. 7 no. 11; Kaul 1998, 134–135; Thrane 2004, 280–281). My survey supports this chronology: while no bird was found below Early Bronze Age figures, some lay on top of Period IV ships[7] (Fig. 3.4d). As with horse figures, birds in this phase seem to have been depicted in a simpler style than later Bronze Age examples (Kaul 1998). These simple birds occur on Tanum 12:1, Tanum 18:1, Tanum 19:1, and Tanum 119:1 (Fig. 3.4c).

This phase also features ships with everted, S-shaped prow extensions on Tanum 12:1, Tanum 18:1, Tanum 119:1, and Tanum 120:1 (Fig. 3.4g). Kaul (1998, 93) interpreted these prows as stylized heads of aquatic birds with S-shaped necks. His interpretation finds support on panels such as Skee 636:1, where birds appear both with and without legs (Fig. 3.4h): when legs are absent and bodies are slender, their resemblance to ships is striking. Based on razor chronology and shoreline dating, this prow seems to have been depicted primarily during Period IV (Kaul 1998, 88; Ling 2008, 92–94) (Fig. 3.4e and 3.4f). Although bird figureheads also appear in Periods V and VI, the razors from Hals Bakker show that the ones from this phase were depicted more simply than during later periods (Fig. 3.4f). Besides the S-shaped prow extensions, ships from this phase show long, upturned keel extensions, straight or slightly downturned stabilizers, crews with occasional depictions of anthropomorphic warriors, and locking planks (Ling 2008, 102–105). These features, however, also appear on Period V ships.

Horse figureheads were also depicted during this phase and sometimes were combined with bird figureheads on ships. Kaul (1998, 176) argued that these hybrid ships belong exclusively to a local group of razors in Thisted, Denmark, during Period IV (Kaul 1998, cat. nos. 170, 173, 186, and 190). However, some rock art ships on panels such as Tanum 1:1, Tanum 192:1, or Tossene 28:1 appear to combine a horse figurehead at one end with a potential aquatic bird head at the other, suggesting that the phenomenon might not have been exclusive to Denmark (Fig. 3.4i).

Finally, the archers depicted on Tanum 12:1 and Tanum 25:1 may also belong to this phase (Fig. 3.4k). The earliest known representation of archers appears on slab no. 42 from the Sagaholm grave (Fig. 3.4j), which, as noted earlier, is dated to Period II–III (Goldhahn 1999a, 141–150). Although archer motifs continued until at least Period V—given that some of them carry sheathed swords with winged chapes (see below)[8]—my survey suggests they were most intensively carved during Period IV. While seven archers were found over or under Period IV ships[9] (Fig. 3.4l), superimpositions with

figures from other periods are rare. Moreover, they were sometimes depicted with other Period IV traits. For example, an archer on Tanum 7:1 carries a sword with a horned pommel—typically dated to Period IV (Montelius 1917, nos. 1082–1083; Broholm 1946, pl. 1; Thrane 2004, 17) (Fig. 3.4m and 3.4n).

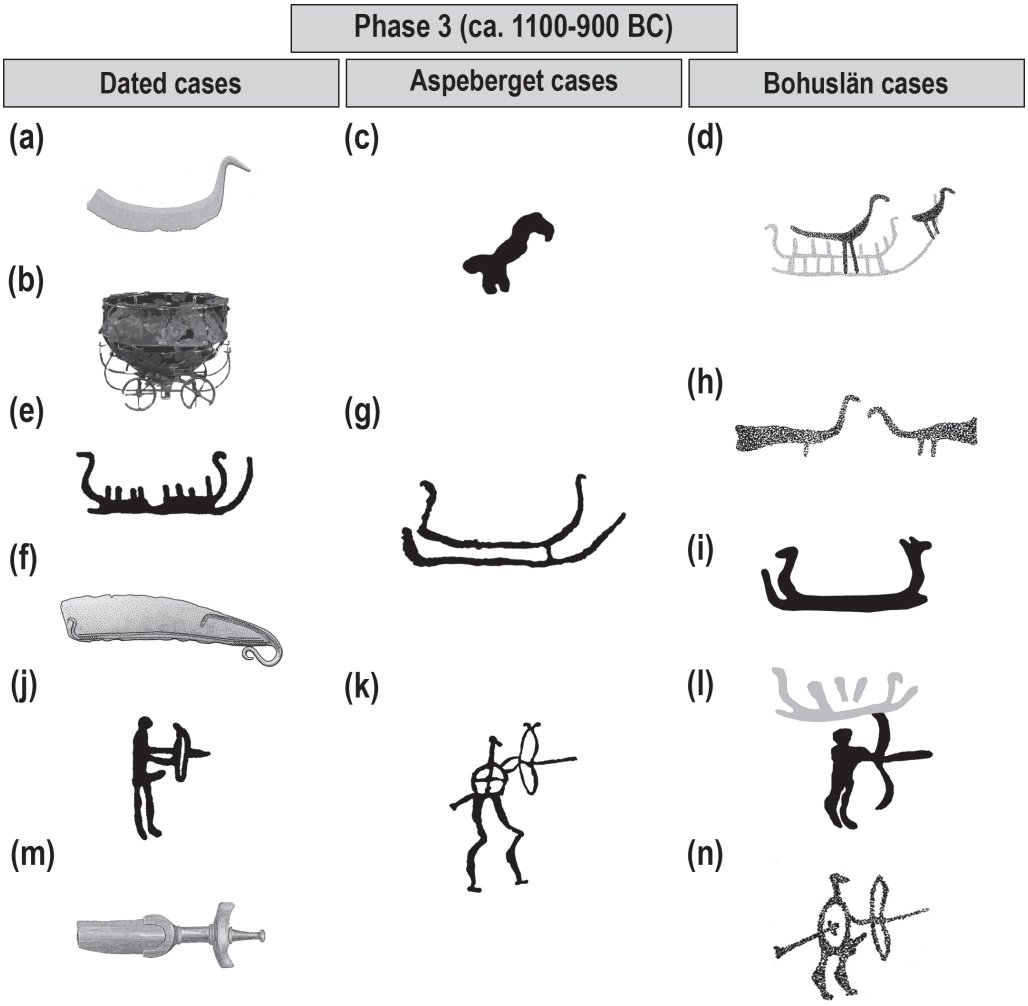


Fig. 3.4. Selected cases with chronological attributes from Phase 3. A) Tönnersjö (Montelius 1917, no. 1015), B) Skallerup cauldron (National Museum of Denmark), C) Tanum 12:1, D) Brastad 46:1 (Andersson and Toreld 2009b), E) Tanum 425:1 (after Tanums Hällristningsmuseum 2005), F) Hals Bakker (Kaul 1998, 192), G) Tanum 120:1, H) Skee 636:1 (Toreld and Andersson 2019b), I) Tanum 192:1, J) Slab no. 42 in Sagaholm (after Bengtsson n.d.), K) Tanum 12:1, L) Foss 6:1, M) Skåne (Montelius 1917, nos. 1082–1083), N) Tanum 7:1 (Andersson and Toreld 2016c). Images not referenced were produced by the author.

Phase 4 (*c.* 900–600 BC)

Phase 4 is mainly characterized by ships with elaborate animal figureheads, Galstad axes, acrobats, and warriors carrying sheathed swords with winged chapes and horned helmets.

The figureheads of this phase are highly elaborate: horse figureheads display larger ears and curled muzzles, and bird figureheads show more contorted necks. At Aspeberget, few elaborate horse figureheads appear on Tanum 12:1 and Tanum 18:1 (Fig. 3.5i). Drawing on razors, Kaul (1998, 90) has argued that these elaborate animal heads were a typical Period V convention. This is exemplified by the Danish razors from Voldtofte Mark and Glibstrup, dated to Period V (Kaul 1998, cat. no. 273 and 310), as well as by several rock art panels such as Brastad 1:1 or Svarteborg 4:1[10] (Fig. 3.5d, 3.5f, 3.5g, and 3.5j). However, Kaul (1998, 130, 2003a, 188) also noted that the transition towards these forms likely began in the middle of Period IV. Some archaeological finds support this argument. For example, the razor from Vestrup Mark, in Denmark, features an S-shaped handle—typical of Period IV—and a ship depicting a horse figurehead with a curled muzzle (Fig. 3.5k). And a Period IV razor from Northern Germany has an elaborate horse figurehead on its handle (Laux 1976, 115, Tf. 62 B9) (Fig. 3.5a). Besides these figureheads, Phase 4 shows elaborate depictions of animals, such as the horse on Tanum 19:1 and some birds on Tanum 120:1 (Fig. 3.5b and 3.5c).

Ships in this phase also show very upturned keel extensions, anthropomorphic crew, and locking planks. We can infer the dating of the keel extension from the low altitude of a ship carved on Svarteborg 13:1 (Ling 2008, 82, 102–105) or its depiction on many Period V razors in Denmark (*e.g.*, Kaul 1998, cat. nos. 173, 211, 319, 333, 371) (Fig. 3.5h). Many ships in Bohuslän display this keel extension (Fig. 3.5f), including examples at Aspeberget on Tanum 12:1, Tanum 13:1, Tanum 18:1, and Tanum 19:1 (Fig. 3.5e). Crews often depict large human figures carrying ritual paraphernalia, such as ritual axes, horned helmets, or raised paddles (Ling 2008, 102–105)—for example, on Tanum 12:1 and Tanum 18:1. And some ships also show locking planks at the prow and/or stern, though none appear at Aspeberget.

A potential depiction of a Galstad-type axe on Tanum 120:1 also belongs to Phase 4 (Fig. 3.5q and 3.5s). These axes (cast over a clay core with spiral blades) are usually dated to Period V based on the Galstad axe from around 800 BC (Göteborg Stadsmuseum, GAM:47999). A similar axe found in 2019 in a hoard at Kallerup, Denmark, supports this date. The hoard included two elaborate horse heads with sinuous necks and a double-faced human figure wearing a horned helmet, all typically dated to Period V (Thy Museum, THY 5035 Kallerup V). Moreover, almost identical axes appear on many Period V Danish razors, such as those from Hvirring (Kaul 1998, cat. no. 275), or on several rock art panels in Bohuslän[11] (Fig. 3.5r).

This phase also features warriors carrying sheathed swords with winged chapes (ϒ) on Tanum 18:1 and Tanum 29:1 (Fig. 3.5l). These chapes have been dated to Period V (*c.* 800 BC) because they resemble the sheaths of Gündlingen swords from the Hallstatt

C0 horizon (Vogt 2006, 68–71; Skoglund 2016, 35–37). My study, however, shows a strong association between winged chapes and ships from Period V and Period IV,[12] suggesting their introduction during the transition to Period V. This interpretation is further supported by the close association between depictions of winged chapes and horned helmets[13] (Fig. 3.5m). Although Aspeberget lacks depictions of horned helmets, their chronology helps refine the dating of winged chapes. Scholars have traditionally placed horned helmets in Period V based on the chronology of Danish artifacts such as the Vestrup Mark razor, the Grevensvænge statuettes, and the Viksø helmets (Vandkilde *et al.* 2021) (Fig. 3.5k and 3.5n). However, a recent radiocarbon date for the Viksø helmet suggests they may have been produced already during the Period IV–V transition, *c.* 1000–750 BC (Vandkilde *et al.* 2021, 7). This fits my observations of several warrior figures carrying horned helmets in connection with Period IV–V ships[14] (Fig. 3.5p). Therefore, given the strong association between winged chapes and horned helmets across Bohuslän, some winged chapes may have been carved earlier than 800 BC.

Other characteristic figures of this phase are the acrobats depicted on Tanum 14:1, Tanum 18:1, and Tanum 120:1 (Fig. 3.5o). They seem to enter the Nordic rock art repertoire during a broader shift toward more elaborate scenes in the Late Bronze Age (Ling 2008, 154). The only acrobat with a relatively certain chronology belongs to the Grevensvænge figurines from southern Zealand (Fig. 3.5n), usually dated to the first half of the Late Bronze Age (Iversen 2014, 243). Since the figurine stands alongside others wearing horned helmets, both features are likely to share chronology (*cf.* above). In fact, acrobats wearing horned helmets appear on Tossene 63:2 or Tanum 325:1, and they are often linked to Period IV–V ships[15] (Fig. 3.5m).

Deer also belong to Phase 4. Fredell (2010, 63–65) argued that sun-deer motifs were introduced to Scandinavia after 800 BC to replace the sun-horse motif depicted on many Period V razors. This date is supported by the recurrent presence of deer on panels with many Late Bronze Age figures and by their absence under Early Bronze Age figures. Moreover, some early animals were updated with antlers in later phases: one male deer on Tanum 12:1 appears to have been created by adding antlers to a previous bull figure (Fig. 3.5v and 3.5w).

The last figures from this phase are the three triskeles on Tanum 18:1 (Fig. 3.5y). The figure—interpreted as a sun motif by Kaul (1998, 220)—appears on several Period V razors in Denmark (Kaul 1998, cat. nos. 83, 261, 280, 287, 365) (Fig. 3.5x). The triskeles at Aspeberget resemble other cases in Bohuslän, although some versions show a quadruple spiral (Fig. 3.5z). Kaul (2025, 95) links these quadruple spirals to swastikas and dates them to around Period V–VI.

Phase 5 (*c.* 600–300 BC)

The main chronological markers of Phase 5 are ships that resemble the Hjortspring boat, squared shields, and raiders.

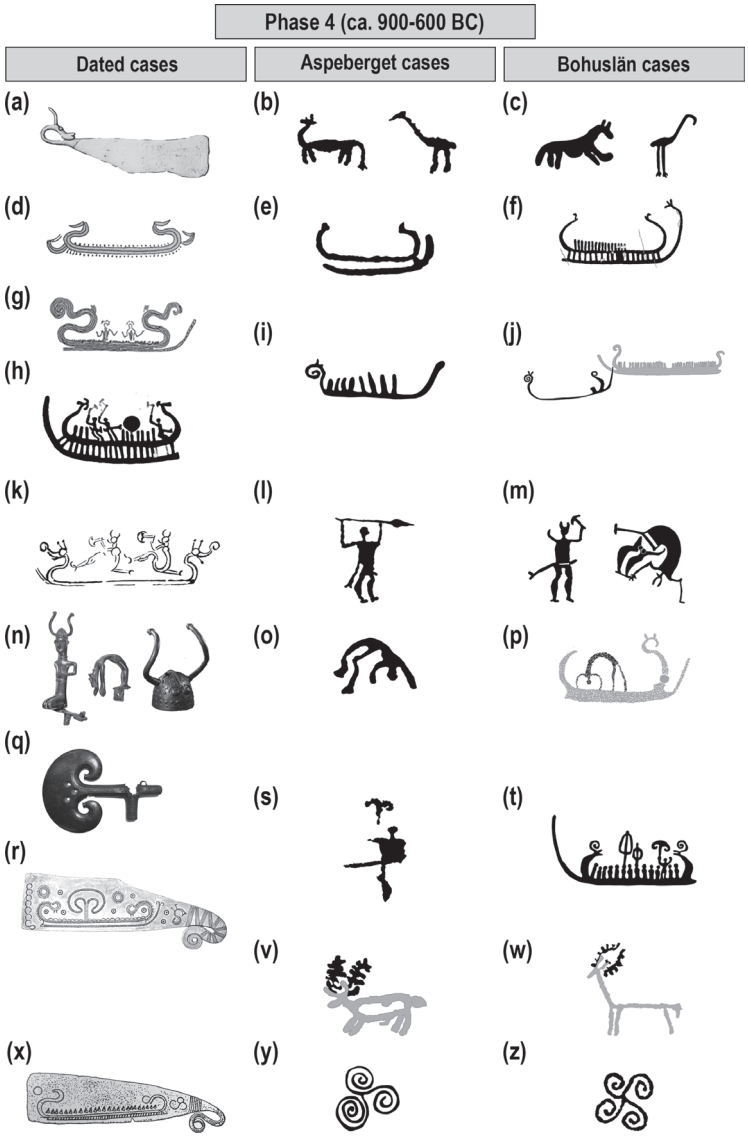


Fig. 3.5. Selected cases with chronological attributes from Phase 4. A) Alfstedt (after Laux 1976, 115, Tf. 62 B9), B) Tanum 19:1 and Tanum 120:1, C) Tanum 192:1 and Brastad 1:1, D) Gilbstrup (Kaul 1998, 53.13), E) Tanum 120:1, F) Svarteborg 4:1 (Andersson and Toreld 2013), G) Voel (Kaul 1998, 53.11), H) Svarteborg 13:1 (Andersson and Toreld 2012b), I) Tanum 18:1, J) Brastad 1:1, K) Vestrup (after National Museum of Denmark), L) Tanum 29:1, M) Tossene 63:2 (Broström and Ihrestam 2001) and Tossene 32:1 (Toreld 2003), N) Grevensvænge and Viksø (National Museum of Denmark), O) Tanum 18:1, P) Tanum 501:1 (Andersson and Toreld 2015a), Q) Galstad (Göteborgs stadsmuseum), R) Hvirring (Müller 1921), S) Tanum 120:1, T) Tossene 73:1, V) Tanum 12:1, W) Kville 151:1 (after Horn et al. *2018c), X) Østbirk (Sprockhoff 1955), Y) Tanum 18:1, Z) Tossene 35:1 (Toreld and Lundenmark 2020). Images not referenced were produced by the author.*

Ships with Hjortspring typology occur on Tanum 12:1, Tanum 18:1, Tanum 23:1, Tanum 25:1, Tanum 26:1, Tanum 28:1, and Tanum 120:1 (Fig. 3.6d). These ships mark a morphological shift: the hull becomes fully symmetrical with open prows and a keel that extends identically at both ends, animal figureheads disappear, and locking planks are frequently placed on both sides of the hull, sometimes supplemented with centered circles that may represent shields (*cf.* Ling 2008, 102–105). Moreover, while some ships still carry armed warriors, they lack the elaborate paraphernalia of the previous phase.

The chronology of these ships poses minor challenges. The Hjortspring boat, dated to around 350 BC, provides the earliest known reference (*cf.* Kaul 2003b, 175; Fauvelle *et al.* 2025, 4–7) (Fig. 3.6b). This date fits their low altitude[16] (Ling 2008, 98–99) and their systematic placement over Phase 4 ships[17] (Fig. 3.6c and 3.6e). But although this evidence suggests they mainly belong to the Early pre-Roman Iron Age, some scholars have argued that the transition to this ship type began in late Period VI (Kaul 2003a, 196–200; Ling 2008, 98–99; Dodd 2010, 114–116). In this context, Kaul (2003a, 196–200) interpreted some ships with symmetrical keel extensions and elaborate animal figureheads in Askum and Bornholm as potential transitional forms between the Late Bronze Age and the Early pre-Roman Iron Age. These transitional ships are absent at Aspeberget but appear on panels such as Lur 205:1 (Fig. 3.6a). Therefore, the transition between Late Bronze Age and Early pre-Roman Iron Age ships in Bohuslän seems to have occurred gradually since the middle of Period VI (600 BC). Interestingly, recent dating of Early pre-Roman Iron Age graves suggests a similar date for the beginning of the Iron Age in Scandinavia (Rose and Meadows 2024).

Square shields are the second feature of this phase. They have been dated to the Early pre-Roman Iron Age based on parallels with shields from the British Isles and the Hjortspring bog (Kaul 2003b, 152–153) (Fig. 3.6f). Since many Hjortspring-type ships show crew members holding these shields, their Early pre-Roman Iron Age dating seems correct (Fig. 3.6g). Nonetheless, some scholars have argued that they may also have been used during the latter part of Period VI (Vogt 2006, 76–77).

The last figure dated to this phase is the rider. Riders have been assigned to Period VI or the Early pre-Roman Iron Age based on stylistic parallels with horses depicted on Pomeranian face urns (*cf.* Kaul 2003a, 204–205; Skoglund 2016, 38). In Bohuslän, rider figures often surround Hjortspring-type ships,[18] and some riders hold the square shields discussed earlier[19] (Fig. 3.6j). Aspeberget features riders on Tanum 16:1, Tanum 25:1, and Tanum 28:1 (Fig. 3.6h). Particularly notable are those on Tanum 16:1, where the horses are slender and highly elaborate. Similar horses appear on several panels across Bohuslän,[20] suggesting that when depicted alone, they also belong to this phase. One example occurs on Tanum 26:1 (Fig. 3.6i).

Undatable figures

Several figures at Aspeberget lack a clear chronology. The most problematic case is cupmarks. As noted earlier, cupmarks date back to the Neolithic (Iversen *et al.* 2022)

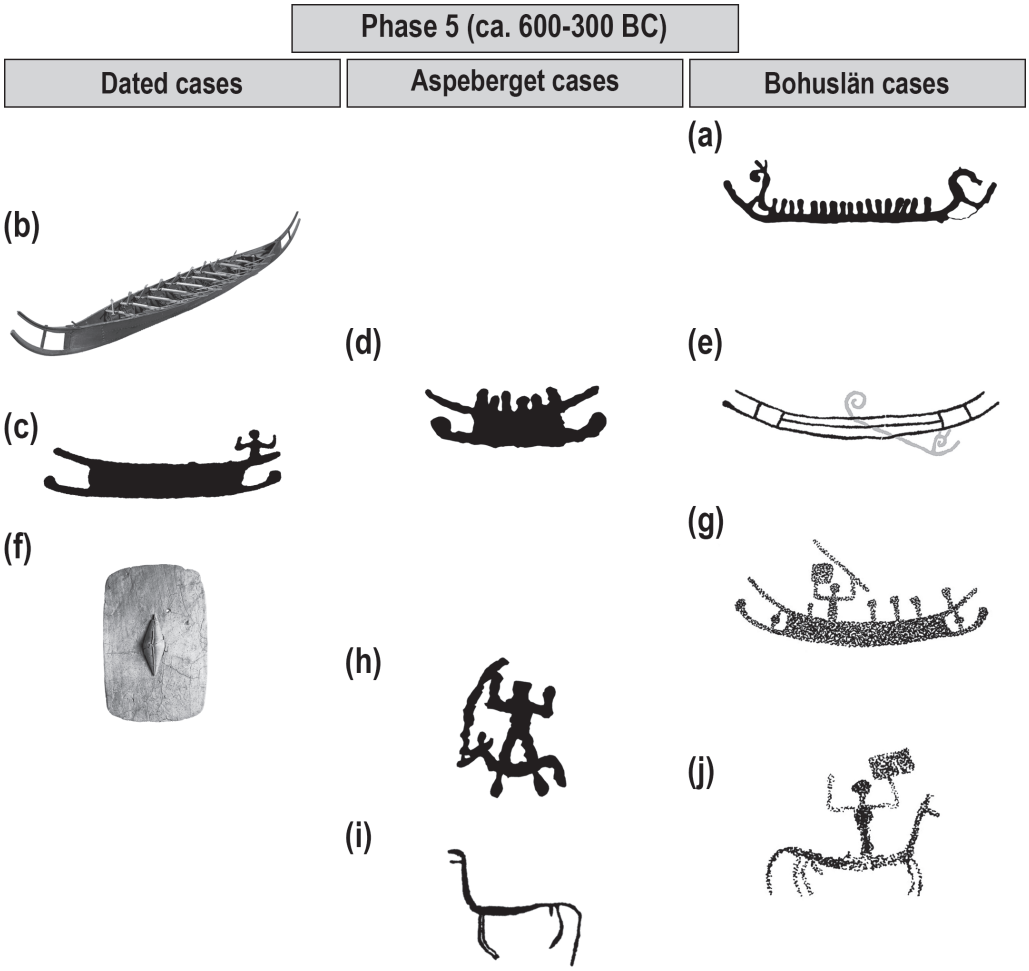


Fig. 3.6. Selected cases with chronological attributes from Phase 5. A) Lur 205:1, B) Model of the Hjortspring boat (National Museum of Denmark), C) Tanum 369:1 (Ling 2006, 26), D) Tanum 120:1, E) Brastad 14:1, F) Hjortspring shield (National Museum of Denmark), G) Tanum 208:1 (Andersson and Toreld 2016b), H) Tanum 28:1, I) Tanum 26:1, J) Tanum 72:4 (after Horn et al. *2018b). Images not referenced were produced by the author.*

and remained typologically unchanged until at least the Early pre-Roman Iron Age (Horn 2015b, 29–32). Thus, some cupmarks at Aspeberget may have been carved before or after the chronological scope of this study.

Circles also pose chronological challenges in all their typological forms. Various types appear on panels such as Tanum 12:1, Tanum 18:1, Tanum 19:1, Tanum 25:1, Tanum 28:1, Tanum 84:1, and Tanum 120:1, but their chronology remains uncertain. One circle is superimposed by a Phase 1 warrior on Tanum 12:1, confirming they were

depicted on the hill since the beginning of the Bronze Age. But they appear across Bohuslän throughout the Late Bronze Age. Their dating is problematic because they probably retained the same form over the Bronze Age (Ling 2008).

Feet and shoe soles were carved at Aspeberget on Tanum 12:1, Tanum 13:1, Tanum 14:1, Tanum 19:1, Tanum 22:1, and Tanum 120:1. Like circles, they can belong to any Bronze Age phase. Some scholars tried to establish a chronology based on morphology. Burenhult (1980) proposed a relative sequence based on pecking techniques, arranged from oldest to most recent: hollowed feet, hollowed feet with toes, and shoe soles. Skoglund (2016, 32–25, 37–38), in contrast, argued that hollowed feet—with and without toes—were mainly carved during Phases 1 and 2 of his chronology (1700–1100 BC), and outlined feet (also known as shoe soles) during his Phase 4 (800–200 BC). My survey, however, shows their dating in Bohuslän is uncertain. Both hollowed barefoot and outlined feet/shoe soles appear below Phase 1 ships.[21] Therefore, both types seem to have been depicted—perhaps with different intensity—throughout the Bronze Age.

Beyond the triskelion discussed in Phase 4, spirals are also difficult to date because they appear on bronze objects from all periods (*cf.* Montelius 1917; Broholm 1943). Single and double spirals occur on Tanum 18:1 and Tanum 120:1, but their dating is uncertain.

Dating some animal figures is equally challenging. Tanum 12:1 depicts two figures that may represent snakes. Snake depictions seem to start in the Early Bronze Age, given their presence on the Norwegian stele from Kyrkje-Eide (Mandt 1992, 346–349) and their position under Early Bronze Age ships on panels such as Tanum 325:1. However, they also appear on many Late Bronze Age razors from Denmark (Kaul 1998, 221–241), leaving their dating unclear. A similar problem arises with an animal resembling a wild boar on Tanum 18:1. Since it was carved over a human figure holding a possible Skogstorp axe, it may date to Phase 2 or later, but its precise chronology remains unknown.

Wheeled transport also poses significant dating challenges. Aspeberget depicts four examples: a chariot on Tanum 18:1 and three wagons on Tanum 12:1 and Tanum 120:1. Winther Johanssen (2010, 166–176) classified wheeled transports in Bohuslän into two groups and six subtypes (see also Grahn 2023; Ling *et al.* 2024a). According to his chronology, the wheeled transports depicted on Aspeberget date to Phase 3 or 4 (*c.* 1100–600 BC). My study does not provide a more precise date.

Spear figures are also challenging because morphological differences between Bronze Age spearheads are minimal (see Jacob-Friesen 1967). At Aspeberget, one spear appears under a Period II–III warrior on Tanum 120:1 (Fig. 3.3o), so it must have been carved during or before Period III. Based on that, one could venture that it is a spear of the Hulterstad or Valsømagle type (*cf.* Bertilsson 2017, 69–70; Horn and Potter 2018, 323). The other examples are unclear.

Finally, 14 human figures in the so-called "adorant" position appear on Tanum 12:1, Tanum 18:1, Tanum 19:1, Tanum 22:1, Tanum 25:1, Tanum 28:1, Tanum 29:1, and Tanum 120:1. Their dating is challenging because they span the entire Bronze

Age and the Early pre-Roman Iron Age. For example, they can be seen inside the Kivik grave (Period Ib–II), wearing a horned helmet and a winged chape on many panels in Bohuslän (Period IV–V), or bearing a spear and square shield on board Early pre-Roman Iron Age ships. Unless they hold a datable object or appear in a superimposition, their chronology remains uncertain. Furthermore, their varied depictions—with or without objects in their hands—cast serious doubt on whether they symbolize worship.

Discussion

Any discussion of the role of carvers in Nordic society must rest on a solid chronological model—one that correlates rock art with contemporary social phenomena and enables the analysis of long-term stylistic changes. Previous models provided a good chronological foundation, but because they often followed Montelius' six-period system, they lacked the consistency needed for quantitative analysis. This chapter improves such consistency by cross-checking known dates with superimpositions and feature associations (Fig. 3.7). The resulting five-phase model captures the *most likely* time range for each phase: Phase 1 (*c.* 1700–1400 BC), Phase 2 (*c.* 1400–1100 BC), Phase 3 (*c.* 1100–900 BC), Phase 4 (*c.* 900–600 BC), and Phase 5 (*c.* 600–300). Compared to previous chronological models—such as those developed by Kaul (1998, 2003a), Ling (2008, 2013), or Skoglund (2016)—these phases show both similarities and differences (Table 3.1).

Here, Phase 1 coincides with Skoglund's Phase 1 and with Kaul's Period I but differs from Ling's Period I, which ends in 1500 BC. Phase 2 also matches Skoglund's Phase 2 but diverges from the start and end dates proposed by Kaul and Ling for Period II and Period III. In my opinion, Period II represents a transition period that cannot be defined without reference to either Period I or Period III. This becomes clear when analyzing the features most often used to characterize the Early Bronze Age. On the one hand, the dating of the Kivik grave to Period Ib–II (Bertilsson *et al.* 2017, 303) suggests that the inturned prow extensions typical of the earliest Bronze Age persisted at least into early Period II. On the other hand, the main markers of the *late* Early Bronze Age can fall within either Period II or Period III: ships with open prow extensions from Sagaholm slabs (Goldhahn 1999b, 141–150), Skogstorp axes (Ling and Bertilsson 2016, 64), or the ships and Nipperwiese shields depicted on the Wismar horn (Horn 2022a, 137). Thus, no clear criteria distinguish Period I from early Period II or late Period II from Period III. The turning point of the Early Bronze Age seems to have been the introduction of the horse figurehead around 1400 BC, which coincides with a marked transformation in ship morphology.

Phase 3 aligns with Kaul and Ling's Period IV and resembles Skoglund's Phase 3. Like Kaul and Ling, I emphasize the aquatic bird motif and the onset of a gradual shift toward the more elaborate forms of Period V. Yet many attributes overlap Phase 2 and Phase 4, making classification difficult. This challenge likely reflects a

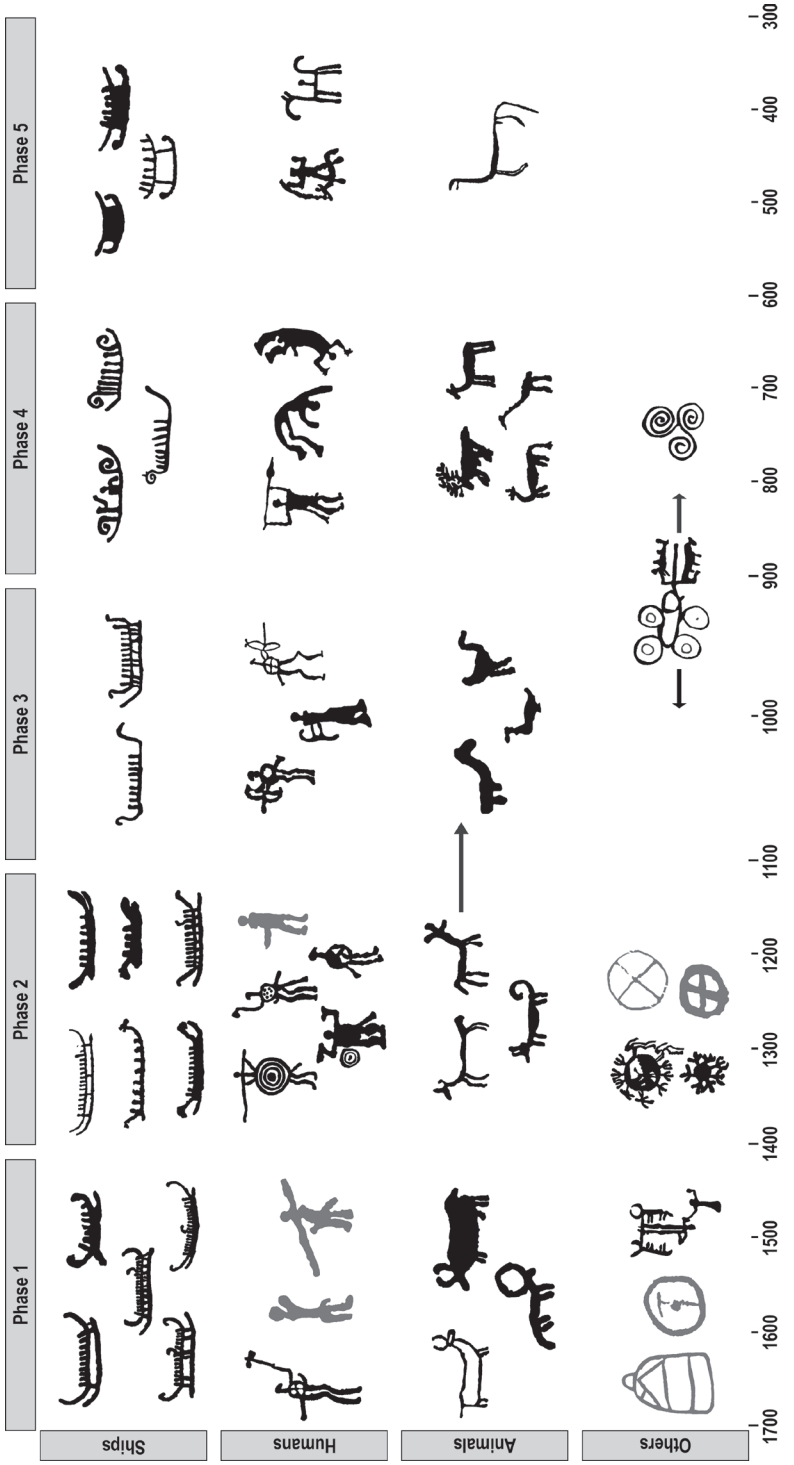


Fig. 3.7. Sample of the most characteristic figures with a certain chronology at Aspeberget. Light gray figures were dated by superimposition. Figures with only a terminus post quem or ante quem are not displayed. For the estimated chronology of each figure, see the Appendix.

Table 3.1. Comparison of chronological models by Kaul, Ling, Skoglund, and Moyano.

Date BC	*Kaul 1998/2003*	*Ling 2008/2013*	*Skoglund 2016*	*Moyano 2026*
1700	Period I	Period I	Phase 1	Phase 1
1600				
1500		Period II		
1400	Period II		Phase 2	Phase 2
1300	Period III	Period III		
1200				
1100	Period IV	Period IV	Phase 3	Phase 3
1000				
900	Period V	Period V		Phase 4
800			Phase 4	
700	Period VI	Period VI		
600				Phase 5
500	EPRIA	EPRIA		
400				
300				

broad and turbulent transition between the Early and Late Bronze Age in the region (Horn *et al.* 2024, 6).

Phase 4 spans both Period V and early Period VI. Unlike Kaul and Ling's models, I do not treat any feature as *exclusive* to Period VI, because all the attributes associated with Period VI—such as the vertical keel extension or the stylistic animal heads—also occur in Period V figures (*cf.* Ling 2008, 104). And in contrast with Skoglund's Phase 4, I argue that the winged chapes may date back to the transition to Period V, in line with the new dates proposed for the Viksø helmets (Vandkilde *et al.* 2021, 7).

The features of Phase 5 resemble those that Ling and Kaul assigned to the Early pre-Roman Iron Age. However, I emphasize that many of these features may already have appeared in late Period VI. This argument can be read in two ways: as evidence that certain figures—such as the Hjortspring-type ships—were carved during the final stages of the Bronze Age, or as evidence that the Early pre-Roman Iron Age began as early as *c.* 600 BC (*cf.* Rose and Meadows 2024). In both cases, the phase shows a drastic typological shift in many figures. While this shift may reflect larger social changes in the region, carvers of this phase drew on previous traditions: they kept a similar repertoire of motifs, carved ships with traits of both the Late Bronze Age and the Early pre-Roman Iron Age, and placed figures on panels used throughout the Bronze Age (Nilsson 2015). These patterns suggest they transformed style while *preserving* a similar tradition.

This preservation, however, was not exclusive to Phase 5, because the results indicate gradual typological changes across all phases. These transitions are clear in prow extensions and figureheads, which progress gradually towards more open and complex forms, and in animals, which became more elaborate over the Bronze Age. And they are also consistent with similar processes observed in graves (Hornstrup *et al.* 2012, 18) and weapons (Horn 2015a, 208). This should come as no surprise because Montelius anticipated this over a century ago, arguing that

> the division into periods [...] is an attempt to bring order to a long and important phase of Scandinavia's cultural history and it is only by imposing such an *artificial division* that we can follow developments during this phase. Nevertheless *there are no sharply defined boundaries* between the different periods of the Bronze Age, as is also true of the boundary between the Stone Age and the Bronze Age or the Bronze Age and the Iron Age. (Montelius 1986 [1886], 45, emphasis added)

These fuzzy boundaries have implications beyond chronology; they reflect social changes in rock art conventions and, by extension, in the roles of carvers. As shown by several anthropological studies, art in chiefdom-like societies follows strict norms about what art objects must represent and how they should be made (Biebuyck 1969, 10–11). References to ancestral forms often define what is "correct" and "incorrect", constraining artists' creativity when designing and crafting these objects (Forge 1967, 119). Changing a style, therefore, implies altering not only an object but also the tradition behind it, so gradual stylistic shifts can make changes easier to accept.

These anthropological patterns do not imply that carvings were static; after all, many were reworked throughout the Bronze Age (*e.g.*, Milstreu 2017; Horn and Potter 2018). But they suggest that the repertoire of images may have been constrained or dictated by group norms. In other words, the decision about *what* to carve could have belonged to society—or at least to those shaping norms—rather than to individual carvers (see also Chapter 9).

Unfortunately, this chapter alone cannot fully answer this question. Chronological markers help define phases and temporal changes but reveal little about carving intensity or its spatial distribution. Therefore, we cannot analyze the relevance of carvers' role throughout the Bronze Age—possibly linked to carving intensity—or how they interacted with earlier carvings. The next chapter applies this chronological model to Aspeberget to answer these and other questions: how carvers engaged with earlier figures, how panels were used during the Bronze Age, and how the chronology of Aspeberget relates to regional changes in rock art.

Notes

1 On the panels Askum 6:1, Askum 58:2, Kville 173:1, Tanum 15:1, Tanum 21:1, Tanum 75:1, Tanum 442:1, 484:1, Tanum 484:2, Tanum 487:1, Tanum 2334, and Tanum 2351. Other, more doubtful cases can be found on Brastad 26:3, Brastad 137:3, Kville 225:1, Svenneby 3:1, Tanum 23:1, Tanum 481:1, and Tanum 835:1.

2 For example, on Kville 159:1, Lyse 614:1, Tanum 208:1, and Tanum 462:1.

3 For example, on Askum 78:1, Kville 157:1, and Lur 205:1.

4 Warriors holding similar axes can be found on Skee 602:2, Tanum 1:1, Tanum 6:1, Tanum 435:2, and Tanum 446:1.
5 Other superimpositions can be found on Tossene 73:1 and Tossene 943:1.
6 The same situation is observed, for example, on Tanum 1:1.
7 For example, on Brastad 46:1.
8 For example, on Tanum 51:1.
9 On Foss 6:1, Hogdal 214:1, Kville 81:1, Svenneby 14:1, and Tanum 454:1.
10 For further examples, see panels Askum 2:1, Brastad 26:1, Bro 4:1, Herrestad 58:3, Lyse 193:1, Skee 1524:1, Tanum 456:1, or Tossene 73:1.
11 For example, on Tossene 73:1 and Tossene 85:1.
12 For example, on Askum 66:2, Askum 78:1, Askum 718:1, Bottna 43:1, Brastad 1:1, 108:1, Kville 157:1, 159:1, Svarteborg 13:1, Svenneby 65:1, Tanum 155:1, Tanum 192:1, Tanum 250:1, Tanum 356:1, Tanum 357:1, Tanum 422:1, and Tanum 456:1.
13 For example, on Bottna 57:1, Brastad 108:1, Bro 607:3, Skee 620:1, Skee 632:1, Skee 648:1, Skee 1539:1, Tanum 1:1, Tanum 248:1, Tanum 249:1, Tanum 456:1, Torp 120:1, Tossene 32:1, Tossene 44:1, Tossene 58:5, and Tossene 926:1.
14 For example, on Askum 2:1, Bottna 57:1, Bro 607:3, Skee 648:1, Skee 1539:1, Skee 1889, Svenneby 17:1, Svenneby 65:1, Tanum 248:1, Tanum 325:1, Tanum 356:1, Tanum 408:1, Tanum 449:1, Tossene 10:1, Tossene 44:1, Tossene 46:1, Tossene 58:5, and Tossene 926:1.
15 For example, on Foss 6:1, Tanum 456:1, and Tanum 501:1.
16 For example, on Tanum 241:1 and Tanum 369:1.
17 For example, on Brastad 14:1.
18 For example, on Bro 10:1, Tanum 208:1, Tanum 241:1, and Tanum 480:1.
19 For example, on Tanum 460:2 and Tanum 72:1.
20 For example, on Tanum 57:1, Tanum 72:4, Tanum 351:1, Tanum 474:1, and Tanum 512:1.
21 For example, on Brastad 107:1 and Tanum 454:1.

Chapter 4

Nothing is carved in stone

In the previous chapter, I concluded that carvers passed down rock art traditions gradually and followed strict social norms. However, the analysis fell short in explaining how rock art practices varied across panels. Carvers interacted with these panels in different ways: some were carved only occasionally, while others were revisited for centuries. As they returned to these longstanding panels, carvers encountered figures carved by their predecessors. Knowing how they interacted with these figures will reveal how they engaged with their cultural heritage and how their roles changed over time. This chapter explores these dynamics by analyzing changes in figures and panels at Aspeberget throughout the Bronze Age.

Introduction

Rock art researchers have long focused on superimpositions and the reworking of figures to build panel seriations (*e.g.*, Breuil 1952; Leroi-Gourhan 1965; Lewis-Williams 1974). But only recently have they shifted from treating these modifications as mere chronological markers to exploring their role in shaping ontology, collective memory, and knowledge transmission (see Jones 2021). Notable examples of this shift are recent studies on Australian rock art suggesting that superimpositions and reworkings may reveal how ancestral traditions were maintained and transmitted across generations (Gunn *et al.* 2022; Goldhahn *et al.* 2023).

Scandinavian rock art researchers have also interpreted the placement and transformation of carvings as a link between rock art and Nordic Bronze Age traditions. Some scholars argued that the relationship between old and new figures on panels carved for centuries reflects practices aimed at maintaining communal memories (Bertilsson 1987, 180–181; Fredell 2003; Ling 2008, 123; Nilsson 2012, 91–92; Goldhahn 2014; Kjeldsen 2017, 98–99; Nyland and Stebergløkken 2021, 13–14; Horn 2022a). Others emphasized that recarving and updating figures represent a respectful engagement with carvings made by ancestors (Milstreu 2017, 46; Horn and Potter 2018, 379). Yet a tension persists between those who see these transformations as evidence of stable beliefs (*e.g.*, Bertilsson 1987, 107) and those who argue that rock art was unstable in both composition and meaning (*e.g.*, Horn and Potter 2020, 105).

Previous attempts to resolve this tension have shown some methodological limitations. Dating efforts have focused more on individual figures than entire panels, and the chronological information provided by superimpositions and updates has often been underestimated (*e.g.*, Ling 2008; Ling and Bertilsson 2016; Skoglund 2016; Rédei *et al.* 2019). Furthermore, the temporal sequence of panels and figures has usually not been quantified, so the potential temporal correlation between neighboring panels remains unexplored. For example, while there have been discussions about the chronology of Tanum 12:1, Tanum 18:1, Tanum 25:1, Tanum 19:1, or Tanum 120:1 (Fredell 2003, 130–147; Ling 2008, 117–123; Rédei *et al.* 2019, 3–6), the temporal correlation between those and other neighboring panels at Aspeberget remains unclear.

This chapter contributes to this discussion by quantifying how figures and panels changed over the Bronze Age through a three-scale analysis based on the chronological model established in the previous chapter (see supplementary information for technical details). The first scale examines three ships with signs of updates and recarvings. They were documented with close-range photogrammetry and visually enhanced with virtual Reflectance Transformation Imaging and Local Relief Models (Horn *et al.* 2022b; Potter 2023; Green *et al.* 2025). These visualizations were then used to reconstruct their carving process (*cf.* Horn and Potter 2018, 2020). The second scale evaluates three large panels by analyzing figure depth, superimpositions, and spatial relationships between phases. The spatial relationship was assessed using Kernel Density analysis, a technique that measures the concentration of features within a defined neighborhood and highlights zones of higher density (ArcGIS Pro v3.1+). In the last scale, rock art production on panels containing at least five datable figures from two or more phases was compared using Bayesian aoristic analysis, a method that estimates event-probability distributions when only time spans are available (Crema 2024).

These methods were not applied to all figures and panels at the same level of detail; the resolution decreases as the analysis scales up. Nonetheless, the selected examples capture the most relevant patterns at Aspeberget.

Maintaining by transforming. The eternal ships of Aspeberget

Several studies show carvers modified earlier figures, sometimes centuries after they were first carved (Hauptman Wahlgren 2004; Sognnes 2008; Fredell 2010; Bertilsson 2017; Milstreu 2017; Horn and Potter 2018). This is well exemplified by three ships depicted on Tanum 12:1, Tanum 25:1, and Tanum 18:1 (Figs. 4.1, 4.2, and 4.3). They rank among the largest figures at Aspeberget: they have lengths of 152, 174, and 167 cm, areas of *c.* 3,259, 1,941, and 2,160 cm^2, and volumes of *c.* 975, 251, and 445 cm^3, respectively. The depth of some of their parts and certain features on their figureheads, prow extensions, keel extensions, and crews suggest they underwent complex transformations throughout the Bronze Age.

The ship on Tanum 12:1 displays at least three carving phases. Its inturned prow extension and oval stabilizer place the initial carving in Phase 1. Later, two short grooves were added to the prow extension, turning it into a horse figurehead typical of later phases. Two observations support this interpretation. First, the ears differ slightly in depth and carving direction from the groove of the prow extension (Fig. 4.1b). Second, although horse figureheads sometimes bend inward (for example, at Brastad 14:1), they more often face outward. Since horse figureheads remained in use throughout the Bronze Age, it is difficult to know when these ears were added. A second feature suggests they were carved relatively early: from the upper ear rise two faint hooked lines that could date to the Late Bronze Age (see below). The depth difference between the ears and these hooked lines suggests that the former were added earlier, likely during Phase 2 or, at the latest, Phase 3.

The crew lines also show signs of modification in their heads and "arms". Of the four crew lines without heads, one is holding a horn. This suggests that either the carvers omitted heads on the horn-bearer from the beginning, or they added the heads later, when the horn left no room for one. If everything had been carved simultaneously, nothing would have prevented the carver from carving the horn on top of the head. Alongside these heads, two vertical lines—which most likely represent paddles—seem to have been attached to the crew members at the prow and stern (Fig. 4.1c and 4.1d). Since depictions of paddles are primarily from the Late Bronze Age (Ling 2008, 102–104), these additions likely date to Phase 3 or 4.

The keel extension also appears to have been reworked. Its unusual length and pronounced upward curve align better with Late Bronze Age features than with the inturned prow and stern extensions. Marks in the middle of the groove suggest that a shorter keel extension, typical of Phase 1 or 2, was lengthened and raised during the Late Bronze Age (Fig. 4.1e). This is supported by two faint hook-shaped lines placed on its tip (Fig. 4.1f)—a feature that appears on some Period V Danish razors such as those from Hvirring, Fjelsted, Skive, or Øsby (Kaul 1998, cat. nos. 132, 223, 275, and 340). Whether these hook-shaped lines were carved during the lengthening of the keel extension or added later remains unclear. Their shallower depth suggests a later addition. Otherwise, one would expect similar depths.

The analysis also shows subsequent carving events that deepened specific parts of the ship (Fig. 4.1a). The prow extensions, keel, keel extension, stabilizer, sternpost, and stempost are deeper than the interior of the hull and crew lines. As suggested by the carvings in Sagaholm, carvers may have deepened only certain parts of a figure to emphasize key features (Goldhahn 1999b, 76–79). However, the fact that the deeper parts show different chronological attributes suggests the figure was recarved (*cf.* Hauptman Wahlgren 2004). The recarving seems to have followed one or more strategies. Carvers may have prioritized elements with particular significance, reinforced the outline to improve visibility, or hollowed the hull—that was initially outlined—at a shallower depth during a later carving event. Deep outlines appear elsewhere on the hill, especially among bulls (for example, on Tanum 12:1, Tanum 18:1,

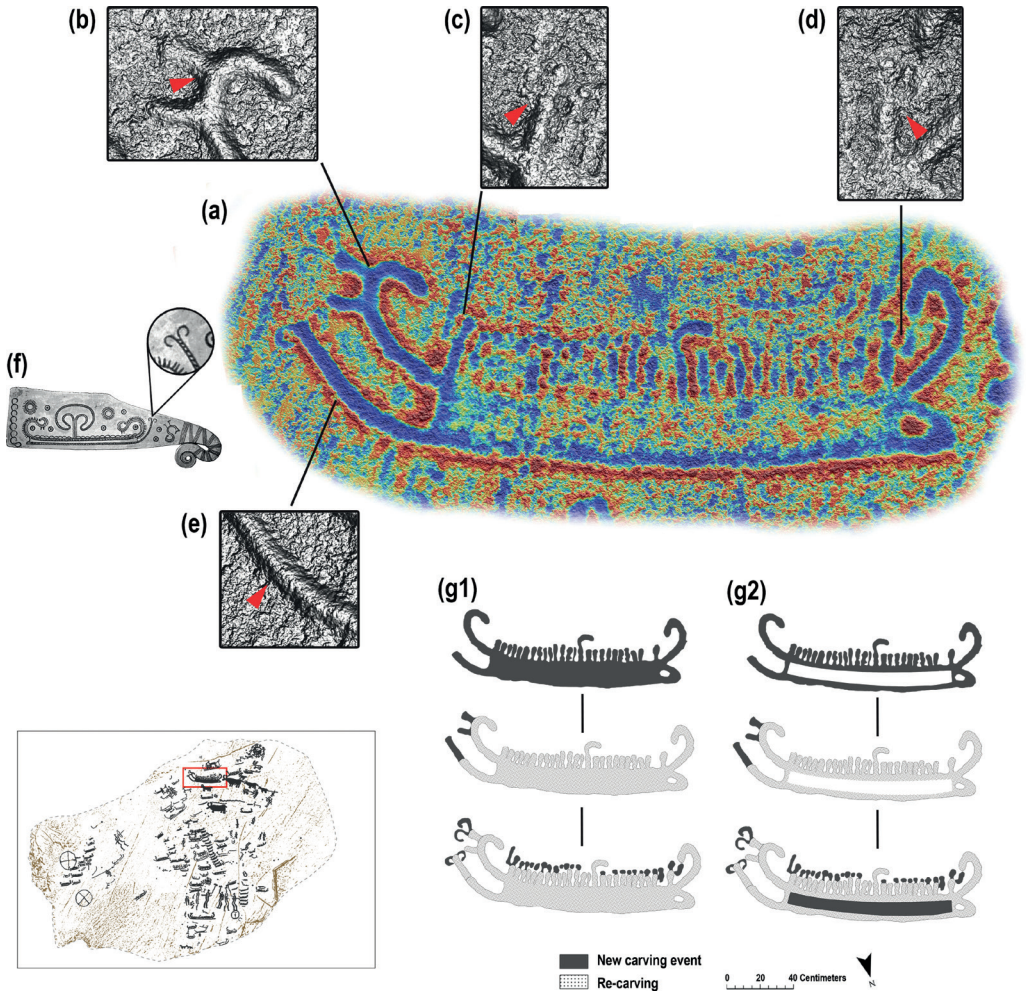


Fig. 4.1. Potential updates on a ship from Tanum 12:1. A) Enhanced topographical visualization made with TVT, B–E) Virtual RTI of details, F) Razor from Hvirring, Denmark, with a depiction of hooked lines in the keel extension (Müller 1921). G1–G2) Two tentative reconstructions of the carving sequence.

and Tanum 25:1). While some of these bulls have outlined bodies and no signs of updates, those with hollowed bodies are generally deeper, reinforcing the idea that they were recarved.

Moving on now to the ship from Tanum 25:1, we need to consider not only the ship itself but also two adjacent figures that show how the ship was made (Fig. 4.2). The ship occupies the central area of the panel and stands out because it is far larger and deeper than the surrounding figures. It displays markedly inturned prow extensions and an oval stabilizer, typically dated to Phase 1, but its keel cuts through another

small ship with everted prow extensions, a feature dated to Phase 2 (Fig. 4.2c). The unusual depth and the chronological inconsistency suggest that the large ship was recarved. I have previously argued that the deepest figure in a superimposition was carved last. This principle, however, does not account for the scenario in which *only one* figure was recarved later, which seems to be the case with these two ships.

The carving sequence of this ship can tentatively be divided into three main phases (Fig. 4.2e). In the first carving event, the carver created the large ship and a nearby bull in accordance with Phase 1 conventions. During Phase 2, a second ship was carved *over* both the ship and the bull, presumably at a greater depth. Later—perhaps still

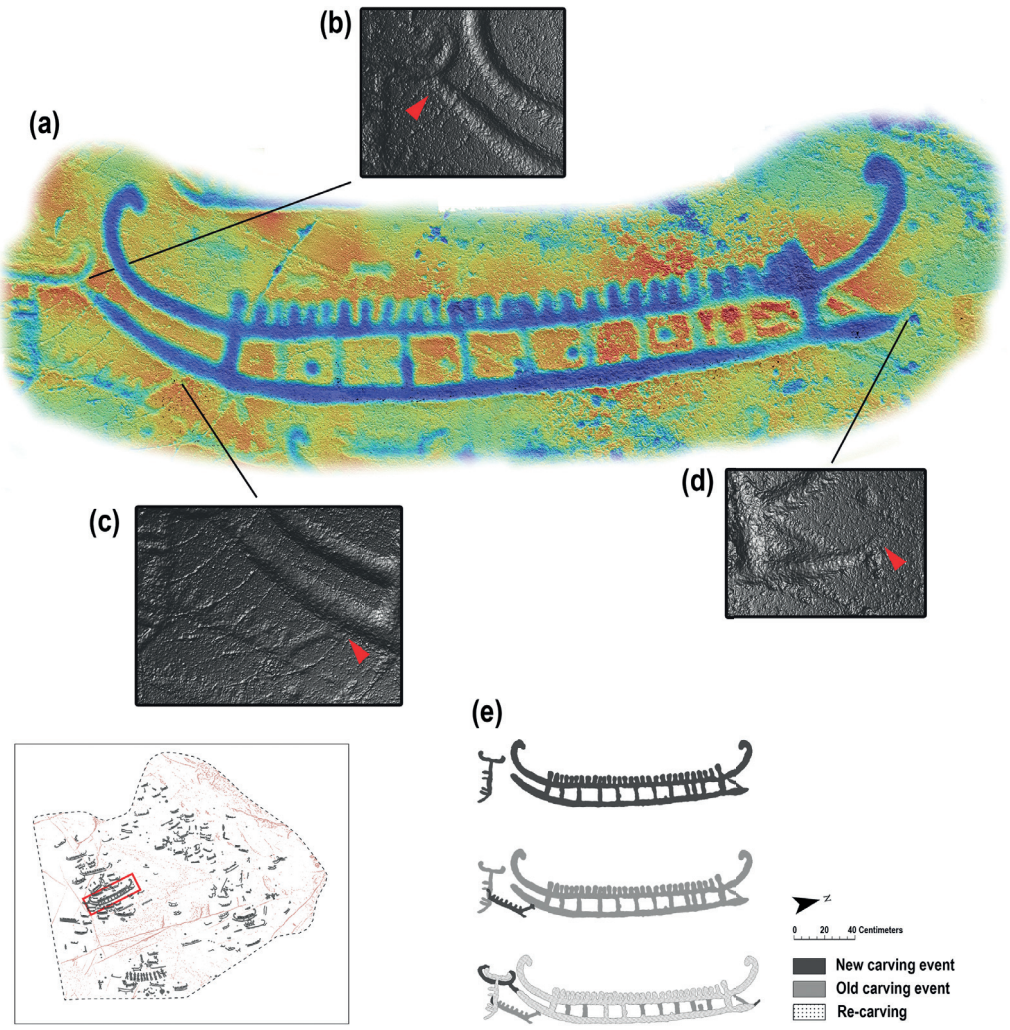


Fig. 4.2. Potential updates on a ship from Tanum 25:1. A) Enhanced topographical visualization made with TVT, B–D) Virtual RTI of details, E) Tentative reconstructions of the carving sequence.

in Phase 2 or in Phase 3—the keel extension and stabilizer of the large ship were likely lengthened, and many parts were deepened, cutting through the Phase 2 ship (Fig. 4.2b and 4.2d). Simultaneously, carvers seem to have added a second pair of horns to the bull and deepened its belly, also cutting the Phase 2 ship. If this sequence is correct, the fact that Phase 1 figures cut through a Phase 2 ship is explained by the recarving of the Phase 1 ship and bull during Phase 2 or 3, perhaps because of their greater social significance.

The last case from Tanum 18:1 is a large ship occupying the center of the panel (Fig. 4.3). The ship has an inturned prow and stern extension typical of Phase 1, but two of its crew members carry Skogstorp axes dating to Phase 2 (Fig. 4.3b). Closer inspection suggests that carvers used two earlier crew lines to create the northernmost warrior and two horn bearers (Fig. 4.3b). Moreover, the ship is markedly deeper than

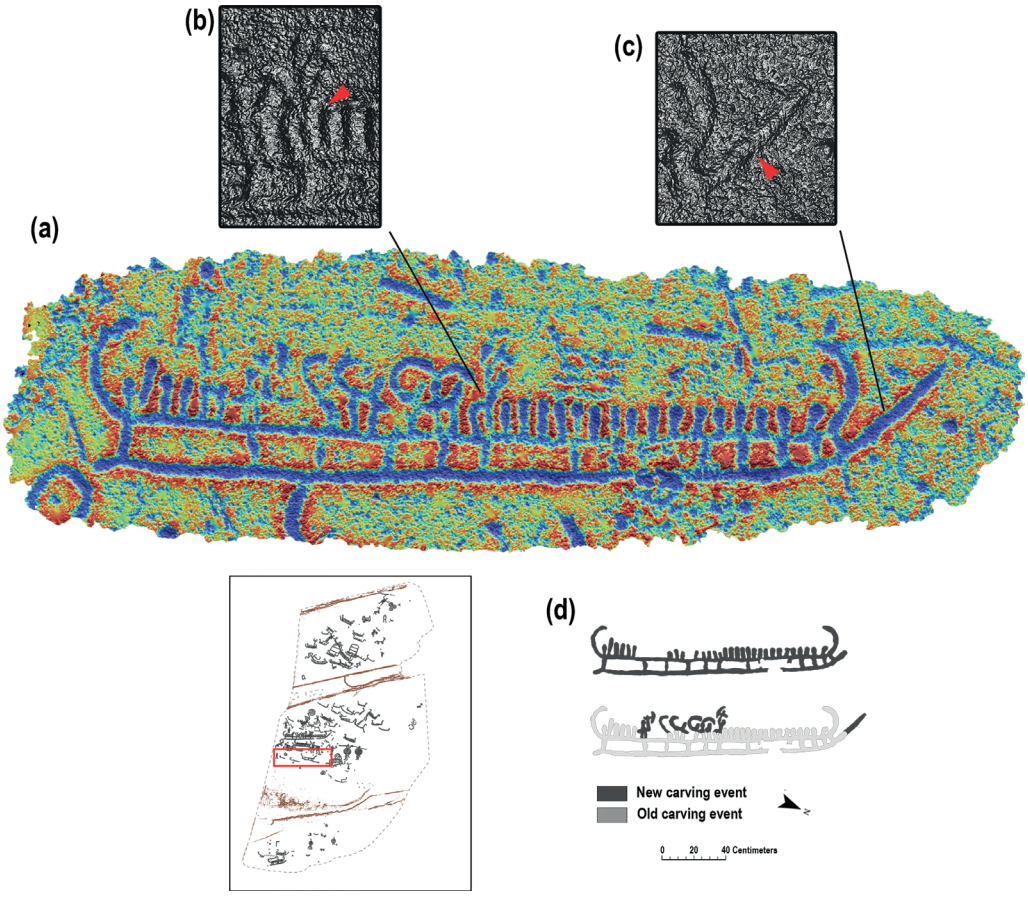


Fig. 4.3. Potential updates on a ship from Tanum 18:1. A) Enhanced topographical visualization by Horn and colleagues (2018a), B–C) Virtual RTI of details, D) Tentative reconstructions of the carving sequence.

most surrounding figures (especially its stabilizer, keel, and keel extension), and subtle changes in groove direction suggest that the keel extension was lengthened (Fig. 4.3c). Although less conclusive, this evidence suggests the ship was recarved and updated.

The updates to these three ships are among the most common transformations in Nordic Bronze Age rock art ships: the addition of animal heads, the lengthening of the keel extension, the addition of anthropomorphic figures to the crew, and perhaps the hollowing of hulls (*cf.* Milstreu 2017, 41–44). These, however, were not the only figures updated at Aspeberget. For example, carvers appear to have turned a bull into a deer by adding antlers on Tanum 12:1 (*cf.* Fredell 2010, 62), added the second pair of horns to the bull mentioned before on Tanum 25:1, and extended and curled the leg of one human figure on Tanum 28:1.

Likewise, the three ships discussed in this section were not the only figures recarved at Aspeberget. As will be shown in Figure 4.8a, the number of exceptionally deep figures decreases over the Bronze Age. That the deepest figures date to Phase 1, and that only a few figures stand out by their depth, indicates that carvers recarved specific old figures. For instance, in the three cases discussed above, the ships stand beside bull figures, and both motifs were carved far deeper than the surrounding carvings, which suggests that later carvers targeted them together. However, how many times they recarved these figures is difficult to estimate. The ships from Tanum 12:1, Tanum 25:1, and Tanum 18:1 are about 18, 13, and 7 times deeper than the shallowest figure on their respective panels. If the shallowest depth reflects a single carving event, these ships would have been recarved at least 17, 12, and 6 times, respectively. Therefore, given the large variation in carving depth across panels and the possibility that a figure could have been reactivated several times through shallow pecking, recarvings seem to have been a recurring practice.

These recurrent recarvings reveal how successive generations of carvers engaged with their cultural heritage. If we take the latest potential date of the initial carving and the earliest potential date of the final recarving, these transformations span at least 500 years at Tanum 12:1 and about 300 years at Tanum 25:1—a period encompassing between 10 and 16 generations of carvers. The updates at Tanum 18:1 could have occurred closer in time because the added features belong to two successive phases, but they likely involved more than one generation. The next section will show that these transformations were not exceptions but part of the broader, long-term construction of the panels.

Maintaining by adding. The cases of Tanum 12:1, 18:1, and 25:1

The intergenerational engagement shown in the three cases discussed above aligns with the development of several panels at Aspeberget over the Bronze Age. Although carvers worked on some panels for centuries, successive generations continually integrated new figures into existing compositions. This is well illustrated by Tanum 12:1, Tanum 18:1, and Tanum 25:1 (see Appendix). Tanum 12:1 depicts 288 figures arranged in two main clusters. The western cluster features 257 figures and the eastern

cluster 30; only a partial Early Bronze Age ship stands between these two groups. Tanum 18:1 features 219 figures divided into three main clusters that are naturally limited by two geological fractures running in a NW–SE direction. The central cluster is the most densely populated, with 131 figures, while the western and eastern clusters

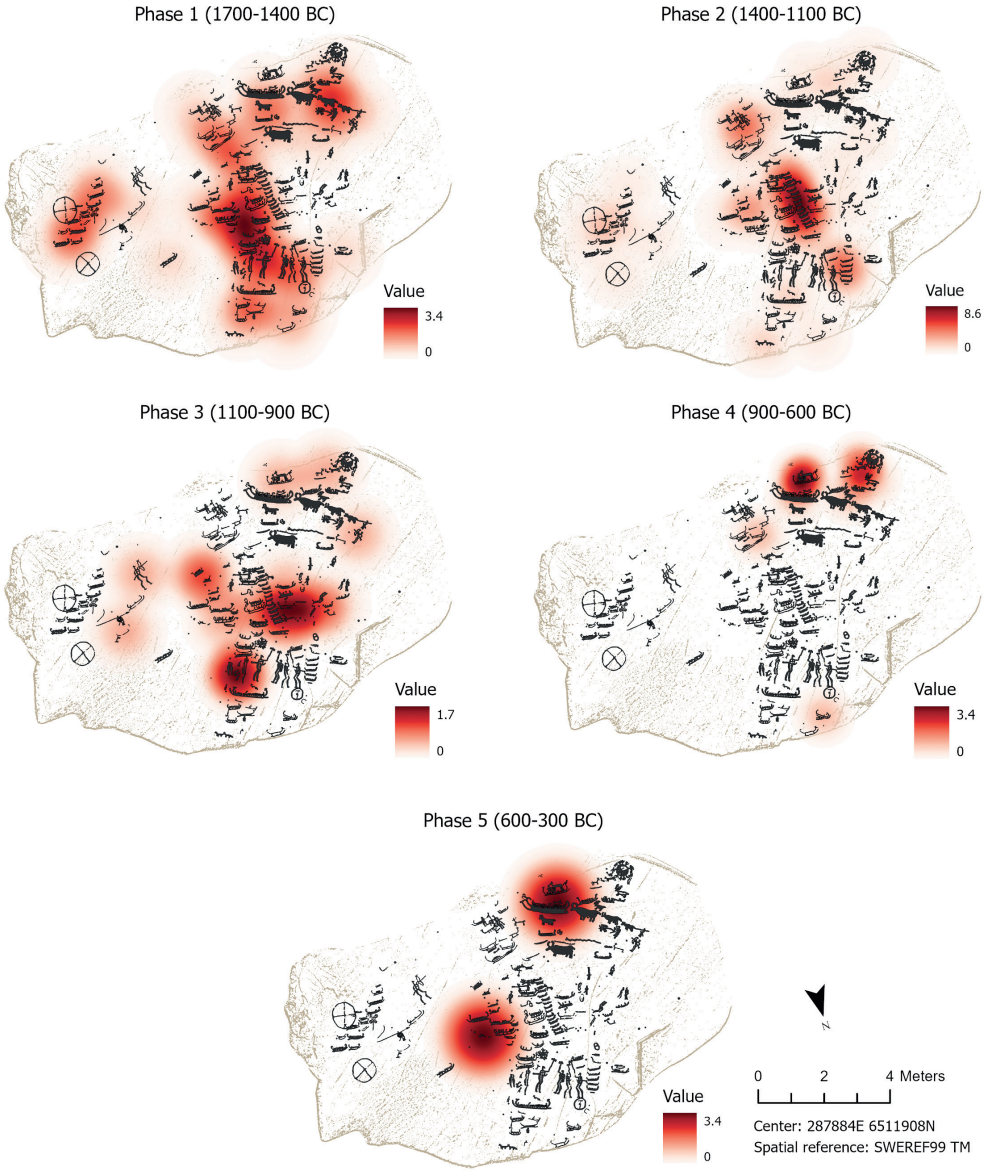


Fig. 4.4. Kernel density estimation of figures on Tanum 12:1 by phase. The same search radius was applied to all phases. The color scale is adjusted per phase, so identical colors represent different density values.

contain 55 and 33 figures, respectively. Finally, Tanum 25:1 depicts 324 figures grouped into three main clusters in the southwestern, southeastern, and northern parts of the panel. They depict 112, 54, and 156 figures, respectively. Only two Phase 5 ships in the middle of the panel fall outside these clusters.

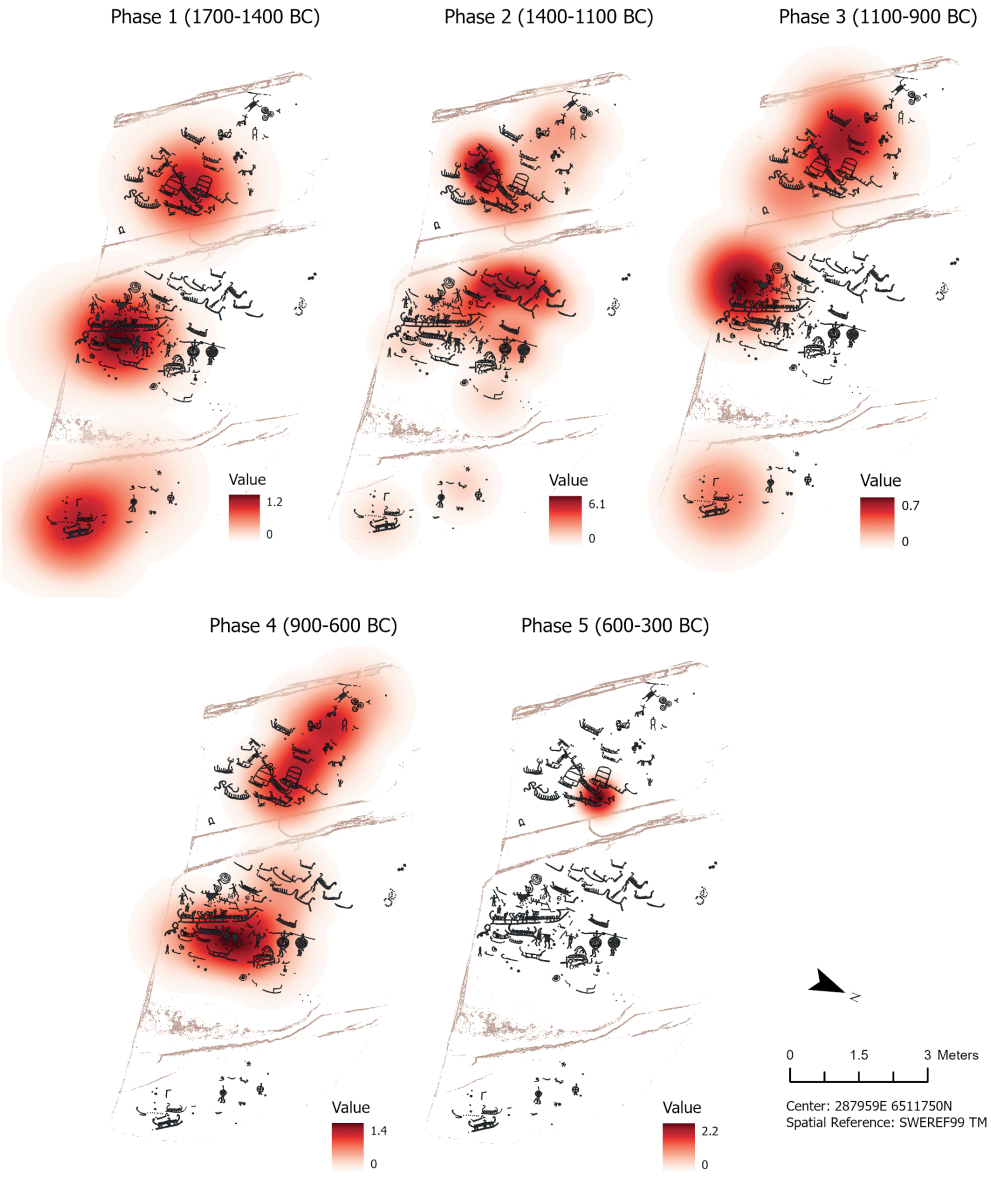


Fig. 4.5. Kernel density estimation of figures on Tanum 18:1 by phase. The same search radius was applied to all phases. The color scale is adjusted per phase, so identical colors represent different density values.

These figures did not accumulate at random. Carvers *integrated* new figures into the panels by preserving the orientation and distribution of previous compositions (Figs. 4.4, 4.5, and 4.6). This is clear on Tanum 12:1 and Tanum 25:1, where Phase 2 figures expanded Phase 1 clusters by increasing their size and density. Similarly, figures added in Phases 3, 4, and 5 filled the spaces between the carvings of Phases 1 and 2 without superimposing them. The placement of birds in relation to Early Bronze Age ships illustrates the point well. Together, these patterns suggest carvers respected previous carvings and considered them when choosing where to place new figures.

This interpretation gains further support from the analysis of superimpositions. At Aspeberget, they occur on Tanum 14:1, Tanum 22:1, Tanum 28:1, Tanum 29:1, Tanum 119:1, Tanum 120:1, Tanum 12:1, Tanum 18:1, and Tanum 25:1—the last three

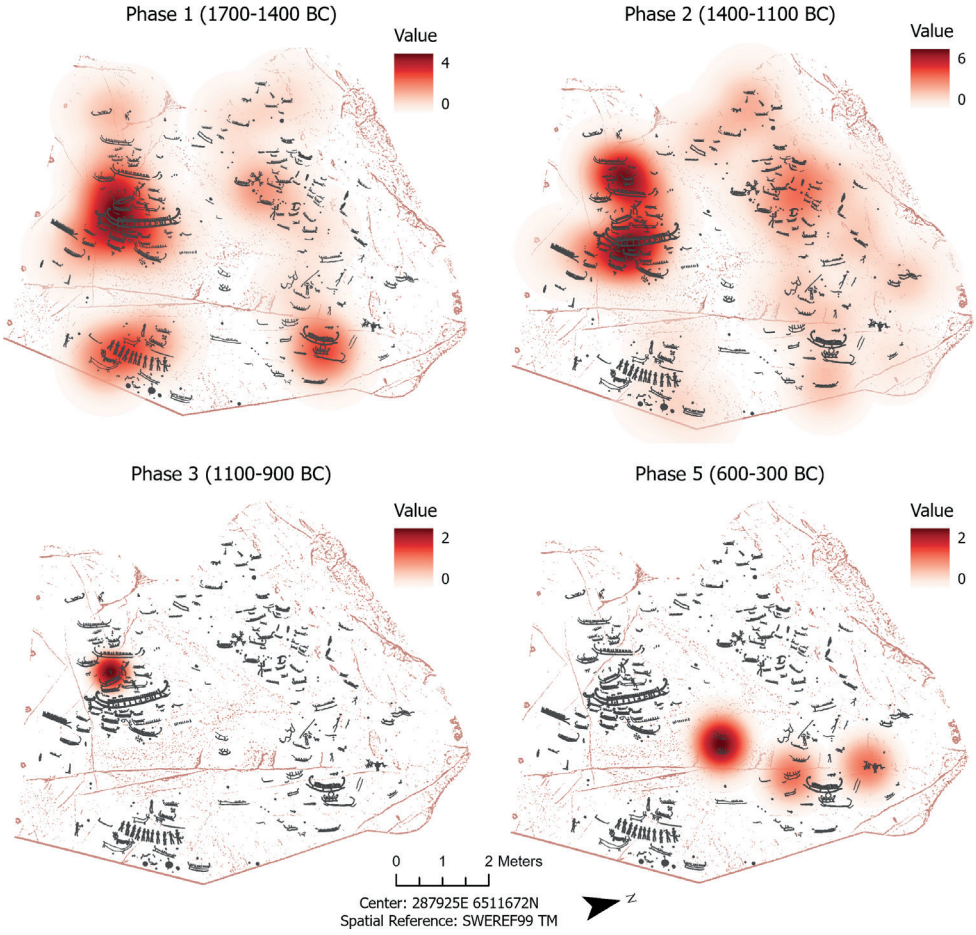


Fig. 4.6. Kernel density estimation of figures on Tanum 25:1 by phase. The same search radius was applied to all phases. The color scale is adjusted per phase, so identical colors represent different density values. The panel does not depict recognizable Phase 4 figures.

displaying the highest amount. Tanum 12:1 has 32 superimpositions involving 50 figures; Tanum 18:1 has 26 involving 40 figures; and Tanum 25:1 has 25 involving 44 figures. This means that only 17%, 18%, and 13% of the figures on each panel were involved in a superimposition. Given that these panels rank among the largest in the region, the frequency of superimpositions is low. These superimpositions occur more often between successive phases, especially between Phases 1 and 2, and frequently involve ships and humans (Fig. 4.7), which may indicate that carvers superimposed specific figures to link their properties (Burenhult 1980, 92; Coles 2005, 11; Horn 2018a, 120). Moreover, most superimpositions cover less than 25% of the underlying figure, and none reach the level of obliteration, where more than half of the earlier figure is covered (following Re 2016). The absence of obliterations shows that, over roughly 1,200 years, no one attempted to deface these panels, in sharp contrast to practices in areas such as Bardal, Norway, where Bronze Age carvers placed figures over earlier motifs from the hunter-gatherer tradition (Sognnes 2008, 242).

This respectful engagement with previous compositions is also reflected in the figures' size. At Aspeberget, only a few figures stand out for both depth and size (Fig. 4.8c), especially because they are much deeper and larger than the surrounding carvings (*cf.* Fahlander 2019). These figures date to the first two phases, especially Phase 1, and remained the largest on their panels throughout the Bronze Age and Early pre-Roman Iron Age (Fig. 4.8b). That these large, deeply carved figures occupy central positions on the three largest panels of the hill reinforces the idea that recarvings targeted figures and panels of special value, which carvers maintained over the long term (see also Chapter 6). Some cases, however, break this pattern. The large ship on Tanum 22:1 illustrates such an exception: despite being the largest ship at Aspeberget, it is shallow and stands alone. To explain why panels like this received special figures, we need to compare how carvers used panels over the Bronze Age.

Maintaining by returning. The temporal dynamics of the hill

To explain why carvers used some panels only at specific moments of the Bronze Age, we must compare the temporal dynamics of panels across Aspeberget (Table 4.1). Setting aside the ships that may date to Late Neolithic II (see Chapter 3), carving activity on the hill began in Phase 1 (Fig. 4.9). During this phase, carvers focused on Tanum 12:1, Tanum 25:1, and Tanum 28:1. Aoristic modeling suggests that the activity at Tanum 28:1 peaked during this phase and then gradually declined (Fig. 4.10). However, the activity never reached the levels of Tanum 12:1 or Tanum 25:1, which featured the highest number of figures and the largest and most complex motifs during this phase. Carvers also worked on other panels, but more sporadically: Tanum 16:2, Tanum 17:1, Tanum 18:1, Tanum 22:1, Tanum 119:1, and Tanum 120:1. Except for Tanum 18:1, which depicts 10 figures from Phase 1, these panels depict only one to three figures. Despite this limited activity, the 2.6-meter-long ship on Tanum 22:1 shows that small panels could host complex carving events.

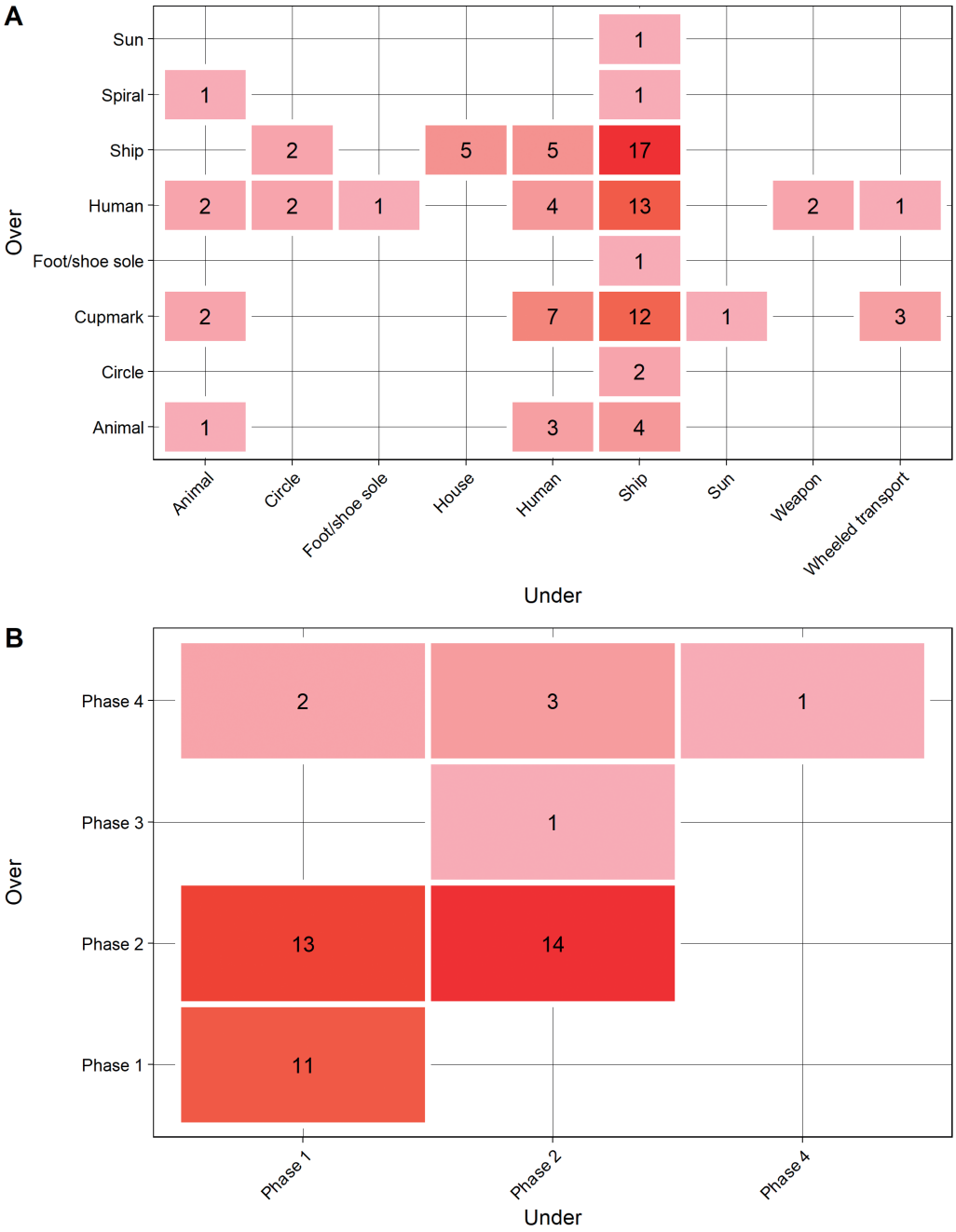


Fig. 4.7. Superimpositions at Aspeberget by (A) figure type and (B) phase (including only figures datable to phases one to five). Higher numbers of superimpositions are shown with stronger colors.

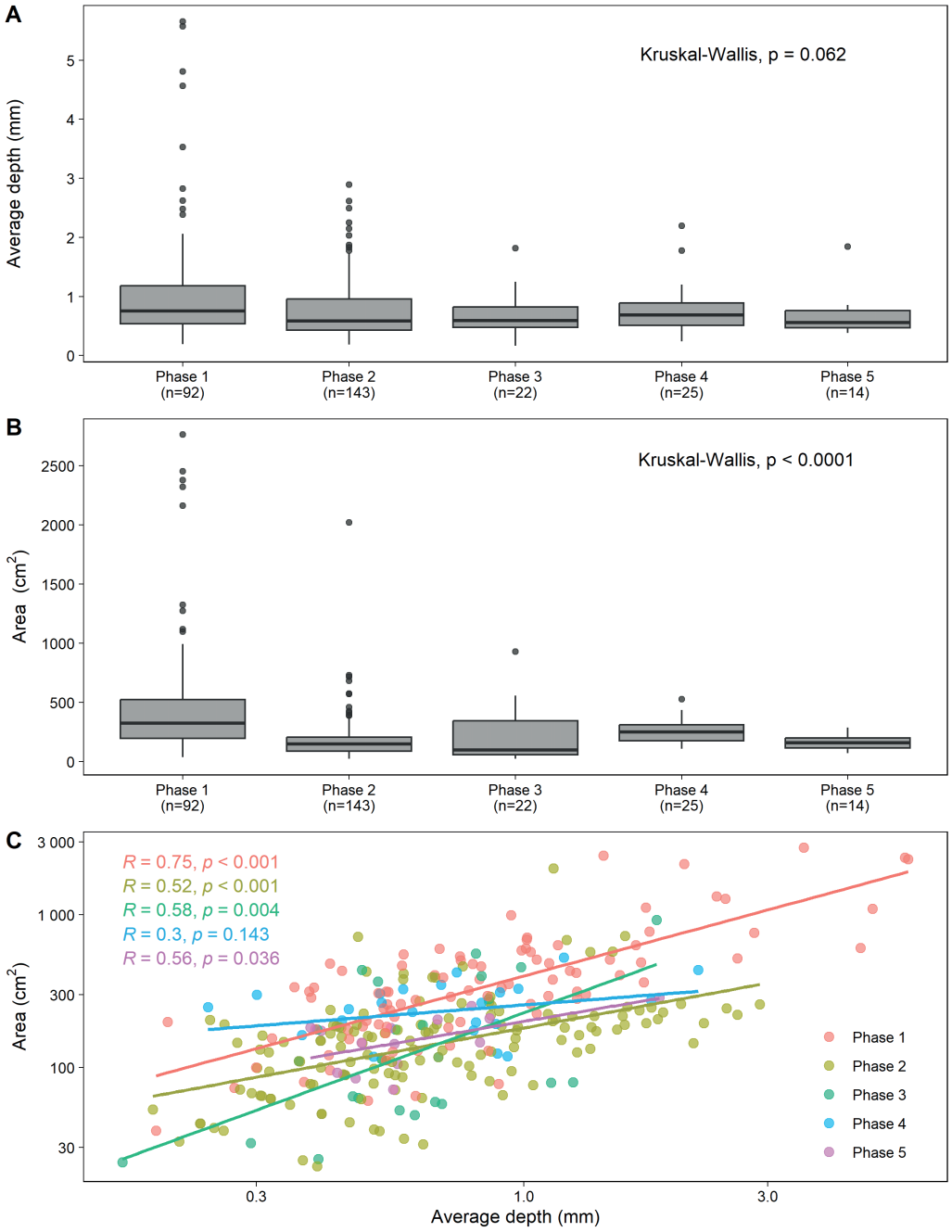


Fig. 4.8. Exploratory analysis of figure size and depth at Aspeberget. A) Frequency distribution of average depth by phase (calculated as volume-to-area ratio), B) Frequency distribution of area by phase, C) Association between average depth and area for figures with calculated volume. Axes in panel C are shown on a logarithmic scale.

Table 4.1. Number of figures per phase at Aspeberget. Figures with terminus post and/or ante quem are not included.

Panel	*Phase 1*	*Phase 2*	*Phase 3*	*Phase 4*	*Phase 5*	*Total*
Tanum 12:1	52	61	17	10	2	142
Tanum 13:1	0	1	0	1	0	2
Tanum 14:1	0	0	0	1	0	1
Tanum 15:1	0	4	0	0	0	4
Tanum 16:1	0	0	0	0	2	2
Tanum 16:2	1	0	0	0	0	1
Tanum 17:1	1	0	0	0	0	1
Tanum 18:1	11	37	6	7	1	62
Tanum 19:1	0	0	2	2	0	4
Tanum 22:1	3	1	0	0	0	4
Tanum 23:1	0	2	0	0	1	3
Tanum 25:1	32	53	1	0	4	90
Tanum 26:1	0	0	0	0	4	4
Tanum 28:1	11	6	3	0	3	23
Tanum 29:1	0	0	0	2	0	2
Tanum 119:1	3	1	2	0	0	6
Tanum 120:1	3	13	2	4	1	23

In Phase 2, activity declined at Tanum 28:1 but increased at Tanum 18:1 and Tanum 120:1. Although carving peaked on both panels during this phase, it did not surpass the number of figures added to Tanum 12:1 and Tanum 25:1 in the same period. Overall, Tanum 12:1 and Tanum 25:1 remained the most prominent panels during the first two phases, followed by Tanum 120:1 and, in particular, Tanum 18:1. Carvers also revisited smaller panels such as Tanum 22:1 and Tanum 119:1, while others—Tanum 13:1, Tanum 15:1, and Tanum 23:1—were carved for the first time. If we set aside the possible Late Neolithic II date of one ship, Tanum 15:1 was used only during this phase.

During Phase 3, carving activity on panels such as Tanum 12:1, Tanum 18:1, Tanum 28:1, Tanum 25:1, and Tanum 120:1 plunged. Although Tanum 25:1 and Tanum 120:1 experienced a less pronounced decline, the number of newly carved figures was far lower than in earlier phases. This did not prevent carvers from carving new panels, such as Tanum 119:1 and Tanum 19:1. Notably, Tanum 19:1 appears to have remained unused until this phase, despite lying just 15 meters from Tanum 18:1, one of the largest panels on the hill. Nothing suggests that rock quality at Tanum 19:1 limited carving; in fact, some figures are highly elaborate. And although the rock could have

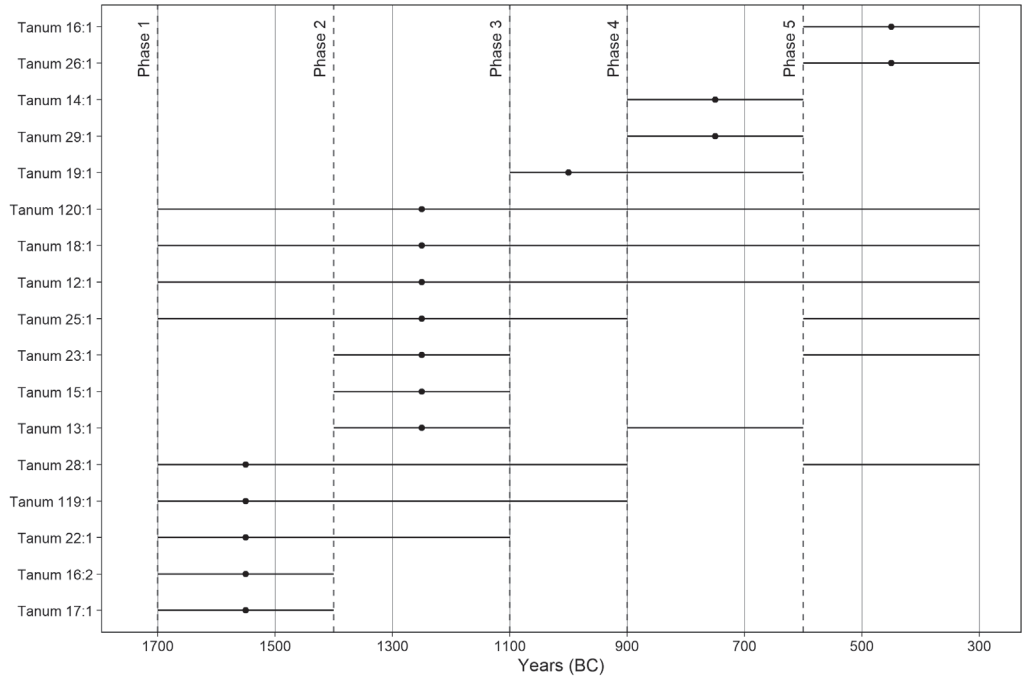


Fig. 4.9. Intervals of use of panels at Aspeberget. Lines represent the phases during which the panel shows activity. Dots indicate the peak of activity, calculated as the middle year of the phase with the largest number of datable figures.

been covered during the Early Bronze Age (Toreld 2016, 72), the paleolandscape of Bohuslän seems to have been relatively open (Ling 2008, 5–6), which would have reduced soil accumulation on the rock. Therefore, whether to carve specific panels seems to have been a deliberate choice.

The decline in activity that began in Phase 3 reached its lowest point in Phases 4 and 5. Although carvers added some Phase 4 figures to the larger panels and reworked a few existing motifs, production dropped sharply compared with the first two phases. Even so, carvers created new panels during this phase (Tanum 14:1 and Tanum 29:1). In Phase 5, they created two new panels (Tanum 16:1 and Tanum 26:1) and "reactivated" panels like Tanum 28:1 and Tanum 25:1, ending centuries of carving inactivity. These hiatuses do not rule out other forms of ritual practice on or around these panels. A grave field, for example, was built on the hilltop (Bertilsson 1987, 108). Since its typology suggests a date in the Early pre-Roman Iron Age (*cf.* Bertilsson 1987, 138), Aspeberget seems to have remained a focal place for ritual activity at the end of the Bronze Age and the beginning of the Iron Age.

In summary, Aspeberget shows non-linear temporal dynamics. Some panels were used for centuries with different intensities (Tanum 12:1, Tanum 18:1, Tanum 25:1,

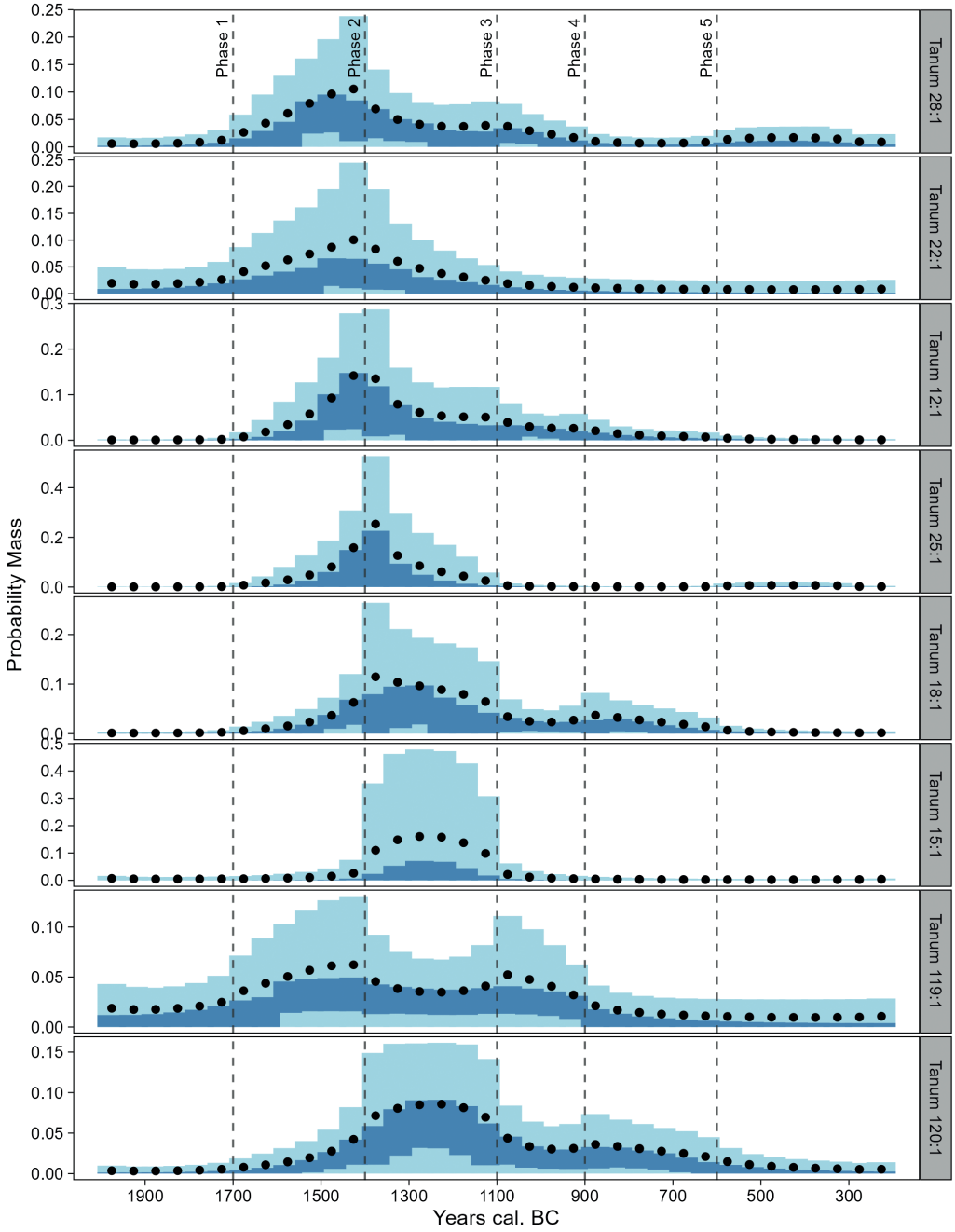


Fig. 4.10. Bayesian aoristic analysis of panels at Aspeberget that include carvings from at least two phases. The analysis uses a non-parametric Random Walk ICAR Model (Crema 2024) to estimate how the likelihood of carving activity changed over time. Results are shown in 50-year intervals.

and Tanum 120:1). Others were carved during only one phase (Tanum 14:1, Tanum 16:1, Tanum 16:2, Tanum 17:1, Tanum 29:1, and Tanum 26:1) or were revisited in two different phases after centuries of inactivity (Tanum 13:1 and Tanum 23:1). Some rocks were carved at the beginning of the Bronze Age and never used again (Tanum 17:1), whereas others were ignored until the Early pre-Roman Iron Age (Tanum 26.1).

Carvers worked on the hill throughout the Bronze Age and Early pre-Roman Iron Age, expanding the number of panels at a steady pace: three new panels in Phase 2, one in Phase 3, two in Phase 4, and two in Phase 5 (Fig. 4.9). These panels were distributed across the hill and placed around the large panels, which remained focal points throughout the period. Although the reasons these new figures were excluded from previous panels will be addressed later (see Chapters 5 and 6), the data suggest that carvers deliberately made these spatial arrangements.

Overall, rock art production rose rapidly in Phase 1 and peaked around the transition between Phase 1 and 2 (*c.* 1400 BC). After this peak, activity decreased sharply in the transition to the Late Bronze Age (*c.* 1100–1000 BC) and remained low throughout the Late Bronze Age and the Early pre-Roman Iron Age. This trajectory aligns with broader regional trends. Tanum, for instance, holds one of the richest collections of Late Neolithic and Early Bronze Age flint daggers and sickles, along with a substantial number of Early Bronze Age bronze objects (Ling 2008, 113–114). However, the higher concentration of bronzes and houses in central Bohuslän during the Late Bronze Age suggests that activity shifted southward as the Bronze Age progressed (Petersson and Toreld 2015, 32).

As with the morphological changes discussed in the previous chapter, these shifts proceeded slowly. At present, Aspeberget depicts 1,211 figures—of which 23 were updated at least once—spanning the five phases defined earlier. If all Phase 1 figures date to the end of that phase (*c.* 1400 BC) and all Phase 5 figures to its beginning (*c.* 600 BC), carving activity would still span at least 800 years; that is, less than two new figures per year on average. Given that Aspeberget was one of the largest rock art areas in the region, annual production across Bohuslän must have also remained low. Even in the most optimistic scenarios—where all figures underwent multiple recarvings—rock art production seems to have been modest and likely connected with special occasions or events (Fahlander 2024, 136).

Discussion

Nordic rock art embodies the work of many Bronze Age carvers. As new carvers joined the tradition, they encountered figures made by their ancestors. This chapter set out to understand how they interacted with these figures and how those interactions were shaped by the social expectations associated with their roles. The results show carvers incorporated new figures into earlier compositions while recarving and updating figures of particular significance. These actions were especially intense until the Late Bronze Age, when rock art production at Aspeberget declined sharply.

Although the next chapters will address the causes of this decline in greater detail (see Chapters 5 and 6), carvers seem to have maintained a historical and cultural bond with their predecessors' work throughout the Bronze Age. These findings support the longstanding view that the temporal development of the panels and the transformation of figures reflect how communities used rock art to engage with their ancestral beliefs and collective memory (Bertilsson 1987, 180–181; Fredell 2003; Ling 2008, 123; Nilsson 2012, 91–92; Goldhahn 2014; Kjeldsen 2017, 98–99; Nyland and Stebergløkken 2021, 13–14; Horn 2022a). And contributes to a wider understanding of ancestral cults in the Bronze Age (*e.g.*, Kristiansen and Larsson 2005, 57; Goldhahn 2007, 285–286; Vandkilde 2013, 170).

This engagement between carvers becomes clear when one sees that most figures were updated in phases other than their initial carving, and that figures with attributes consistent with only one phase rarely show signs of updates or recarvings. This pattern mirrors what we see on bronzes, where figures appear to have remained unchanged after their creation. Considering that figures in both rock art and bronzes underwent minor *short-term* changes, recarvings and updates appear to have been primarily an intergenerational phenomenon. The central question is, therefore, to what extent these long-term changes entailed shifts in the meaning of the figures and, perhaps, in the values associated with the role of carver.

Scholars such as Horn and Potter (2020, 105) and Tilley (2021, 193) have argued that the meanings of the figures were never fixed but shifted as they were transformed and as new figures were added to the panels. However, carvers incorporated new figures into earlier compositions and recarved earlier ones, consciously *maintaining* certain figures and panels of special social significance. The interaction with past figures was therefore an active engagement with ancestral traditions and their capacity to mobilize and reinforce social memory. Although these memories were transmitted orally—and may therefore have gradually lost their connection with the original form and meaning of the carvings (Horn 2022a, 137)—the idea that meaning changed over time seems at odds with the constant maintenance of some figures. Of course, engagement with past figures may have varied from case to case: some figures may have been updated to change their meaning, while others may have been recarved to preserve it. Yet the figures discussed earlier were both recarved *and* updated.

Drawing on the results of this chapter and insights from anthropological studies, I suggest that updates also functioned as acts of maintenance. Ethnographic research shows that art in many traditional societies is deeply rooted in the reproduction of ancestral forms and traditions established by previous artists (Forge 1967; Biebuyck 1969). Because of their ancestral origins, these societies usually form strong emotional bonds with art objects and entrust their creation to specialists who bear responsibility for preserving and reproducing these traditions (Biebuyck 1969; Firth 1992; Gell 1994; Malinowski 2016 [1921]). Their performance is then evaluated by the audience—and sometimes by institutional authorities—according to its technical, magical, traditional, and aesthetic *correctness* (Boas 1927; Linton 1941; Layton 1991; Firth 1992; Malinowski

2016 [1921]). This constant feedback from their audience both limits and empowers these artists. While their creative choices are constrained by the attributes of objects made by their ancestors, they also participate in defining those attributes and may shape the audience's preferences over time (Forge 1967; Layton 1991). Importantly, the changes that artists may introduce to art objects do not necessarily imply a loss of reference to ancestral forms and conventions; in fact, the audience often overlooks such changes when evaluating their conformity to traditional styles (Forge 1967, 119). One explanation for this tolerance is that tradition is anchored more in the social concepts and values evoked by art objects than in their particular design (Forge 1973).

Similarly, rock art could have changed in *form* without losing its connection to the social values that Bronze Age communities intended to transmit to future generations. For example, although some attributes of rock art had to be adjusted to reflect technological changes in the actual objects they depict—such as ships or weapons—these changes did not necessarily affect the social values associated with those objects. However, figures could not change *drastically* if they were meant to preserve links to ancestral forms and styles. Carvers, therefore, seem to have faced a dilemma: adapting old styles to new realities while maintaining certain links to ancestral forms and conventions. At Aspeberget, the absence of obliterations, the selective recarving of particular figures, and the overall engagement with earlier compositions suggest that figures retained their core meaning over long periods of time, even when their formal attributes changed. It was probably *because* some of these figures were updated and recarved that different generations could make their own the rock art made by their ancestors. This flexibility in evaluating the conformity of the carvings to traditional canons may have provided the role of carver with both the stability and resilience needed to endure for centuries (see also Chapter 7).

This flexibility seems to have been partially driven by the rock's material properties. By preserving figures for centuries, the rock "forced" successive generations of carvers to engage with them (Nilsson 2015, 125). In this regard, the rock exerted a double, almost contradictory, effect. On the one hand, it offered durable material that carvers could use to materialize and preserve ancestral traditions; on the other, it preserved old forms and styles that eventually demanded reinterpretation and transformation. As Díaz-Guardamino (2021, 100–102) has argued, artists did not necessarily seek the durability of the rock when choosing the support for their images. Given that Scandinavian visual culture was expressed in a wide range of perishable and nonperishable materials—each with its own stylistic rules (Bradley 2015)—the durability of rock does not seem to have been a decisive factor for carvers when creating rock art. Nonetheless, unlike other materials, the granite in Bohuslän is hard and has degraded very little over time, enabling dozens of generations of carvers to interact with the same surfaces (Chapter 5). By contrast, most bronze objects produced during the Early Bronze Age did not circulate during the Late Bronze Age, and once deposited in graves, the figures depicted on them were out of sight after a generation or so. Similarly, while the graves themselves became permanent landmarks in the

landscape, the figures carved inside some of them remained typically inaccessible for generations to come (*cf.* Goldhahn 2007, 245). I argue that, intentionally or not, the rocks reinforced the ancestral tradition more effectively and continuously than other media.

Furthermore, being made of an immovable, durable material, rock art also rooted the tradition in the territory (Cruz Berrocal and Gárate 2025, 64). The longevity of the figures not only "forced" the carvers to interact with past figures but also compelled them to return to the same places. Whether intentionally or not, rock art turned the landscape into a social setting for recurrent practice. This repeated practice increased the number of figures in these spaces, thereby amplifying the impetus to return and carve more figures (see also Chapter 6). However, this interpretation seems at odds with the temporal evolution of Aspeberget. Although some figures were carved on the hill during the Late Bronze Age and Early pre-Roman Iron Age, the activity was drastically lower than at other nearby clusters of panels, such as Bro Utmark, Lövåsen, or Kalleby. In other words, if the maintenance of ancestral traditions was indeed a central component of rock carving practices, why was a site as important as Aspeberget only sporadically revisited by Late Bronze Age carvers? The next chapter explores this question by examining why Aspeberget and its rocks were originally selected as carving places.

Chapter 5

First the rock, then the art

Chapter 4 showed that carvers maintained ancestral traditions linked to rock art by reworking figures and preserving earlier compositions. But the marked decline of rock art activity at Aspeberget during the Late Bronze Age raises the question of why a place that had been actively used and maintained for centuries was eventually relegated. To understand this shift, we must first consider why the hill was originally chosen. With that aim, this chapter examines the topographical and geological characteristics of the panels at Aspeberget and the hill's position in the landscape. This analysis clarifies the type of knowledge carvers needed to conduct their work and the criteria they followed when selecting rocks.

Introduction

Rock art has often been linked to the marking of places of special significance. For example, scholars have argued that rock art places were chosen for their topographical features mimicking the broader landscape (*e.g.*, Nash 2002), their location along transit routes (*e.g.*, Bradley 1997), their proximity to valuable resources (*e.g.*, Bradley *et al.* 1994), or their physical and visual association with landscape features (*e.g.*, Whitley 2024). Ethnographic work likewise shows that many Indigenous societies valued rock art sites as much as the images themselves, with certain panels regarded as portals to the supernatural realm (Taçon and Ouzman 2004, 39–42; Whitley 2024, 6). These perceptions contributed to a strong integration of rock art within what Whitley (2024) has termed the "ritual landscape": an ontological view that distributes ritual power across distinct landscape features.

Similarly, many Scandinavian scholars argue that rock art panels embodied animacy or magical power that carvers engaged with (*e.g.*, Goldhahn 2010, 109–110; Lahelma 2010, 52; Lødøen 2010, 37, 2015; Bertilsson 2015a, 82; Fahlander 2021, 311; Tilley 2021, 9). Such a magical connection with the rocks would be unsurprising, given that Scandinavian societies in the Late Iron Age believed that spirits inhabited certain rocks (Price and Raffield 2024, 77). However, what specific features led the carvers to choose some rocks over others remains unclear.

Scholars have proposed a wide range of factors to explain the spatial position of the panels, many of which are discussed in more detail in the sections below. Briefly put,

examples include *rock properties* such as shape, smoothness, quality, fractures, or slope (*e.g.*, Coles 2000; Nordenborg Myhre 2004; Gjerde 2006; Ranta *et al.* 2019; Horn and Potter 2020); associations with *natural elements* such as water (*e.g.*, Ling 2008) and the sun (*e.g.*, Hernandez Monfort 2020); connections with other *anthropic features* such as settlements (*e.g.*, Bertilsson 1987), metal workshops (*e.g.*, Melheim 2018), or graves (*e.g.*, Goldhahn 2012); and their *link to previous panels*, with which they created narrative sequences and associations (*e.g.*, Tilley 2021).

These features, however, have rarely been examined with quantitative methods, and comparative analyses between panels remain limited. As a result, we still lack a clear understanding of why carvers chose Aspeberget to make rock art and why they placed figures on specific rock surfaces. This gap is especially evident in the geological characterization of the panels. While some studies in heritage conservation have analyzed rock surfaces to assess weathering (*e.g.*, Walderhaug and Walderhaug 1998; Swantesson 2005), no comprehensive geological analyses have yet studied the *internal* properties of Bohus granite and considered how these properties may have influenced the selection of carving surfaces. Recent spatial analyses in central Sweden suggest that carvers preferred particular rock types (Löfstedt and Löwenborg 2025), but comparable studies are lacking for the geology of Bohuslän. Similarly, although topographic and landscape features are frequently discussed, they have rarely been subjected to systematic analysis using digital technologies—Stamnes and Steberglokken (2020) and Horn and colleagues (2023) being notable exceptions.

This chapter addresses this gap by combining a geological characterization of the rocks with a spatial analysis of the 27 panels documented at Aspeberget (see supplementary information for technical details). The geological analysis was conducted by members of the project "Tracing Carvers on the Rocks" (DIGARV 2020-03817), which investigates the relationship between geological features and carving activity by examining Bohus granite and its near-surface structure with non-destructive ultrasonic sound-wave techniques (Liebl *et al.* 2023). The spatial analysis draws in part on the multi-scalar approaches developed for Atlantic rock art (Valdez-Tullett 2019; Barnett *et al.* 2024) and evaluates several factors potentially related to rock art placement: panel size, figure dispersion, rock slope, rock orientation, rock shape, and water flow (ArcGIS Pro v3.1+).

Panel size was calculated as the area of its convex hull: the smallest polygon without corners bent inwards that encloses all figures on the panel. Figure dispersion was measured as the standard distance: the degree to which features are concentrated or dispersed around the geometric mean center. Rock slope and orientation were calculated as the incline of a surface relative to the horizontal and as the compass direction or azimuth faced by the rock. Rock shape was estimated using the vector ruggedness measurement, which captures variation in the three-dimensional orientation of grid cells within a neighborhood. Finally, water flow was modeled using the topographic wetness index, which estimates where water accumulates in an area with elevation differences as a function of slope and the upstream contributing area.

Additionally, the position of Aspeberget within the landscape was analyzed by checking shoreline changes in the area. The paleoshoreline reconstruction was produced by Ashely Green (University of Gothenburg) in ArcGIS Pro (v3.1+) using elevation data from Lantmäteriet and shore displacement estimates from Sveriges geologiska undersökning (after Påsse and Daniels 2015). Local corrections were made using shoreline models specific to Bohuslän (Berntsson 2006; Ling 2008, 47–57).

Finally, the visual prominence of Aspeberget was assessed using four viewshed analyses: cumulative, inverse, fuzzy, and total (ArcGIS Pro v3.1+ and QGIS v3.42.1). A viewshed determines which locations in a digital elevation model (DEM) can be connected to a viewpoint by an uninterrupted straight line within a specified distance. The analysis considers the position of an observer at a given height and the surface altitudes provided by the DEM. When the viewshed is calculated from the terrain towards the target location, the analysis is commonly known as inverse viewshed. A cumulative viewshed combines several viewshed maps from various viewpoints, indicating how many viewpoints can be seen from or are seen at each location (Llobera 2003). Fuzzy viewsheds incorporate distance-decay functions to model how visible each cell is under specific environmental conditions or depending on the physical characteristics of the target feature (Fisher 1994). Finally, a total viewshed follows the logic of cumulative viewsheds, but it calculates visibility from all locations to all others, producing a map that highlights the most visible areas of the landscape (Cuckovic 2016).

The chapter presents the results on three scales of analysis. First, it summarizes the findings of geological analyses and reflects on their potential social implications for carvers' technical knowledge. Second, it analyzes several topographic features of the panels to discern which factors influenced the selection of specific locations on the hill. Finally, it examines the relationship between Aspeberget and the wider landscape, focusing on its connection to the shoreline and its visibility from surrounding areas.

The geology of the rocks

In discussing which rock properties influenced where carvers placed rock art, some researchers argued that the chosen surfaces stood out for their smoothness and overall quality (Coles 2000, 12; Tilley 2021, 90, 190). To assert this, however, we must first consider their geological properties and the constraints they imposed on carving (Liebl *et al.* 2023).

Rock art figures in Bohuslän were carved on Bohus granite, a granite formation that stretches along the northern coast of southwestern Sweden (Fig. 5.1). This granite formed around 925 million years ago, toward the end of a major geological event known as the Sveconorwegian orogeny (Eliasson *et al.* 2003; Müller *et al.* 2017; Rosing-Schow *et al.* 2023). It is mainly composed of quartz, k-feldspar, and plagioclase, with varying amounts of biotite and muscovite. This mineral composition and its uniform magmatic

structure give Bohus granite its notable mechanical strength (Åkesson *et al.* 2004; Dumoulin *et al.* 2024). However, repeated magma surges produced variation in composition, texture, and color across the region (Eliasson *et al.* 2003).

The granite surface visible today was mainly shaped by glacial movement. As ice sheets advanced and retreated, they polished the surface and triggered pressure fluctuations that created stress-induced fractures (Grämiger *et al.* 2017). Fractures are common in granite and, in combination with physical and chemical weathering (Swantesson 2005), can make the rock more vulnerable to weathering. However, granite in cold climates erodes slowly. Studies of Bohus granite show that weathering has removed at most a few centimeters from the surface (Swantesson 1992, 2005), and many panels still preserve their original glacially polished surfaces, which appear to have protected them from significant degradation (Siman-Tov *et al.* 2017; Blackburn *et al.* 2019). Thus, the surfaces used by Bronze Age carvers have undergone only *minor* alterations to date.

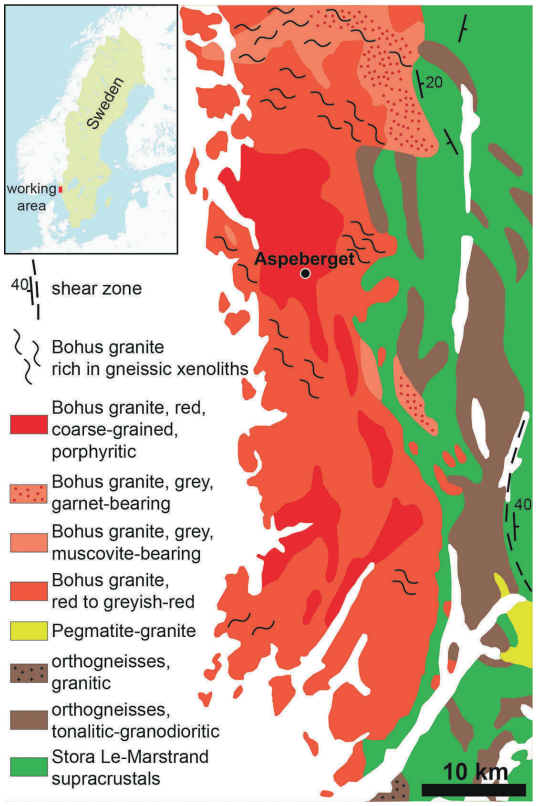


Fig. 5.1. Geological map of dominant rock types in Bohuslän with the location of Aspeberget indicated.

Our experiments on Bohus granite show that carving was facilitated by weakened superficial layers present in *some* rocks. These layers were caused by synglacial stress relief and, to a lesser extent, postglacial weathering (Liebl *et al.* 2023, 121–122). Sound-wave measurements suggest that the first weakened layer typically extends eight to nine millimeters below the surface, although sometimes—such as in Kville 157:1—it reaches about 11 millimeters. All rocks examined in this study contain such layers, and none of the figures carved on the analyzed panels exceed their depth, which suggests they were essential for carving. But since nothing on the rock surface reveals their location, carvers could not have determined where these layers were by observing the surface alone.

Sound-wave profiles also show that these weakened layers varied *within* panels. At Kville 157:1, for example, one profile differed from the others by one to two millimeters. Notably, this profile came from an area with no carved figures, suggesting that certain parts of the panels lacked the geological conditions needed for carving.

This finding matches experimental results showing that carving may be easy in one spot yet become much more difficult just a few centimeters away (Liebl *et al.* 2023, 123). Together, these observations show that geological constraints may have influenced panel compositions more than previously assumed.

Although geological properties mattered when selecting rocks to carve, not all surfaces with weakened layers were used, and among those that were, the number of carvings varied greatly. Consider, for example, Tanum 15:1 and Tanum 12:1. Tanum 15:1 depicts four ships from Phase 2. During the same phase, Tanum 12:1 offered ample rock with suitable geological properties to accommodate these ships (as evidenced by figures from Phases 3, 4, and 5 later carved on the panel). Instead of using this available space, carvers placed the ships on a small panel with no clear geological advantage. Unless new tools suddenly enabled carving in areas that old tools could not penetrate, the choice and temporal development of panels cannot be explained *solely* by geological factors (see also Chapters 6 and 7). In other words, carvers did not exhaust all workable parts of a panel before moving to new rocks (see also Chapter 4). This raises a key question: *among* panels with favorable geological conditions, which features did carvers prioritize? The following sections explore this question.

The topography of the panels

Beyond geology, scholars have proposed several factors influencing the placement of figures (see below). Yet among the variables examined at Aspeberget—namely rock size, figure dispersion, roughness, slope, orientation, directionality, and wetness—only wetness seems to predict where carvers placed rock art.

Rocks differ greatly in size. Panels such as Tanum 12:1, Tanum 25:1, Tanum 120:1, or Tanum 18:1 are between 70 and 120 times larger than the smallest figurative panels on the hill. These large panels are not confined to specific areas of the hill or limited to rocks of a particular size. Both large and small panels appear across the hill, and the number of figures depicted does not seem to correlate with the amount of surface available. This becomes clear when comparing Tanum 18:1 and Tanum 19:1. Although the rocks lie only 15 meters apart and share similar size and external characteristics, Tanum 18:1 depicts nearly eight times more figures than Tanum 19:1. Unless Tanum 19:1 has severe geological constraints, rock size does not seem to have been a critical factor in its selection.

Since rock size in this study is measured by the convex hull of each panel (see above), both the number of figures and their spatial spread influence this measure. While the figures tend to cluster within panels, their dispersion varies across panels and is uncorrelated with the number of figures depicted. For instance, Tanum 12:1 has the greatest dispersion, despite being the second-largest panel on the hill.

If not for their size, rocks might have been chosen for their visual features. Some scholars have noted that figures were sometimes placed in relation to geological features such as cracks or depressions (*e.g.*, Coles 2000, 21–23; Bengtsson 2004, 125;

Nordenborg Myhre 2004; Bengtsson and Ling 2007, 47–48)—features that could help divide the panels and create pictorial compositions (Coles 2000, 79–82; Tilley 2021, 90). At Aspeberget, however, only Tanum 120:1 and Tanum 18:1 exhibit natural fractures that subdivide the surface into distinct sections. These sections depict similar but not identical compositions, with some figures appearing more frequently in certain sections. For example, spirals cluster in the upper section of Tanum 18:1, while animals and wheeled transport concentrate in the upper sections of Tanum 120:1. Yet these differences are not pronounced enough to treat each section as an independent pictorial unit. Therefore, fractures do not appear to have been sought for compositional purposes. In fact, these are the only two panels where such a division would even be possible. Other fractured panels, such as Tanum 25:1 and Tanum 28:1, show no clear relationship between figures and the divisions created by these fractures. And Tanum 12:1—the most complex panel on the hill—lacks both fractures and depressions.

Alternatively, carvers may have selected rocks for their shape (Lødøen 2010, 38), using them to create miniature landscapes (see Horn *et al.* 2026). Although some panels at Aspeberget might be interpreted in this way, rock shape cannot predict figure placement. The roughness of panels varies little regardless of their size and appears to be connected to the general topography of the hill (Fig. 5.2a). Since the northern part of the hill is rougher, panels such as Tanum 14:1, Tanum 120:1, or Tanum 12:1 have a high roughness index. In panels like Tanum 120:1 or Tanum 12:1 (Fig. 5.10), rock shape may have influenced their selection but was not always crucial, given that other major panels, such as Tanum 18:1, are essentially flat. Although carvers may have produced miniature landscapes only on specific rocks, the analysis shows that rock shape cannot be considered a *general* explanatory factor for figure placement.

In another line of interpretation, Coles (2000, 79) argued that carvers prioritized inclined rocks that facilitated bottom-up viewing. At Aspeberget, however, slope does not predict panel location. Some figures were indeed carved on very steep surfaces—for example, Tanum 84:1 or Tanum 120:1—but the variation between panels seems to be associated with the rougher topography of the northern part of the hill (Fig. 5.2b). The presence of figures on very steep rocks shows that carvers did not avoid difficult locations. At Tanum 120:1, for example, the lack of a stable working surface would have made carving challenging and likely required equipment such as scaffolding or ropes. Yet large panels with low slopes, such as Tanum 25:1 or Tanum 28:1, demonstrate that they did not actively seek steep surfaces either.

The direction of the slope matters when assessing whether panels were deliberately oriented towards natural elements such as the sun. Since figures become more visible under certain lighting conditions, some scholars suggested that carvers chose locations based on the amount, intensity, and direction of sunlight (*e.g.*, Coles 2005, 9; Sognnes 2008, 236; Nyland and Stebergløkken 2021). And echoing a long-standing tradition that has viewed rock art as an expression of sun cosmology (*e.g.*, Kaul 1998; Helskog 1999; Kristiansen 2012), Hernandez Monfort (2020, 32, 56) proposed that

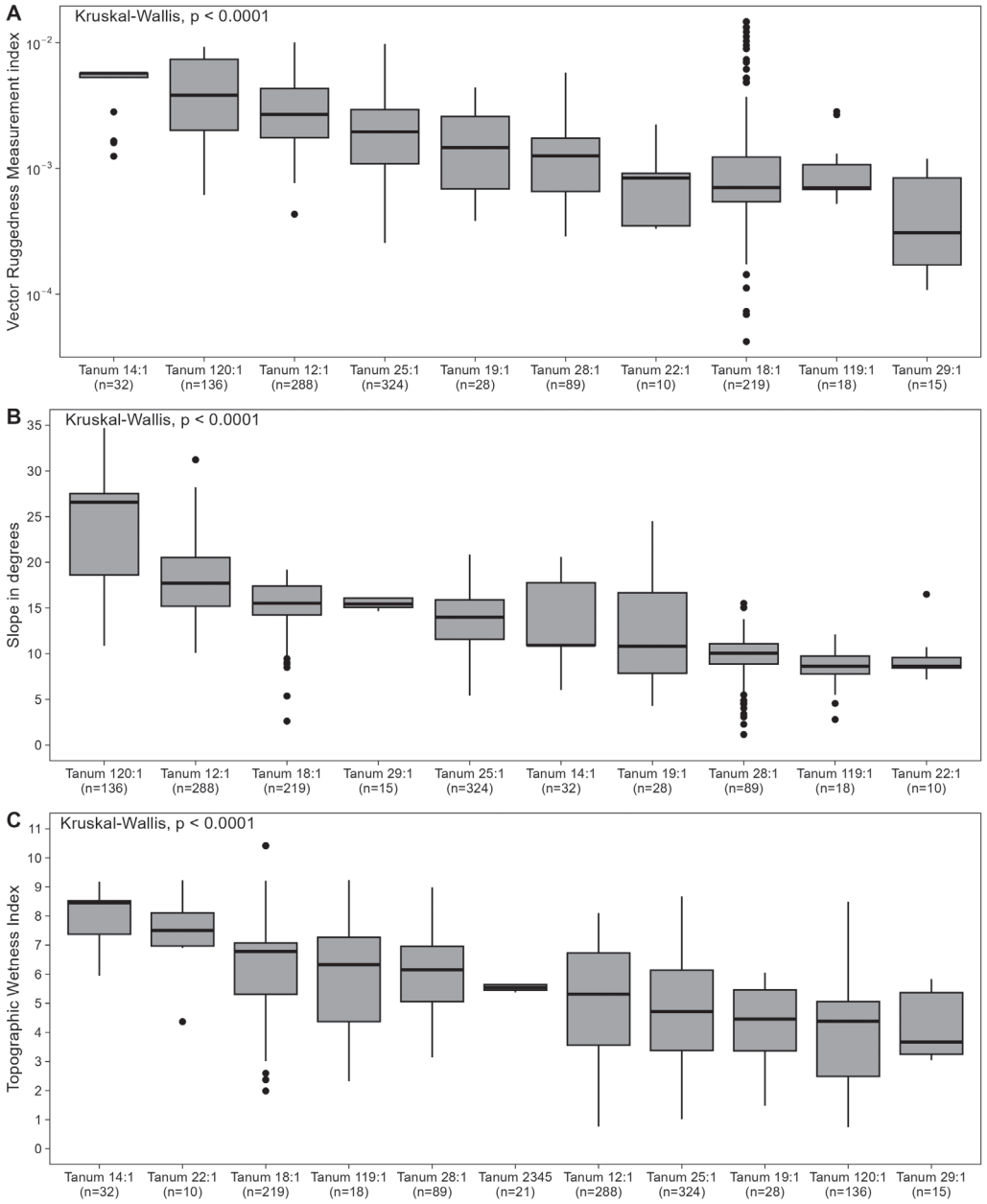


Fig. 5.2. Exploration of three topographic metrics at Aspeberget: A) Vector Ruggedness Measurement Index, B) slope, and C) Topographic Wetness Index.

figures at Aspeberget were oriented towards sunrise or sunset (see also Bertilsson 2015a, 86). While most figures at Aspeberget face the east quadrant (where the sun rises), their orientation—understood as the general trajectory of a figure towards a hypothetical viewer—varies widely: from a median of 24 degrees on Tanum 12:1 to 152 degrees on Tanum 119:2 (Fig 5.3). Moreover, the *directionality* of the figures—that is, the general trajectory of a figure based on its own attributes (for instance, the direction a ship sails or the direction a human figure faces)—is usually perpendicular

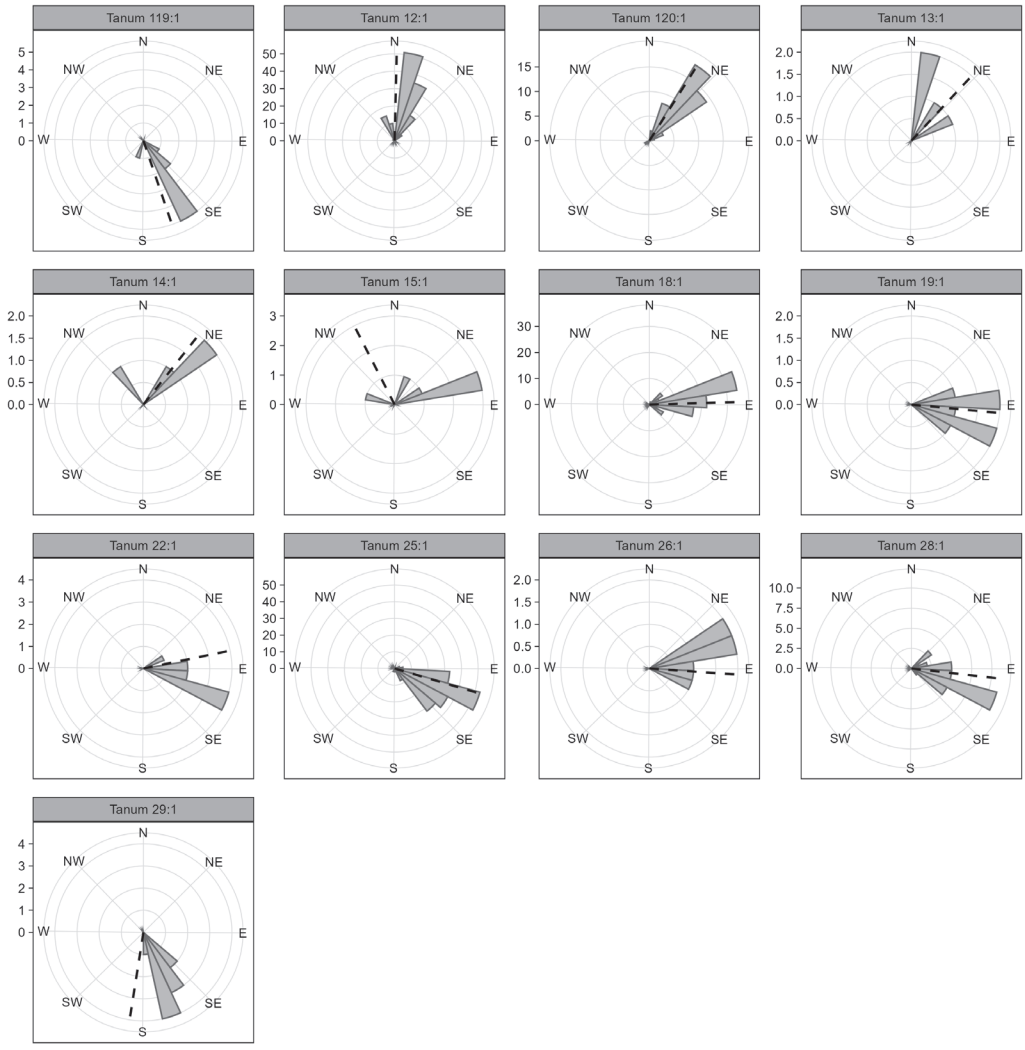


Fig. 5.3. Frequency distribution of figure orientations by panel. Orientation describes the general trajectory of a figure relative to a hypothetical viewer's position. The dashed black line indicates the average slope orientation of the rock.

to the orientation of the rock surface, pointing left or right across the panel (Fig. 5.4). This suggests that it responds more to internal relationships between figures than to external references (*cf.* Rédei *et al.* 2020; Skoglund *et al.* 2022). Since figures typically follow the natural orientation of the rock surface (expressed as the median slope orientation of the panel), and these surfaces often face natural pathways and bodies of water, carvers seem to have oriented figures towards these landscape features rather than the sun.

The orientation towards water aligns with a widely accepted view that Bronze Age figurative rock art was closely associated with the shoreline and other bodies of water (Ling 2008, 2013; Nimura 2016; Nimura *et al.* 2020). This association was reflected not only in the obvious maritime theme of many panels but also in maritime ritual practices. For example, scholars have proposed that cavers created figures when launching boats (Ling 2008, 226), that they placed figures at the water's edge so they could be ritually washed by the waves (Helskog 1999, 73; Kjeldsen 2017, 97; Fahlander 2021, 314), that they carved certain figures to prevent the retreatment of the coast

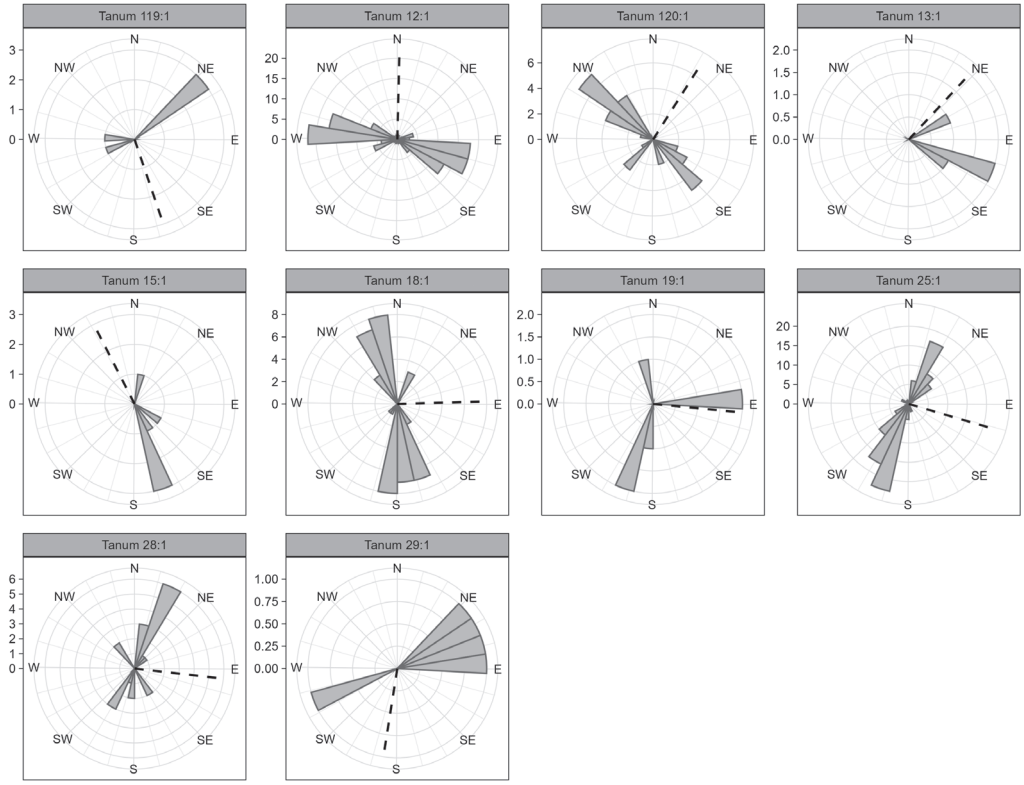


Fig. 5.4. Frequency distribution of figure directionalities by panel. Directionality captures the general trajectory of a figure based on its own attributes. The dashed black line indicates the average slope orientation of the rock.

(Nimura 2016, 123), that they created large figures as a magical action to counter the increasing distance to the shoreline caused by land uplift (Fahlander 2019, 64–65), or that they used the panels as liminal agents in the land–sea interface of the landscape (Westerdahl 2006, 26).

Water has also been associated with the rocks themselves, as some scholars observed a spatial association between figures and the dark discoloration of micro-vegetation caused by constant water flowing over the rock surface (Brunius 1868). Later research has also noted the association between figures and areas of the rock where puddles form or water flows (Bradley *et al.* 2002; *e.g.*, Hauptman Wahlgren 2002, 45; Bengtsson 2004, 36; Nordenborg Myhre 2004; Coles 2005, 84; Horn *et al.* 2023). These areas of the rock were probably sought to associate figures with water, but perhaps also for the sounds produced by flowing water (*cf.* Goldhahn 2002; Tilley 2021, 160), the textures generated as water moves across the surface (Bradley *et al.* 2002; Tilley 2021), or because running water made the panel resemble real landscapes (Horn *et al.* 2026).

Horn and colleagues (2023) have recently tested this phenomenon through a quantitative spatial analysis of five panels in Bohuslän, revealing a strong association between the positions of the figures—especially ships—and the water flows that appear on the panels after rainfall or ice melt. Their findings align with the results of my study, which show a clear association between panel locations and the places where water naturally drains *on the hill* (Fig. 5.5). This association is especially strong on panels like Tanum 14:1 or Tanum 22:1, and most panels lie in areas where water flows more intensively (Fig. 5.2c). In other words, carvers seem to have deliberately positioned figures in relation to natural water flows.

The position and direction of these water flows depend on the rocks' slope and morphology. If carvers had chosen areas with specific shapes and slopes that incidentally placed figures on water, the association would be spurious. However, earlier analyses show that neither slope nor topography determined panel placement. Another possibility is that water erosion softened certain areas, making them easier to carve. Yet water cannot alter the internal structure of Bohus granite in ways that would facilitate carving (Peternell and Liebl, personal communication). Finally, constant water flow could have polished certain surfaces, making them visually appealing, and carvers may have been drawn to these polished zones rather than to the water itself. While this may account for some cases—for example, on Tanum 14:1—many figures in Bohuslän were carved *beside* and *facing* water flows (Horn and Potter 2020, 101–102). Taken together, these observations suggest that carvers deliberately sought water flows when deciding where to place figures.

In summary, carvers considered several factors when selecting places to carve. After assessing the geological properties of the rocks, they seem to have prioritized rocks with water. Yet water flowed over many rocks across the region, and panels clustered in specific areas of the landscape. This pattern suggests that what mattered was not just the rock itself but also its surroundings, an issue that will be explored in the next section.

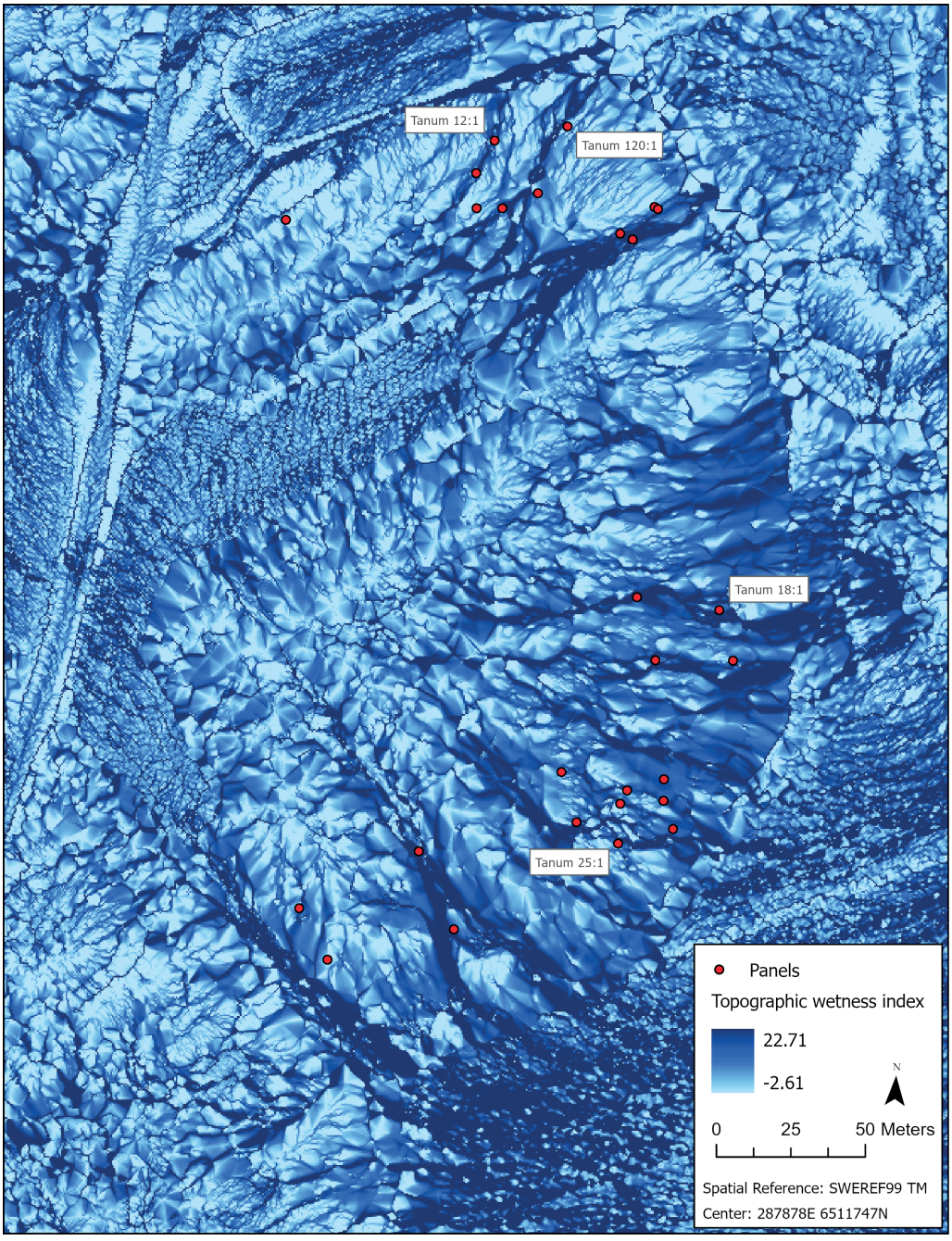


Fig. 5.5. Location of panels in relation to parts of the hill that are more likely to generate water streams. Computed in ArcGIS Pro (v3.1+) using the Topographic Wetness Index on elevation data from Lantmäteriet (lidar, 0.5 meters).

The surrounding landscape

Tanum is characterized by fissure valleys, open plains, and natural passages. Several small rivers descend from the surrounding highlands and converge on the Tanum plain, a broad lowland that formed part of a fjord during the Bronze Age (Ling 2008, 112–114). Aspeberget stood along the shores of this fjord. This section briefly examines Aspeberget's position within the broader landscape, and it considers whether its selection as a rock art site is related to other forms of human activity in the area.

Some scholars have linked the location of rock art to its proximity to settlements, metal workshops, and graves. The relationship between panels and settlements remains debated (*cf.* Bertilsson 1987; Ling 2008). Although figurative rock art and settlements occasionally appear in the same areas in Bohuslän (Petersson and Toreld 2015), settlement sites are scarce and tend to lie outside of the areas with the highest concentrations of figurative rock art (Vogt 2006, 131–148; Ling 2008, 154). Metal workshops are also rare in Bohuslän (Vogt 2006, 150–151), and unlike in other parts of Scandinavia (Goldhahn 2007; Melheim 2018), they show no consistent association with rock art sites. Moreover, despite the substantial number of Early Bronze Age bronze items recovered in Tanum (Ling 2008, 223), the correlation between rock art and metal finds is negative (Horn 2022b, 8). Burials have also been frequently associated with rock art placement (Bertilsson 1987, 180–181; Goldhahn 2007, 243–246; Ling 2008, 225–226), leading some researchers to suggest that certain figures were carved in connection with funerary ceremonies (Goldhahn 2012, 225). Yet some parts of Bohuslän lack this association altogether (Petersson and Toreld 2015, 46).

The geographical position of Aspeberget does not appear to relate to any of these features. The settlements that can be securely dated to the Bronze Age are not spatially associated with the hill, metal workshops are absent in the area, and although the area surrounding Aspeberget features many cairns—likely dating to the Bronze Age and the Early pre-Roman Iron Age—nothing suggests they played a role in the position of rock art (see Fig. 5.9 below). The burial field on the top of Aspeberget may date to the Early pre-Roman Iron Age (*cf.* Bertilsson 1987, 108, 138), much later than the first figures carved on the hill. Thus, as far as Aspeberget is concerned, the panels do not seem to have been placed with graves in mind. If anything, the burials may have been placed there because rock art panels already marked the hill as a meaningful place.

Other scholars have proposed that panels were carved alongside pathway networks (Coles 2005, 84; Ling 2008, 240; Petersson and Toreld 2015, 40–42; Tilley 2021, 190) or agropastoral routes (Toreld 2016, 73). Yet it seems unlikely that Aspeberget was chosen because it lay in a *natural* transit zone. During the Bronze Age, the hill was on a peninsula entering the fjord mentioned above. Anyone approaching on foot would have had to pass the inlet leading north toward Vitlycke, then walk south to reach the hill. Reaching it by sea would have required sailing into the winding fjord and maneuvering around dozens of small islands. This held for most of the Bronze Age. Only toward the end of the period and into the Early pre-Roman Iron Age would the

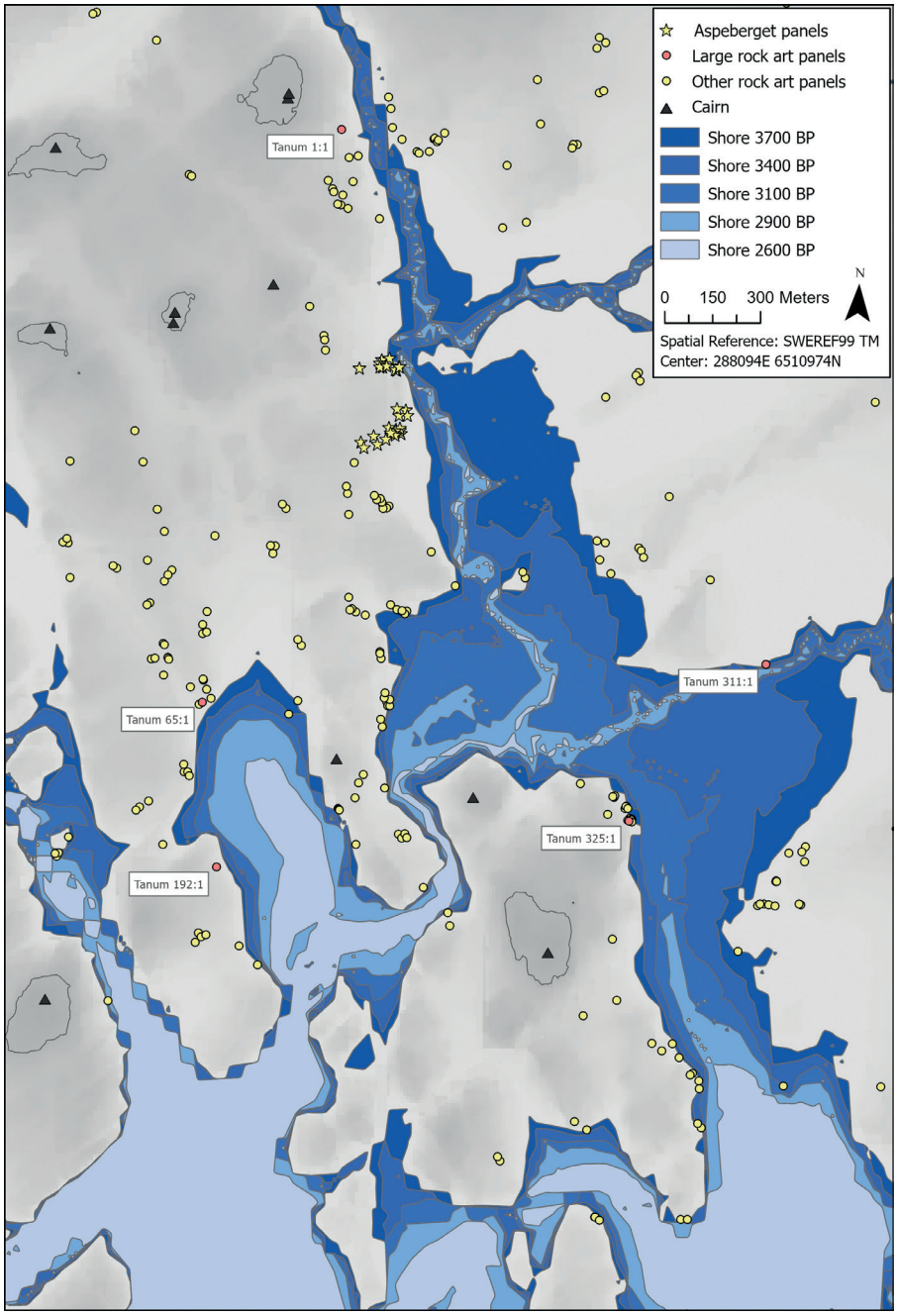


Fig. 5.6. Shoreline displacement throughout the Bronze Age around Aspeberget. Paleoshorelines estimated by Ashely Green (GU) in ArcGIS Pro (v3.1+) using elevation data from Lantmäteriet and shore displacement values provided by Sveriges geologiska undersökning (after Påsse and Daniels 2015). Corrections made with local models (Berntsson 2006; Ling 2008).

receding shoreline have made access on foot easier. Even so, nothing suggests that Aspeberget was chosen because of its location along natural pathways.

Rather than for its position along routes, Aspeberget seems to have been chosen for its strong and enduring connection to the Tanum fjord. During Phase 1—when the shoreline was about 17 meters higher—panels such as Tanum 120:1, Tanum 17:1, or Tanum 18:1 stood only 30 meters away from the water (Ling 2008, 120). This suggests that the shore was a key factor in selecting the hill as a carving site. While it is difficult to determine whether the figures were created as part of the economic and ritual practices that took place along the coast during the Bronze Age (Ling *et al*. 2020, 2024b; Skoglund *et al*. 2025), the fjord clearly shaped the activities performed at Aspeberget. Shoreline changes, however, modified the relative position of the panels as the sea gradually receded (Fig. 5.6). This gradual shift was likely imperceptible within a single generation. Still, if rock art making relied on the knowledge carvers transmitted across generations, the criteria guiding the selection of new locations must have been adjusted to the new landscape (*cf.* Nimura 2016, 122–126).

These shoreline changes likely influenced carving activity during the Late Bronze Age. By Phase 4, Aspeberget was no longer located directly on the edge of the fjord but instead overlooked what was probably a river or stream flowing southward. Although the sea remained a prominent feature in the area and many rock art sites continued to be used, the receding shoreline probably diminished the strategic value of Aspeberget for maritime activities. This shift correlates with a sharp decline in the number of figures carved on the hill during the Late Bronze Age, as well as in panels such as Tanum 1:1, further north (Chapter 4). In both cases, the receding shoreline reduced the size and depth of the inlet that connected these sites more directly to the sea during the Early Bronze Age.

This loss of direct access to the sea may help explain a broader shift in rock art production in the area over the Late Bronze Age. As Aspeberget lost prominence, other panels located further south remained close to the sea and reached their peak of activity (Fig. 5.6). Notable examples are Tanum 65:1, Tanum 192:1, Tanum 311:1, and Tanum 325:1. This pattern suggests that rock art activity shifted southward when the coastline retreated, relegating sites such as Aspeberget to a secondary role. This interpretation makes sense if the physical connection of panels to water was ritually important (Helskog 1999, 73; Kjeldsen 2017, 97; Fahlander 2021, 314), or if they were located close to boat-launching and landing sites (Ling *et al.* 2024b). In the latter scenario, a reduced draft due to a drop in sea level could have affected the navigability in the inlet, making Aspeberget less accessible by boat. Although testing this hypothesis falls beyond the scope of this study, it merits further investigation.

The visual properties of the figures

Although most scholars accept that rock art making was intimately connected to the landscape, it remains unclear whether carvers designed and placed figures for people

transiting such landscapes. Some argued that the layout of the figures suggests panels were designed for an audience (Nordbladh 1978, 205–209; Coles 2011, 12; Ranta *et al.* 2019, 6). But given the low slope of many rocks and the shallowness of the figures, others contended panels would hardly have functioned as communicative media for large groups (Ling 2008, 156), and that carvings may have been experienced through touch and near vision (Lahelma 2010; Skoglund *et al.* 2020).

Unfortunately, these studies did not analyze the visual properties of Nordic Bronze Age rock art with quantitative methods (*cf.* Horn 2022b, 17). To assess whether visibility influenced figure placement, this section considers three scenarios: a) that carvers positioned figures on rocks visible from the surroundings; b) that Aspeberget itself functioned as a prominent visual landmark in the area; and c) that carvers chose areas of the hill offering panoramic views of the landscape.

To evaluate whether the figures were placed in visible parts of the hill, I tested their visibility to an approaching viewer at Tanum 1:1 and Foss 6:1—two panels with enough open surroundings to make the scenario realistic. The figures on Tanum 1:1 are painted red, and those on Foss 6:1 are unusually deep, providing a good approximation of how visible carvings were when freshly made. Under optimal weather, the figures were recognizable from about 50 meters, and finer details became discernible at around ten meters. In other words, the details of the figures (those more relevant for a potential audience) would have been visible only when standing directly in front of the panels. This shows that the figures had little visual impact beyond the hill itself, and that large and steep panels such as Tanum 120:1 and Tanum 12:1 were not chosen to enhance the visibility of the carvings (Fig. 5.7a and 5.7b). Since fresh carvings remained visible for several years, they could have helped carvers to refind and recarve them, but they hardly served as landscape landmarks to guide people traveling through the area. Moreover, the figures would have been visible primarily to people approaching the hill from the fjord and would have remained hidden for those arriving on foot from the northwest. This situation changed only in the Late Bronze Age, when the receding shoreline made land access from the east possible. By that time, however, the production of rock art in Aspeberget had declined significantly (Chapter 4).

Given the figures' limited visibility to an approaching viewer, Aspeberget may have been chosen for the visual prominence of the hill itself. Rising about 40 meters, the hill is clearly noticeable when it is approached from the north or south-southeast, but far less so from the northwest or southwest. Total viewshed analysis shows that Aspeberget was among the most visible zones around the fjord, but not significantly more visible than other nearby hills (Fig. 5.8). Furthermore, large and complex panels like Tanum 1:1 lay on low and flat rocks outside of these highly visible areas, proving that rock art was not necessarily placed on prominent landmarks.

While neither the figures nor the hill functioned as visual landmarks in the landscape, Aspeberget could at least have offered a panoramic view over the Tanum plain, which during the Early Bronze Age—when carving activity peaked—was

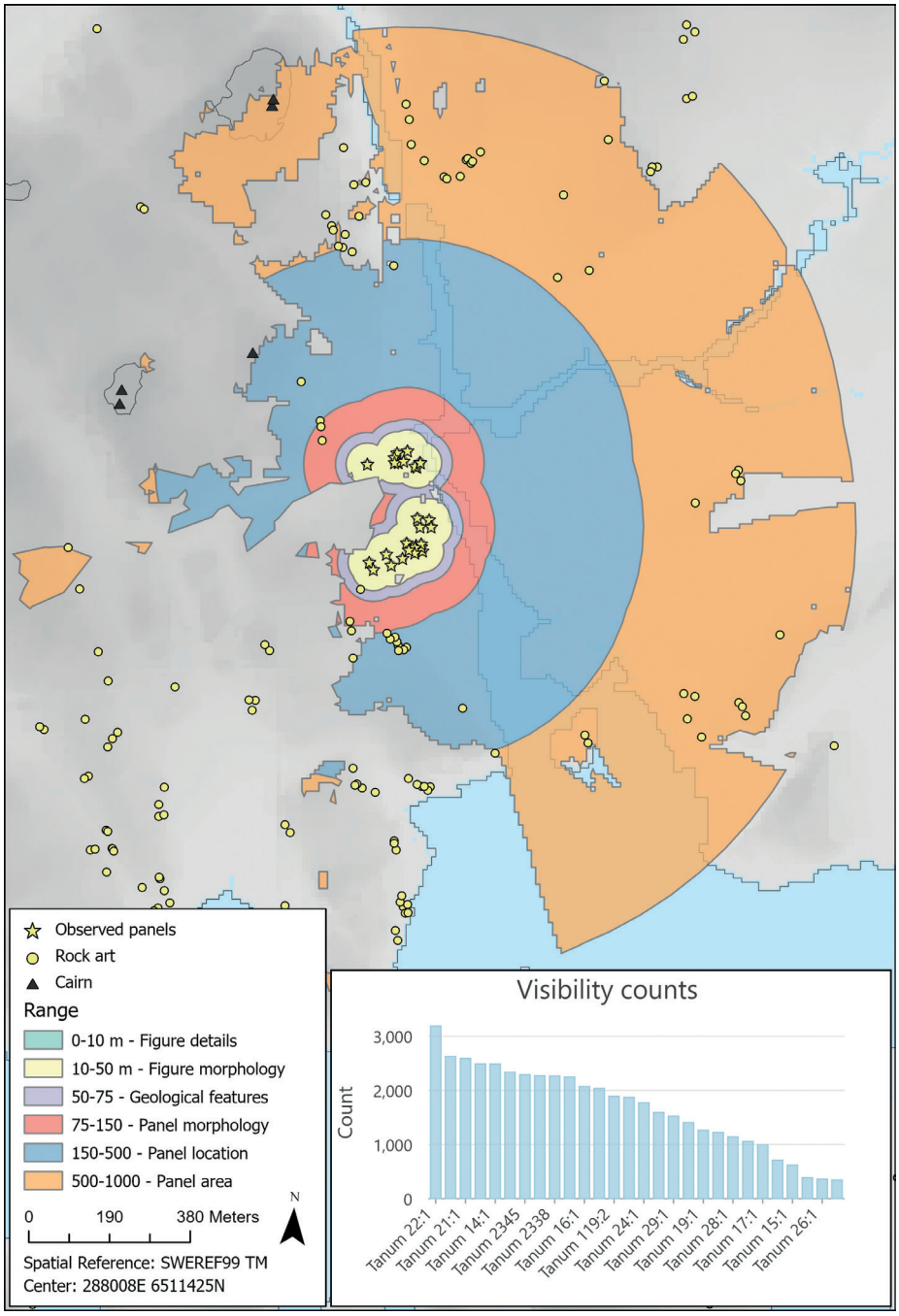


Fig. 5.7. Inverse fuzzy viewshed for observers approaching Aspeberget. Colors indicate the figures' visual properties as observers approach the hill. Viewshed computed in ArcGIS Pro (v3.1+) using elevation data from Lantmäteriet (lidar, 5 meters). Paleoshoreline estimated for c. 3400 BP (Ashely Green, GU).

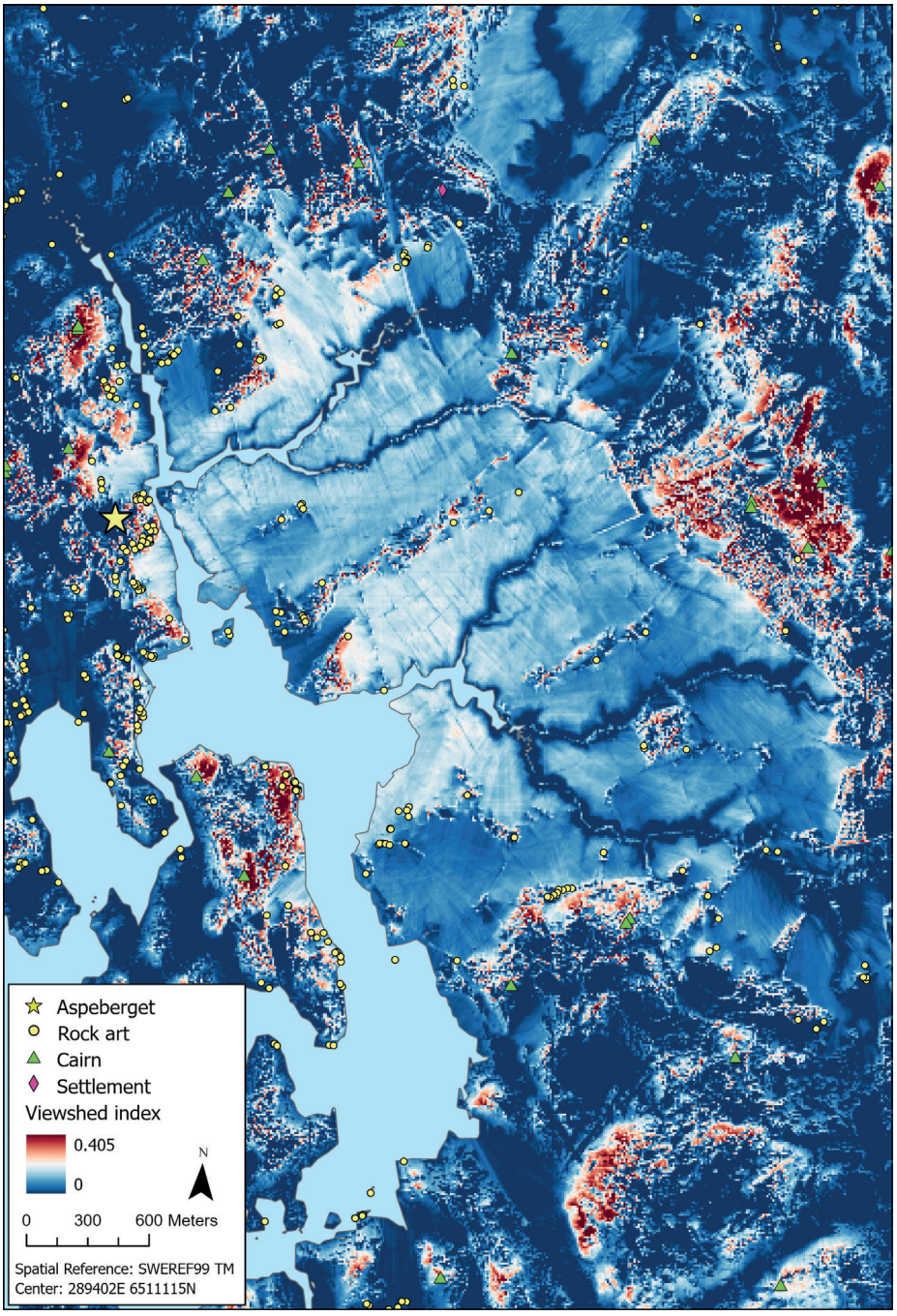


Fig. 5.8. Total viewshed around Aspeberget. Computed in QGIS (v3.42.1) with 16 sampled lines of sight (Cuckovic 2016). Elevation data from Lantmäteriet were interpolated to 10-meter resolution to exclude modern roads. Paleoshoreline estimated for c. 3400 BP (Ashely Green, GU).

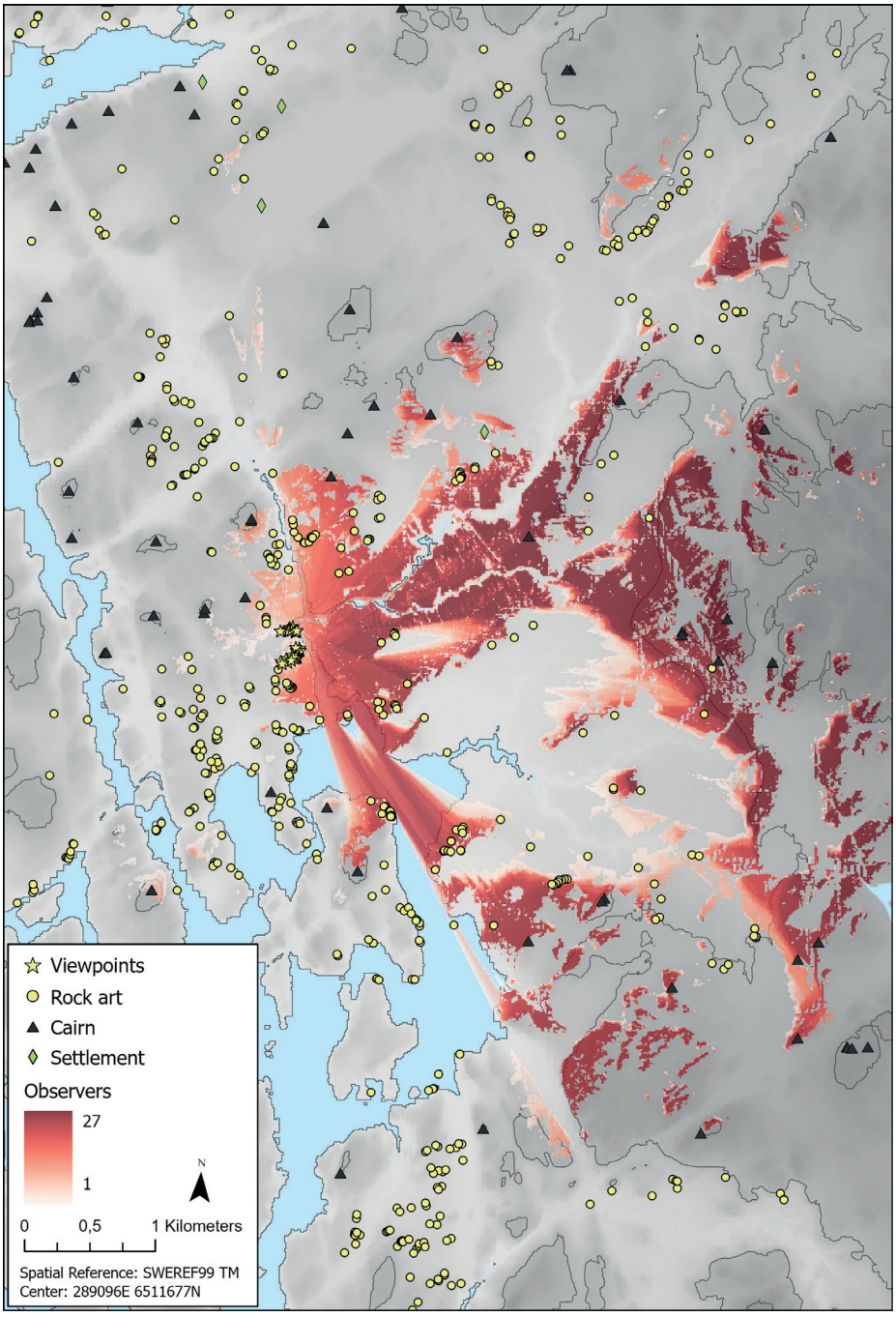


Fig. 5.9. Cumulative viewshed from observers standing on the panels at Aspeberget. Viewshed computed in ArcGIS Pro using elevation data from Lantmäteriet (lidar, 5 meters). Paleoshoreline estimated for c. 3400 BP (Ashely Green, GU).



Fig. 5.10. Panoramic view of Tanum 12:1.

dominated by the surrounding sea. Consistent with earlier research (Horn 2022b, 17), viewshed analysis shows that the vision from the panels was oriented primarily towards the fjord (Fig. 5.9). However, nothing suggests that this orientation was chosen to facilitate the sighting of other rock art locations, landscape features, or human-made structures. Notably, many large nearby panels, such as Tanum 1:1, Tanum 311:1, Tanum 76:1, or Tanum 351:1, lie entirely outside the viewshed. Only the area around the Lövåsen panels may have been visible in optimal weather, though the panels themselves would have been extremely difficult to see. Overall, the placement of the panels appears to have been linked to the hill's topography rather than to any potential visual control of the landscape, suggesting that visibility was not the primary concern of the carvers.

Discussion

This chapter set out to understand why carvers chose Aspeberget to create rock art and which features they prioritized when selecting specific rock surfaces on the hill. The results suggest they first assessed the rock's geological properties, since unsuitable surfaces would have made carving impossible. Once this obstacle was overcome, carvers seem to have sought topographical features that connected figures with water flows and the sea. It was the sea—not the hill's geological or topographical features—that gave Aspeberget its strategic maritime position in Tanum during the Early Bronze Age. But as the shoreline receded, the hill gradually lost this strategic position in the landscape. The history of Aspeberget seems, therefore, closely intertwined with the history of the coast.

Of all these findings, geological analysis provides the greatest insight into the technical knowledge carvers possessed, because they needed a precise understanding

of the internal characteristics and mechanical properties of the rock to detect weakened layers (Liebl *et al.* 2023). Since these layers do not correlate with any visual cue on the surface, identifying suitable areas must have required trial and error or some heuristic method yet to be determined: perhaps trial pecking or knocking on the surface to detect sound differences. Such strategies may not have left clear archaeological traces, yet they would have been sufficient for the carvers to decide where to carve.

Since the rock's physical properties remained stable throughout the Bronze Age, individuals did not need to learn these carving strategies from scratch. Instead, they could have relied on the knowledge of more experienced carvers. Because gaining this knowledge individually would have been costly in terms of time, failed attempts, and potential resource waste, carvers likely had strong incentives to draw on their peers' expertise. In this sense, the geological know-how they possessed fits Boyd and Richerson's (1996, 80) definition of cumulative culture: "accumulated changes over many generations resulting in culturally transmitted behaviors that no single human individual could invent on their own". Each carver would not only have inherited the technical solutions developed by predecessors but also the opportunity to further adjust and improve them for the generation to come.

Despite their reliance on cumulative knowledge, carvers may not always have estimated rock properties correctly and may well have made mistakes. These mistakes, in turn, may have carried social consequences and shaped their social prestige. Similar to what was observed in many Indigenous societies—where the social prestige of artists is often tied to mastery of technical and ritual knowledge and how this knowledge is used to impress the audience (Boas 1927; Gell 1994; Malinowski 2016 [1921])—carvers may have used their carving skills to display technical and ritual dexterity (Coles 2005, 9–11; Tilley 2021, 43; Horn *et al.* 2023, 852). But if carvings were part of ritual practices, a failed carving might have been perceived by these societies as jeopardizing initiation rites, journeys, or other activities that depended on these rituals. Therefore, carvers would have carried a significant social responsibility in executing their work.

This carving responsibility suggests that the figures conveyed all their cultural value when created, and for those who witnessed the process. As the viewshed analysis showed, neither the topographic position of the panels nor the visual properties of the figures were effective for transmitting messages or influencing the behavior of people transiting the landscape. If the carvings exerted any influence, it was on those involved in the activities taking place at the panels (Horn 2015b, 40). Therefore, the visual properties of the figures may have been less important than the act of carving itself (Coles 2000, 123; Sognnes 2008, 238), and the social meaning of rock art probably lay more in practice than in representation (Ling 2008; Fahlander 2024). Ultimately, it was through the interaction among the carver, the rock, and other elements that the act of carving attained its greatest social and symbolic significance.

One of these elements was clearly water. The spatial connection of Aspeberget with the sea, the strong association between figures and water flows, and the dominance of ships and other maritime motifs support the view that Nordic Bronze Age rock art was fundamentally a maritime phenomenon (*cf.* Ling 2008). It is tempting, therefore, to interpret the association between figures and water as evidence of carvers actively constructing a maritime cultural landscape. In brief, a maritime cultural landscape refers to the interplay between the physical and cognitive dimensions of a maritime environment (Westerdahl 2020). That includes the physical components of such environments (economic resources, topographical features, etc.), the social activities that engage with these components (sailing, shipbuilding, fishing, etc.), and the symbolic perception of the environment (maritime cosmology, maritime rituals, etc.).

Although archaeological remains of maritime activities in western Sweden are still scarce, there is growing evidence of boats (von Arbin and Lindberg 2017), boatbuilding activities (Austvoll 2020; Ling *et al.* 2024b), and imported objects transported by sea (Ling *et al.* 2013, 2014, 2019; Melheim *et al.* 2018). There is also a growing consensus that maritime rituality was an important part of the Nordic Bronze Age cosmology. This is reflected in the inclusion of aquatic resources such as seaweed, beach pebbles, and mollusks in graves (Horn 2024); the placement of hoards on the coast (Skoglund *et al.* 2025); the construction of ship settings (Ballard *et al.* 2004; Wehlin 2013); and rock art itself (Ling 2008). Interestingly, ritual practices linked to water continued into the Iron Age, where streams, rivers, bogs, and lakes were venerated as liminal spaces between the mundane and the supernatural realms (Price and Raffield 2024, 79).

Given the apparent practical and spiritual ties between Nordic societies and water, carvers may have been entangled in maritime cosmology and water symbolism. Anthropological studies consistently show that the sea is often charged with ritual and symbolic power (Moyano Di Carlo 2018, 73–82). For example, some Indigenous societies perceive the sea as an animated domain inhabited by ancestral spirits, making any interaction with it an interaction with the supernatural (McNiven 2004, 2008, 2025). Such supernatural forces often need to be tamed through ritual interventions on the water and the shore, and rock art figures sometimes serve as mediators of these animacies (Westerdahl 2006; McNiven and Brady 2012; Fahlander 2024; Whitley 2024, 10–12). If Nordic Bronze Age rock art was created with such intentions, then the production and long-term maintenance of carvings would have contributed to the creation and reinforcement of a shared maritime identity in the region (McNiven and Brady 2012, 84–85).

While maritime identity likely influenced where carvers placed figures, it cannot explain why the number of figures varies so greatly between panels. Rock properties do not seem to account for these differences, and the strong association between figures and water flows is observed across panels of many sizes. Large panels were not

necessarily the most visible from the surrounding area, nor did they always occupy positions suited for visual control of the maritime environment. The strategic position of Aspeberget may explain why the hill became a rock art site, but not the recurrent interest in carving certain rocks. And nothing suggests that panel size influenced the type of figures depicted on them. In short, there is no direct correlation between the panels' physical or spatial characteristics and the number or type of figures they depict. The next chapter addresses this problem by broadening the scope of analysis to western Bohuslän.

Chapter 6

The big got bigger

Chapter 5 suggested that carvers placed figures on rocks with suitable geological properties and in association with water, drawing on accumulated technical knowledge and maritime cosmology. But it also raised questions about why certain areas of the landscape concentrated more carvings than others, and why the number of figures varies greatly between panels. This chapter addresses these issues by exploring the social processes that may have shaped both the spatial placement and compositional diversity of the panels. In doing so, it examines how such variations shed light on the broader social and cultural contexts in which carvers worked.

Introduction

Rock art is often unevenly distributed in the landscape (Whitley 2024), and Nordic Bronze Age rock art is no exception. Scandinavian scholars have long been intrigued by this uneven pattern, and although some argued that the distribution was constrained by geological conditions and the availability of rock surfaces (Bertilsson 1987, 59; Toreld 2016, 72), most accept that rock art placement reflects social practice rather than environmental constraints (Goldhahn and Ling 2013, 286–287). However, what those social practices involved remains debated. Malmer (1981) and Bertilsson (1987) explained the uneven distribution of figures through a center-periphery model in which dense carving areas functioned as hubs of innovation and diffusion. Larsson (1986, 141) interpreted areas with high concentrations of rock art and metal objects as "central places" where chiefs organized economic, social, and religious activities. Kaul (2004, 103) and Tilley (2021, 92–94) saw these locations as pilgrimage destinations. And recent research has proposed that these sites hosted regional social gatherings (Coles 2000, 129; Ling 2008, 117–120; Melheim and Ling 2017, 68–71; Melheim and Sand-Eriksen 2020, 90; Ling *et al.* 2022, 63).

While these interpretations help frame the potential social context of the activity, they fall short of defining the specific purpose of individual panels or how they relate to one another. Coles (2005, 94) proposed that panels of different sizes were spatially and symbolically linked, while Tilley (2021, 177–178) and Lindhé (2025, 133) envisioned them as components of sequential narratives. Although this type of association has been documented ethnographically (*e.g.*, Hayden *et al.* 2023, 103), it remains unclear

whether it explains the distribution of figures in Bohuslän. Petersson and Toreld (2015, 64), for example, interpreted archaeological evidence from Arendal as reflecting a "long tradition of a landscape organized by humans", yet they found no significant spatial associations between panels.

Addressing this issue requires systematic quantitative analysis of panels at a regional scale. Since the first inquiries in the late 1980s (Burenhult 1980; Malmer 1981; Bertilsson 1987), few studies have compared panels in Bohuslän spatially and numerically (Ling 2008; Petersson and Toreld 2015; Nimura 2016). Recent work shows that the statistical comparison of large rock art assemblages can reveal the underlying structure of the rock art landscape (*e.g.*, Riris and Oliver 2019; Valdez-Tullett 2019). Building on this research, this chapter analyzes a dataset of 3,414 panels and 78,896 figures (Riksantikvarieämbetet-Fornsök, October 2023) using ecological metrics and clustering methods (see supplementary information for technical explanations).

The ecological metrics used are diversity and similarity (Oksanen *et al.* 2024). Diversity was calculated using the Shannon diversity index, which considers the number of figure types in a given panel (richness) and their relative abundance (evenness). Similarity between panels was assessed using the Jaccard index, which compares the number of figure types shared by two panels.

These metrics were then implemented in four clustering methods: k-medoids, hierarchical clustering, hot spot analysis, and the Inhomogeneous Pair Correlation Function. K-medoids groups n objects into k clusters by minimizing dissimilarity between data points and actual data points assigned as cluster centers (Maechler *et al.* 2023). Hierarchical clustering builds nested clusters based on similarities or dissimilarities among data points (R Core Team 2024). Hot spot analysis identifies statistically significant spatial clusters of high (hot spots) and low values (cold spots) in weighted datasets (ArcGIS Pro v3.1+). And the Inhomogeneous Pair Correlation Function measures spatial dependence in point patterns with uneven density by estimating the probability of finding two points at a given distance compared to a random Poisson process (Baddeley *et al.* 2016).

The chapter begins by examining figure frequencies for individual panels in Aspeberget and western Bohuslän. Next, it analyzes the spatial distribution and associations between panels to identify patterns in their location. These patterns are then taken up in the final two sections, which explore whether thematic or compositional attributes shaped the observed associations.

An uneven rock art landscape

Aspeberget was clearly a central place for rock art activity in the region, given that it accounts for approximately 1.5% of figures documented in Bohuslän. But not all panels received the same attention (Fig. 6.1a). Up to 78% of these figures are concentrated in panels such as Tanum 25:1 (n = 324), Tanum 12:1 (n = 288), Tanum 18:1 (n = 218), and Tanum 120:1 (n = 136). The remaining panels rarely exceed 30 figures and sometimes

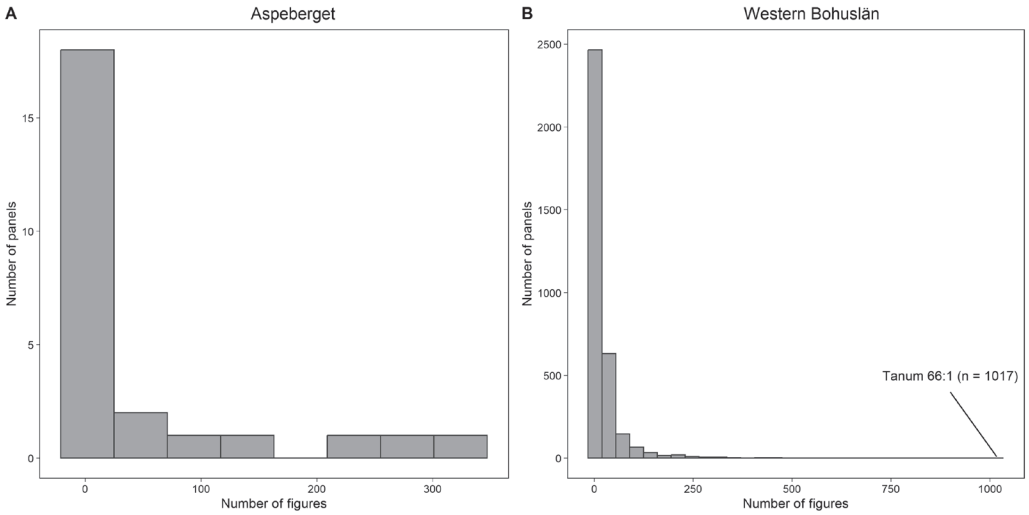


Fig. 6.1. Number of figures per panel in (A) Aspeberget and (B) western Bohuslän. The frequency of figures in Bohuslän was calculated based on information provided by Riksantikvarieämbetet.

depict just a couple. Although dating every figure is not possible, the analysis suggests that, except for Phase 5, carvers distributed figures unevenly across panels throughout the Bronze Age (see supplementary information).

This uneven distribution is repeated across Bohuslän (Fig. 6.1b). Only 398 of the 3,414 panels documented in the region account for 58% of the figures. Notable examples of these large panels are Tanum 66:1 (n = 1017), Jörlanda 46:1 (n = 945), Skredsvik 101:1 (n = 732), Foss 6:1 (n = 682), Tanum 1:1 (n = 642), Tanum 184:1 (n = 508), Tanum 326:1 (n = 470), Tanum 96:1 (n = 465), Torsby 336:1 (n = 450), Kville 157:1 (n = 409), Tanum 192:1 (n = 409), Valla 51:1 (n = 350), Tossene 10:1 (n = 346), or Brastad 1:1 (n = 335). Some of these panels stand out for their elaborate figures and complex scenes, but others rank high only because of an unusually large number of cupmarks (for example, Tanum 66:1 or Jörlanda 46:1). Moreover, their periods of use varied considerably: panels such as Tanum 1:1, Kville 157:1, Tanum 192:1, or Brastad 1:1 were used during the entire Bronze Age, while the 929 cupmarks on Tanum 66:1 may belong to a single phase. But regardless of the process behind them, these panels have accumulated up to 44 times as many figures as the average panel in Bohuslän.

This sharp difference in frequencies also applies to the types of figures depicted (*cf.* Nimura 2016). Aspeberget alone contains about 62% of all the figure types documented in the region, with a predominance of cupmarks, ships, humans, animals, circles, and feet/shoes (Fig. 6.2). The largest panels on the hill—those with more than 160 figures—show 13 of the 21 types used in this study, and mid-size panels (such as Tanum 14:1, Tanum 28:1, and Tanum 120:1) depict 11 of these types. But as the panel

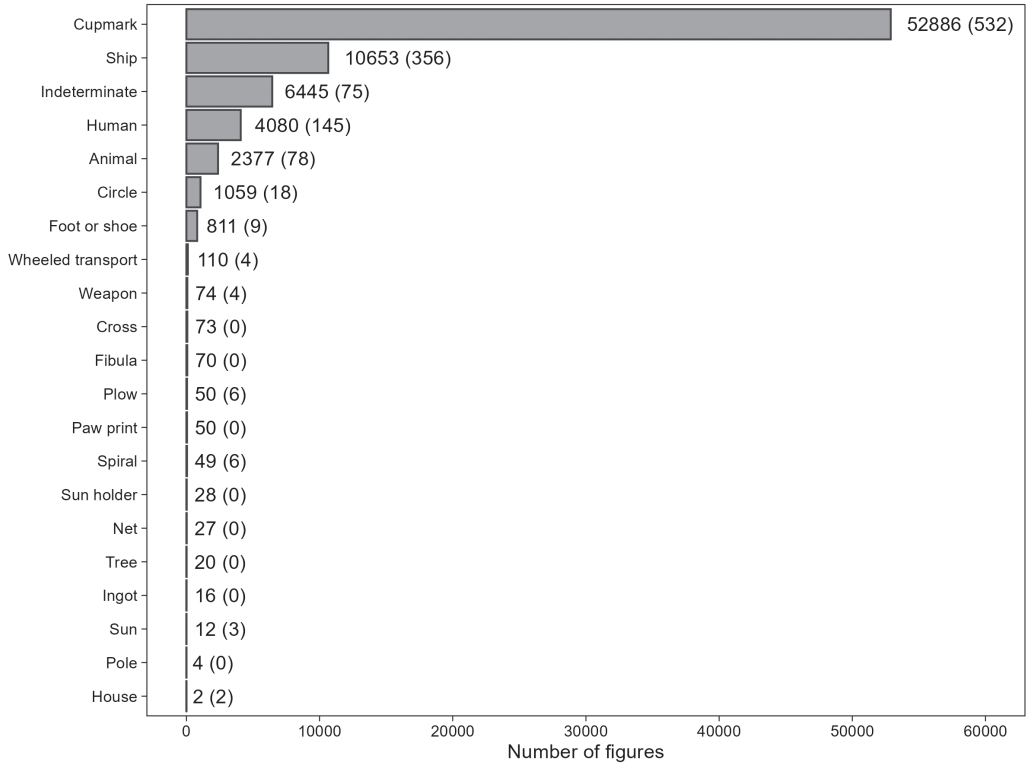


Fig. 6.2. Number of figures per type in western Bohuslän. Counts in parentheses indicate the number of figures of that type in Aspeberget. The frequency of figures in Bohuslän was calculated based on information provided by Riksantikvarieämbetet.

size decreases further, the number of types drops noticeably. This trend is even more pronounced in western Bohuslän, where the largest panels—such as Tanum 1:1, Foss 6:1, and Tanum 192:1—feature all documented types (Fig. 6.2). On the contrary, the bottom tenth of the panels depicts only eight types. This suggests the prevalence of a common theme across large panels and less diversity in small panels.

At Aspeberget, diversity within panels increases exponentially with panel size, with panels such as Tanum 12:1, Tanum 25:1, Tanum 18:1, Tanum 120:1, and Tanum 28:1 diverging by a factor of four from the smallest panels on the hill (Fig. 6.3). These large panels naturally show greater diversity because a larger number of figures increases the likelihood of depicting multiple types. Yet larger numbers of figures do not always correlate with higher diversity. Tanum 25:1, for example, has lower diversity than Tanum 12:1, despite having 12.5% more figures. This drop in diversity likely reflects the repeated carving of specific types. Tanum 25:1 is dominated by ships, whereas Tanum 12:1 features a wider set of types, including figures such as ploughs and wagons.

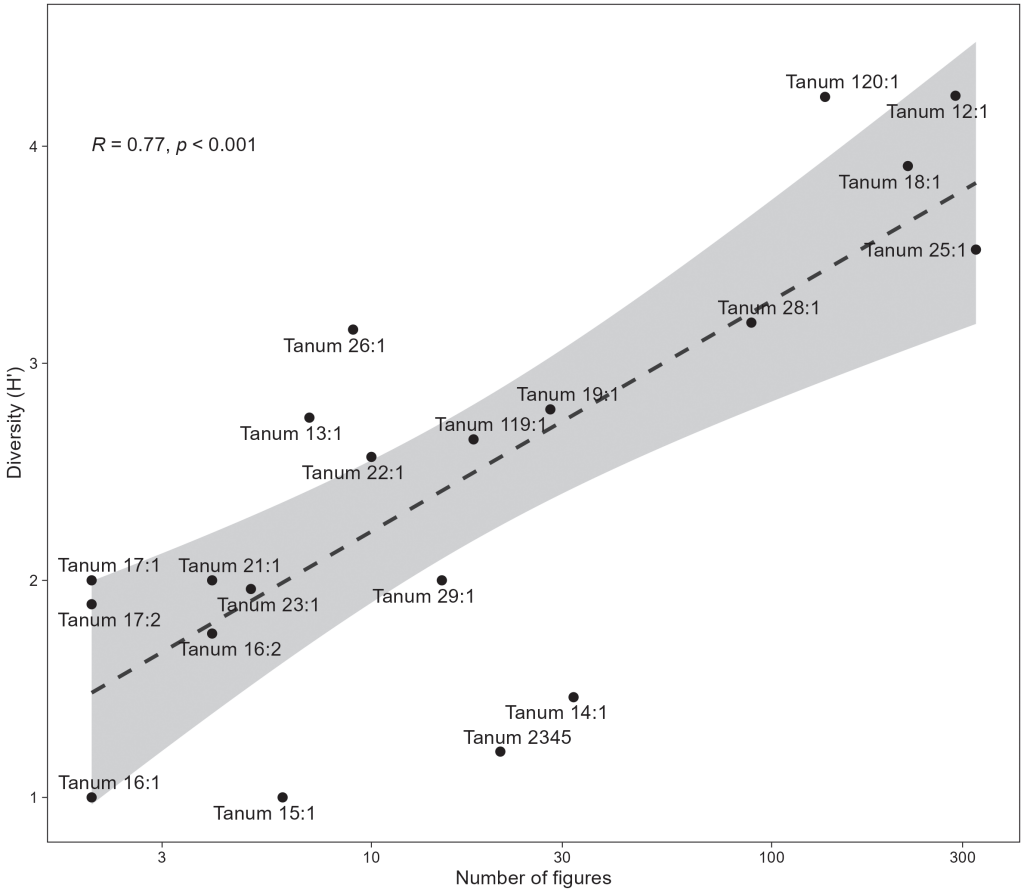


Fig. 6.3. Association between diversity (H') and number of figures per panel in Aspeberget. Note that some axes are displayed on a logarithmic scale.

In western Bohuslän, the correlation between size and diversity is less consistent (see supplementary information). Many large panels exhibit low diversity due to the overrepresentation of certain figures. Tanum 66:1 is a good example: despite being the largest panel in the region with 1,017 figures, its diversity index is low because 929 of those figures are cupmarks. Nonetheless, except for panels dominated by cupmarks, large panels generally display considerable diversity in both composition and pictorial arrangement.

Besides depicting numerous carvings and diverse compositions, large panels also featured the largest, deepest, and most complex figures (Fig. 6.4). The large and deep ships, bulls, humans, and wheeled transport on Tanum 12:1, Tanum 25:1, Tanum 18:1, and Tanum 120:1 illustrate this point. Although carvers could have produced these figures on such panels simply because they offered advantageous geological properties

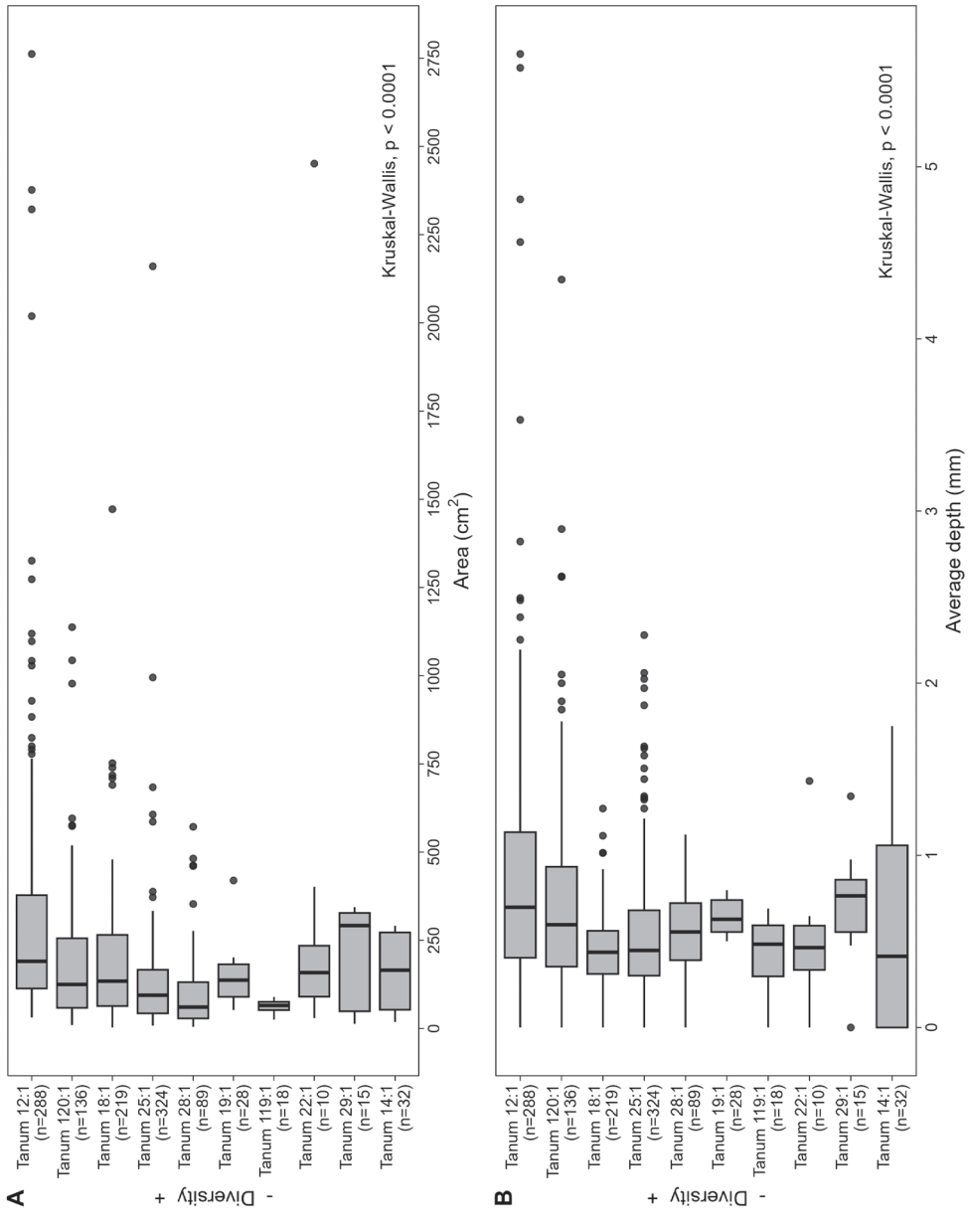


Fig. 6.4. Size (A) and relative depth (B) of figures per panel at Aspeberget. Panels are arranged from most to least diverse (H').

(Liebl *et al.* 2023), certain figures show that geology alone did not determine figure size or depth (see also Chapters 5 and 7). For example, one of the largest carvings at Aspeberget is a 2.6-meter-long ship on Tanum 22:1. When carvers created this figure during Phase 1, panels such as Tanum 12:1, Tanum 25:1, or Tanum 18:1 still offered enough available rock to accommodate it. Yet they invested their labor in this small and rather peripheral panel. Similarly, a 94-centimeter-long wheel on Tanum 84:1 stands alone on the north side of the hill, and a detailed, deeply carved acrobat can be found on a relatively small panel like Tanum 14:1. Since rock quality does not seem to explain the complexity of the figures, the decision to carve complex figures on specific panels seems to have been deliberate (*cf.* Coles 2000, 107–108).

A hierarchical rock art landscape

The numerical analysis revealed substantial variation in the number and types of figures depicted on the panels, but it ignored the spatial distribution of these panels. This section links panel diversity with their geographical position to assess how carvers placed rock art across the landscape.

The analysis reveals that panels in Bohuslän cluster at distances of ~500 meters or less (Fig. 6.5a)—a pattern also observed in Norway (*cf.* Stamnes and Stebergløkken 2020, 171). Practical factors may have shaped this clustering: the availability of exposed rock surfaces (Toreld 2016, 72), the geological properties of the rocks (Liebl *et al.* 2023, 121–123), or the morphology of the coast—characterized by fjords and inlets (Ling 2008, 107). Yet these factors do not explain why small, simple panels often surround the larger and more complex ones (Fig. 6.5b). Aspeberget illustrates this: small panels do not seem to have been restricted by limited exposed rock; geological differences between small and large panels do not account for their mark contrast in figure frequency (Chapter 5); and although the hill held a strategic maritime position, it did not always attract the most complex carving events in the region (Chapters 4 and 5). Thus, the spatial association between *complex and simple* panels appears to reflect that carvers deliberately organized rock art in the landscape.

As part of this spatial organization, carvers seem to have created complex panels in specific coastal areas of central and northern Bohuslän (Fig. 6.6). The results show that Tanum parish holds the highest concentration of complex panels, followed by other hot spots of activity in Torsbo, Brastad, Tossene, Askum, Arendal, Lommeland, Skee, and Svarteborg (*cf.* Bertilsson 1987; Ling 2008). All these clusters lay along the Bronze Age coast, bays, or inlets, including Svarteborg, which, despite being away from the seafront, maintained direct access to the ocean through a long inlet running between Sotenäs and Stangenäs. This suggests that their maritime location played a decisive role in the growth of these carving areas. But since many figures lack reliable dating, these areas may have developed at different points in the Bronze Age. Brastad, for example, seems to depict a higher proportion of Late Bronze Age figures than

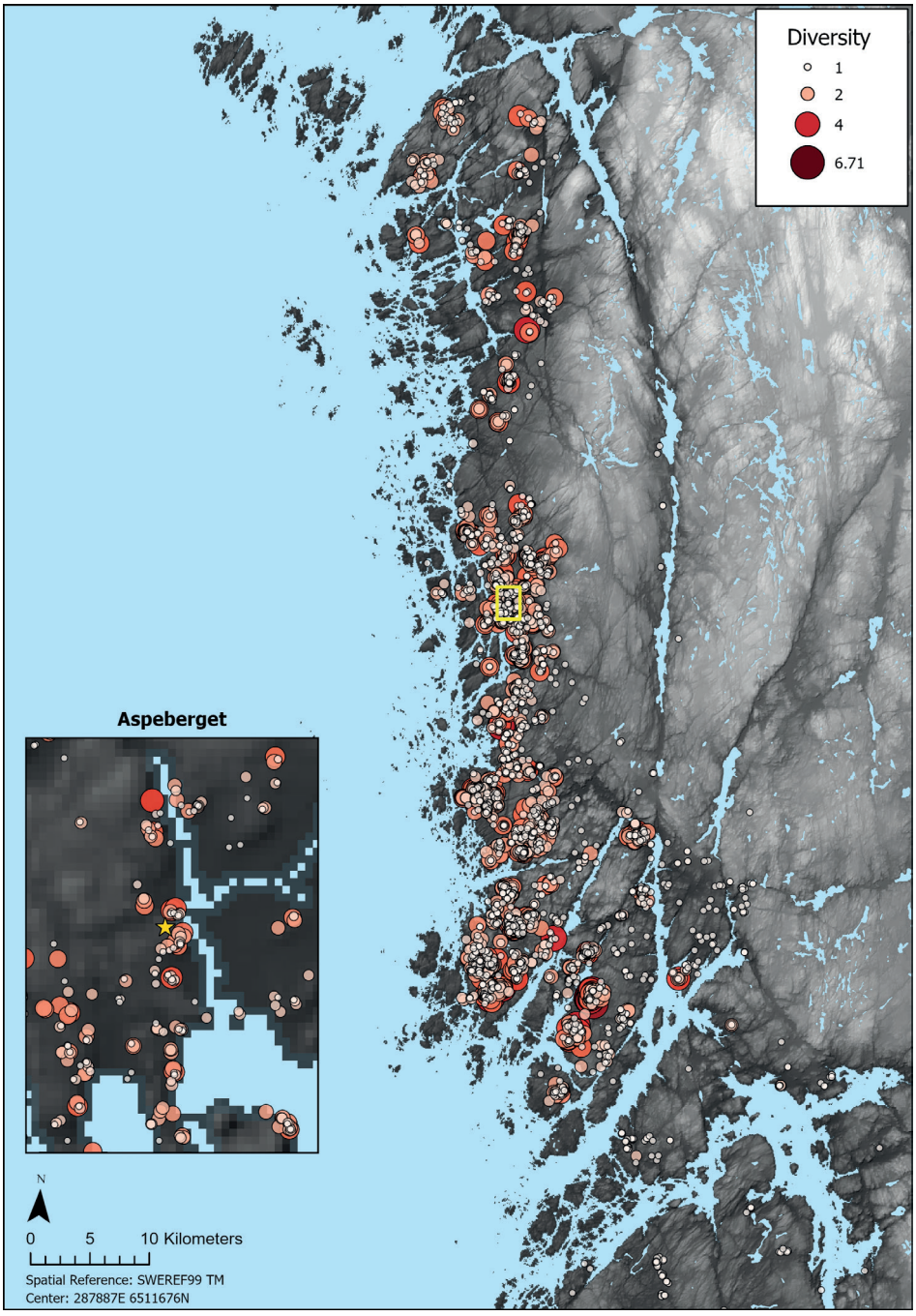


Fig. 6.5. Spatial distribution of panels in central and northern Bohuslän, categorized by diversity. The top-left corner displays the results of the Inhomogeneous Pair Correlation Function. Paleoshoreline estimated for c. 3400 BP (Ashely Green, GU).

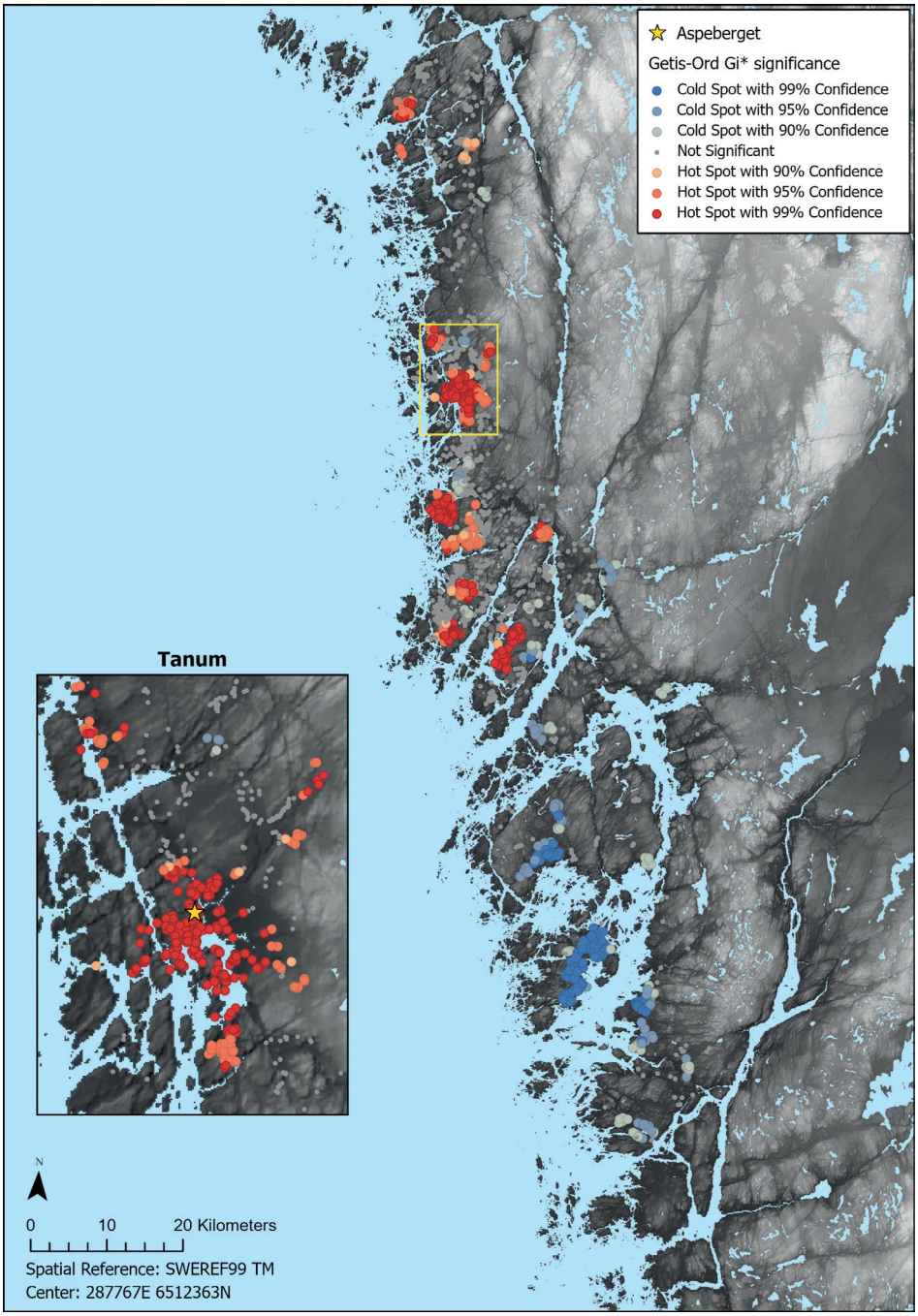


Fig. 6.6. Hot spots of rock art diversity (H') in western Bohuslän. The number of figures per panel was calculated using information from Riksantikvarieämbetet. Paleoshoreline estimated for c. 3400 BP (Ashely Green, GU).

Tanum. The result, therefore, reflects the rock art landscape more during the Late Bronze Age than during the Early Bronze Age.

These hot spots naturally contain some of the largest and most complex panels in the region: Tanum 1:1, Kville 157:1, Brastad 1:1, Tossene 48:1, Askum 67:1, Svarteborg 9:1, Tanum 435:1, Hogdal 210:1, or Skee 614:1. Their complexity, however, varies between areas. Many panels in Tanum are much larger and more complex than the most prominent panels in smaller hot spots. Aspeberget, for example, hosts four major panels within an area of approximately 5.5 hectares. Few places in Bohuslän gather so many complex panels in such proximity, although the area around Brastad 1:1 may offer a comparable concentration.

Only a few large, complex panels, such as Foss 6:1 and Tossene 73:1, sit outside these main centers of rock art activity. They rank among the largest panels in Scandinavia and depict large, highly complex figures, yet they are in areas with few highly diverse panels. Similarly, the Fossum area features large and elaborate panels such as Tanum 155:1 and Tanum 262:1, despite a relatively low density and diversity of panels in the surrounding area. This situation may be influenced by limited archaeological research in certain areas of Bohuslän—Tanum, for example, has received special attention over the past 30 years. Even so, the overall amount of documented rock art in the region is high, and the pattern would shift only if future discoveries uncovered *many* large and complex panels, which seems unlikely. Therefore, large panels outside of hot spots were perhaps carved ad hoc, without turning the area into a place of recurrent activity. This imbalance between places of high and low activity is even clearer when comparing central and northern Bohuslän with its southern counterpart (Fig. 6.6). The south shows several *cold* spots comprising small and relatively simple panels scattered along the coast, suggesting that rock art making was not only confined to high-level events in major hubs but also to low-profile activities on a local scale.

In summary, the results support the view that carvers planned the placement of figures across the landscape (in line with Bertilsson 1987; Coles 2000; Ling 2008; Petersson and Toreld 2015). Given that rock properties and coastal topography cannot fully account for the distribution of panels and figures, we should conclude that they focused on places with special social or ritual significance (*cf.* Whitley 2024). Over the Bronze Age, this practice created a hierarchical spatial structure, with large panels depicting many complex figures in core areas of the landscape and smaller, less diverse ones surrounding them. Since Aspeberget stood at the center of the largest concentration of rock in Bohuslän and depicted some of the most complex panels, it likely played a central role in the region, at least during the Early Bronze Age.

A thematic hierarchy?

The previous section showed that panels were spatially correlated and hierarchically organized, but it did not explain the relationships between them. This section

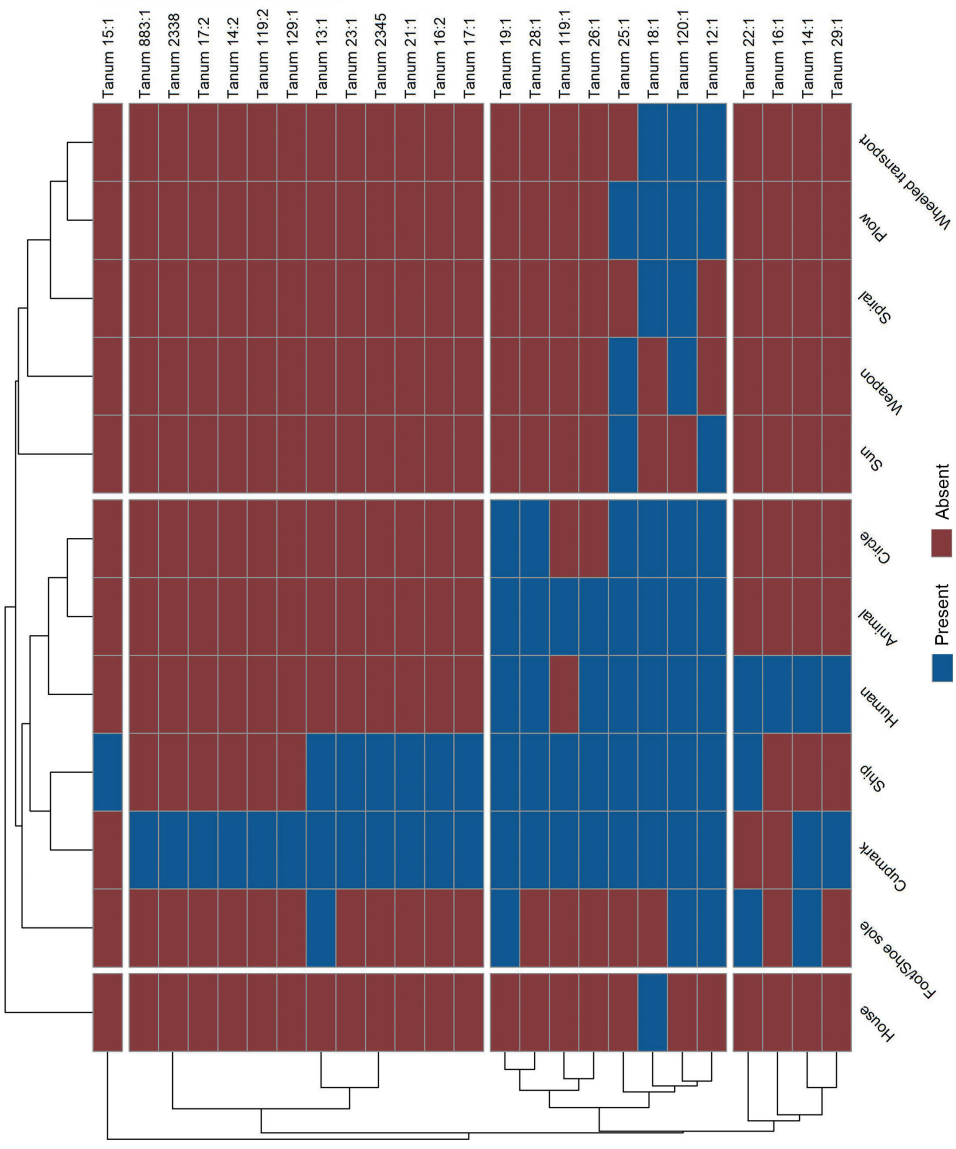


Fig. 6.7. Hierarchical clustering of panels at Aspeberget based on which figure types are present or absent on each panel. The clustering uses the Jaccard distance and the average-linkage method.

examines whether these relationships were thematic—that is, whether panels depict different figures.

At Aspeberget, the panels form three main clusters (Fig. 6.7). The first cluster contains panels with diverse compositions that include weapons, spirals, wheeled transport, plows, and sun motifs; these panels are Tanum 12:1, Tanum 120:1, Tanum 18:1, Tanum 25:1, Tanum 26:1, Tanum 119:1, Tanum 28:1, and Tanum 19:1. The second cluster—comprising Tanum 29:1, Tanum 14:1, Tanum 16:1, and Tanum 22:1—features panels with few figures and a greater emphasis on human motifs. And the third cluster includes panels depicting only cupmarks or a combination of cupmarks and ships.

These clusters appear to be influenced more by the frequency of certain figures than by thematic differences between panels. For example, cupmarks and ships were depicted in large quantities, so their co-occurrence across panels is more likely. In contrast, humans, animals, circles, and feet/shoe soles are less common and appear on fewer panels. Other figures, such as wheeled transport, plows, and spirals, are even rarer and, having been carved only on a few panels, form a single cluster in the analysis. This pattern also appears in Bohuslän as a whole, where 87.6% of *figurative* panels depict ships, 84.3% depict cupmarks, 44.7% depict humans, and only 29.8% portray animals. The contrast with other less common figures is even greater, showing that a large part of the phenomenon was dominated by the carving of ships and cupmarks across the landscape.

This strong predominance and widespread presence of ship and cupmarks produce two main clusters of panels in Bohuslän: one dominated by diverse panels and one by cupmarks and ships (Fig. 6.8). These clusters are mixed and spread across the region, so specific combinations of figures cannot be linked to particular geographic areas—beyond some areas where only cupmarks appear. Nonetheless, some figures seem to have been depicted more often in certain areas of Bohuslän (*cf.* Ling 2008, 152–153). For example, hot spots of ships occur in Tanum and Torsbo; humans in Tanum, Torsbo, and Lommeland; animals in Tanum and Brastad; feet and circles in Brastad and Foss; and cupmarks in the northern part of Tanum (Fig. 6.9, 6.10, and 6.11).

Intensively carved areas like Tanum might be overrepresented in the analysis because they enclose many figures. As the number of figures increased, they were more likely to depict similar types and higher concentrations of specific figures. These areas could therefore show similar compositions and hot spots of certain types simply because they held more figures, greater variation, and longer periods of use. Yet Tanum is not a hot spot for feet/shoes or circles, showing that the concentration of figure types is not merely a consequence of rock art density. Instead, local groups of carvers may have favored certain motifs, or, even more likely, individual carving events may have prioritized certain motifs.

This prioritization would explain why sites like Lommeland become relevant only when human figures are considered, or why large panels may occasionally show different levels of diversity. Tanum 66:1 and Tanum 1:1, for example, depict 1,017 and 642 figures, but their similarity index is almost twice as low as that between Tanum 1:1

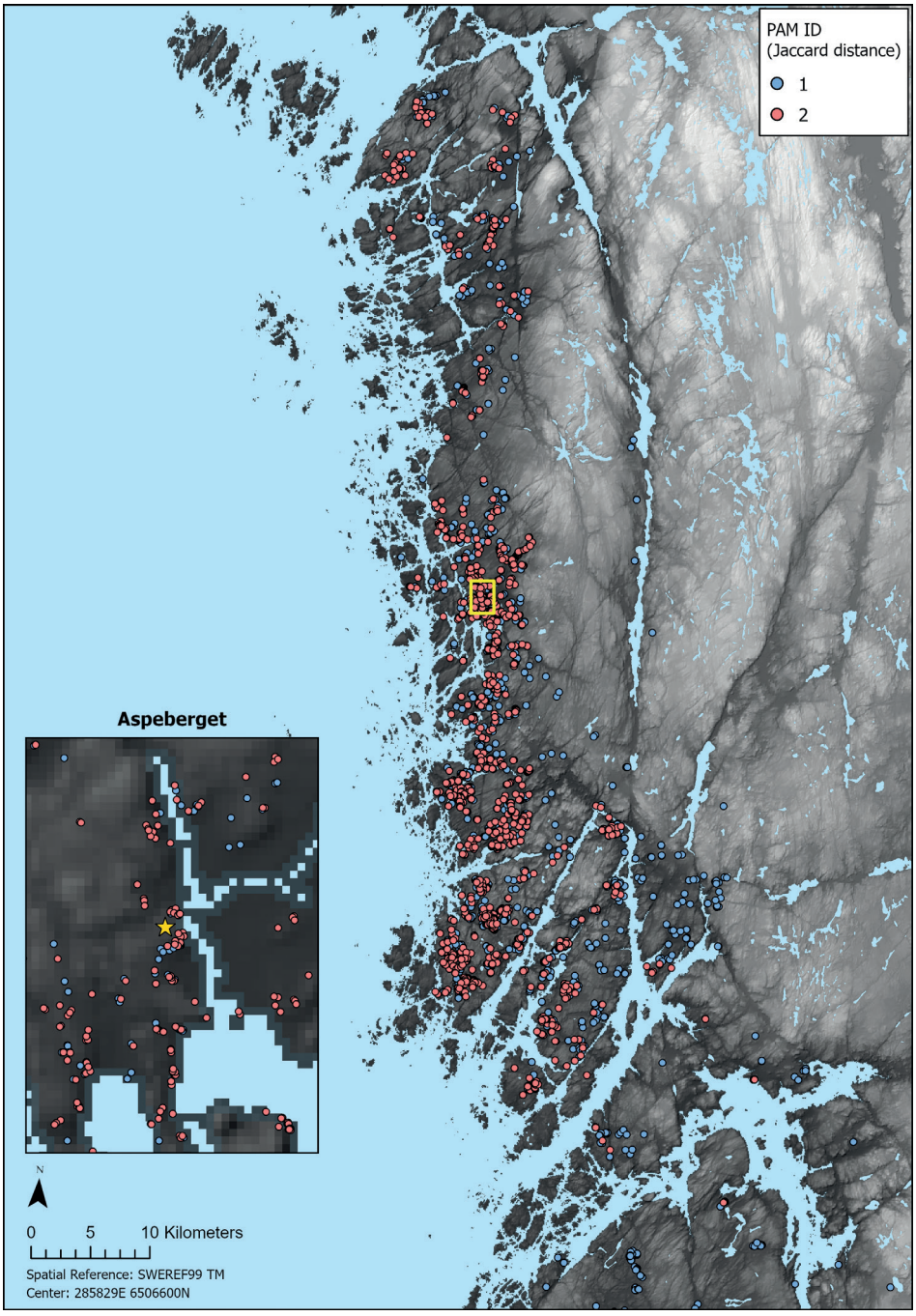


Fig. 6.8. K-medoids clustering of panels in western Bohuslän using the Jaccard distance. The frequency of figures was calculated based on information provided by Riksantikvarieämbetet. Paleoshoreline estimated for c. 3400 BP (Ashely Green, GU).

and Tanum 12:1, which depicts only 288 figures. The reason is the extremely high number of cupmarks in Tanum 66:1 and its lower type diversity. Tanum 66:1 shows that large, monothematic carving events could have changed the temporal trajectory of a panel and distorted similarity between sites. Thus, the similarity among large panels seems to have resulted not only from the high number of figures depicted but also from similar preferences in what carvers chose to carve.

If carvers followed shared preferences in designing panels, we might be tempted to interpret differences between panels as signs of distinct ritual purposes. At Aspeberget, for example, the greater presence of wagons and plows on panels such as Tanum 120:1 may be interpreted as rituals linked to agricultural activities in contrast to maritime rituals performed on ship-dominated panels such as Tanum 25:1. However, the higher number of wagons and plows on Tanum 120:1 appears to have a chronological explanation: the panel was carved more intensively during the Late Bronze Age, when these motifs were more common. Moreover, the wagons and plows of Tanum 120:1 do not exceed other motifs—such as warriors and ships—in number or complexity. Therefore, even if panels at Aspeberget served different ritual functions, those functions do not show a clear correlation with the types of figures depicted.

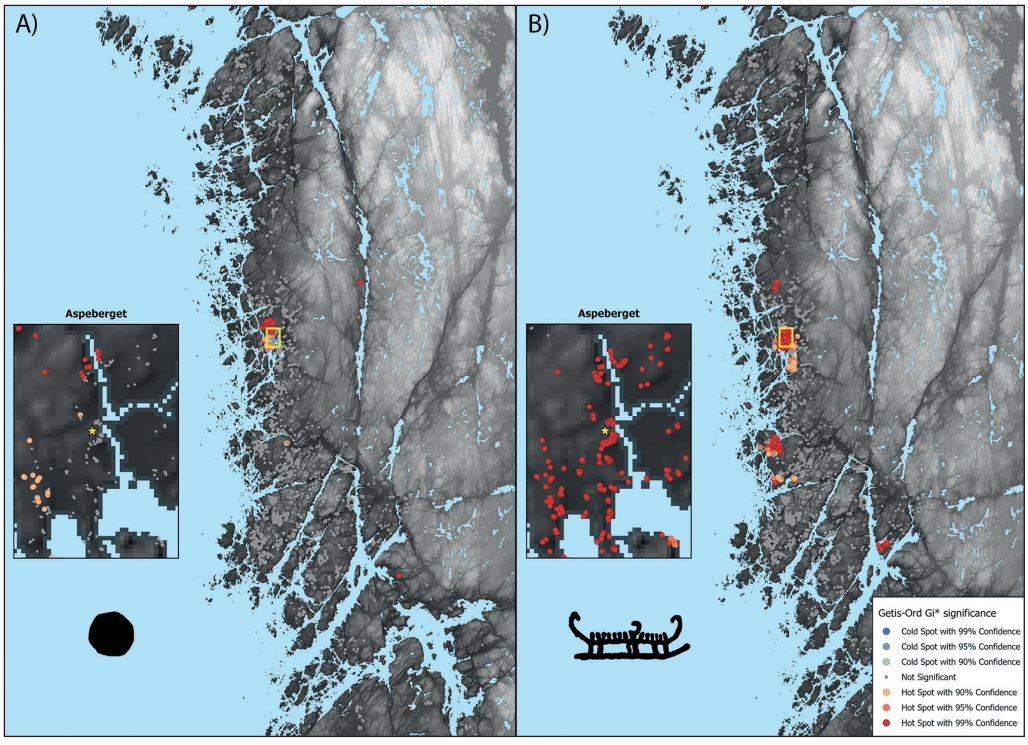


Fig. 6.9. Hot spots of A) cupmarks and B) ships. The frequency of figures was calculated based on information provided by Riksantikvarieämbetet. Paleoshoreline estimated for c. *3400 BP (Ashely Green, GU).*

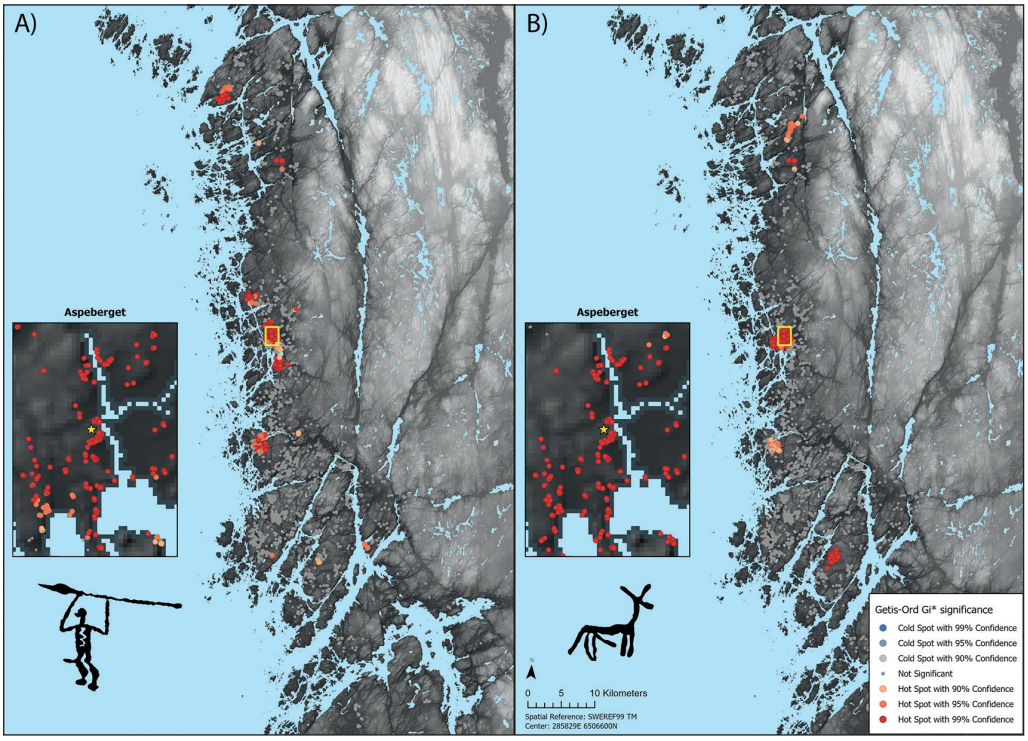


Fig. 6.10. Hot spots of A) humans and B) animals. The frequency of figures was calculated based on information provided by Riksantikvarieämbetet. Paleoshoreline estimated for c. 3400 BP (Ashely Green, GU).

A narrative link?

Beyond similarities and differences between types of figures, panels show variation in how these figures were arranged on the surface. The links between panels, therefore, could have been made through pictorial arrangement rather than thematic differences. As noted earlier, some scholars interpreted these arrangements as elements of sequential narratives that people experienced as they transited the landscape (*e.g.*, Tilley 2021, 177–178; Lindhé 2025, 133). Quantifying how people move between panels and the narratives these arrangements may have portrayed falls outside the scope of this study. Still, if a narrative sequence existed at Aspeberget, it should be reflected in panels that share and complement one another in both theme and composition. Crucially, the figures forming such compositions should be chronologically consistent. For example, carvers working in Phase 1 could only have created a narrative using figures from that phase. Carvers in Phase 2 may have incorporated figures from Phase 1 into new compositions, but never figures from Phase 3, and so on. The chronology of the figures is therefore essential when assessing the possibility of narratives across panels. Taken together,

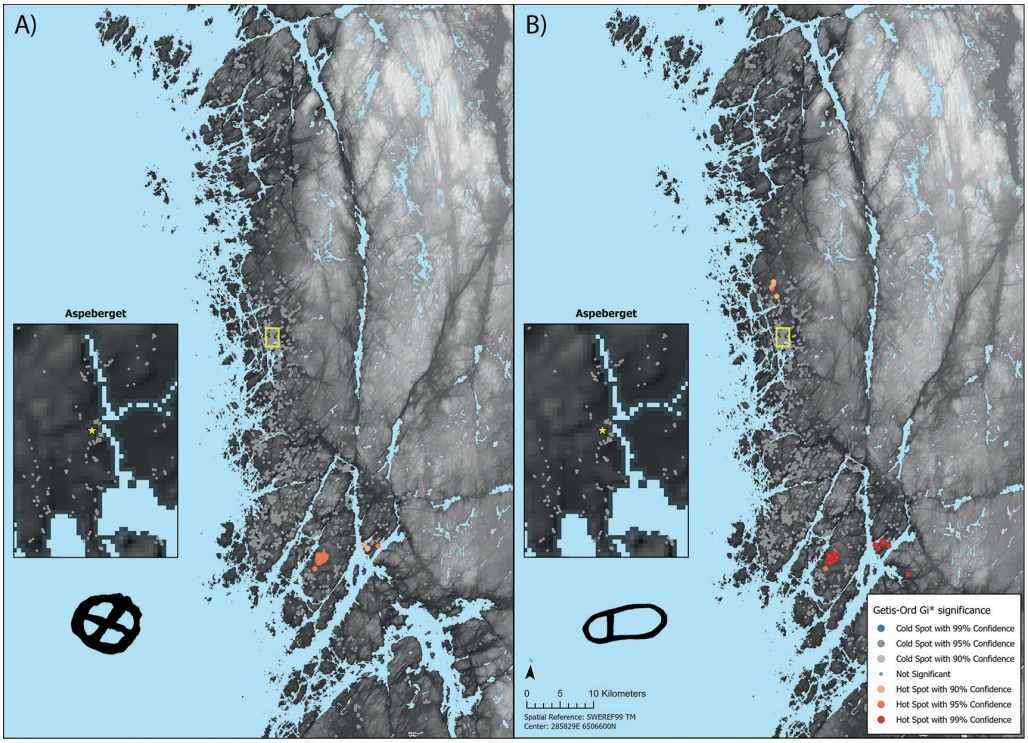


Fig. 6.11. Hot spots of A) circles and B) feet or shoe soles. The frequency of figures was calculated based on information provided by Riksantikvarieämbetet. Paleoshoreline estimated for c. 3400 BP (Ashely Green, GU).

the compositional and chronological analyses presented below cast significant doubt on the existence of such narrative sequences at Aspeberget.

The contrast between Tanum 12:1 and Tanum 25:1 illustrates how panels from similar periods could exhibit different compositions (*cf.* Fig. 10.1 and 10.9 in Appendix). Tanum 12:1 is dominated by large, deeply carved ships, bulls, and four human warriors who likely first caught viewers' attention. This type of warrior is absent in Tanum 25:1, where the composition revolves around a large ship in the center-left of the panel. This ship is flanked by three or four bulls, yet they are less centrally placed than the bulls on Tanum 12:1. Moreover, they are smaller, shallower, and two of them have outlined bodies—a type of body absent on the other side of the hill. These differences in style and position are also clear with the sun motif, which only has a prominent place on Tanum 12:1. Other differences can be attributed to chronology: the wagons, archers, plows, birds, snakes, and a male deer of Tanum 12:1 are related to the greater longevity of this panel (see Chapters 3 and 4).

While these differences show that carvers could represent the same number and type of figures in different ways, they seem more stylistic than narrative. The panels

seem to express a single theme through different stylistic choices, and the selection and arrangement of figures offer little evidence to argue that carvers pursued different narrative goals or intended to link their compositions (at least no evidence that can be tested and reproduced).

These allegedly linked narratives face another spatial problem: panels with similar compositions are not necessarily close to one another (*cf.* Petersson and Toreld 2015). Tanum 25:1 and Tanum 28:1, for example, show similar compositions centered on ships, yet other nearby panels, such as Tanum 23:1 and Tanum 26:1, depict ships and animals absent on Tanum 25:1 or Tanum 28:1. Similarly, the type and arrangement of figures on Tanum 12:1 resemble the composition of Tanum 1:1 (located one kilometer away) more than any other panel at Aspeberget. These cases show that any narrative link between panels would have required complex movement through the landscape, something not yet demonstrated.

Scholars should also prove the chronological consistency of these narrative links. The sequence of carvings on Tanum 12:1 and its adjacent panels exemplify that these links are not always possible (see also Chapter 4). Tanum 12:1, which reached its peak of carving activity in Phase 2, is surrounded by four panels: Tanum 13:1, Tanum 14:1, Tanum 15:1, and Tanum 120:1. Tanum 15:1 depicts four Phase 2 ships and a doubtful Late Neolithic II ship (see Chapter 5); Tanum 13:1 contains two datable ships from Phases 2 and 4; Tanum 14:1 has only one datable figure, an acrobat from Phase 4; and Tanum 120:1 was mainly carved in Phases 3 and 4. Carvers hardly carved these panels to complement their compositions because when Tanum 12:1 was used most intensively, some of the neighboring figures did not yet exist. A thematic link might have operated during the Late Bronze Age, but not during the Early Bronze Age, and therefore cannot explain the spatial distribution that had been forming since the beginning of the Bronze Age.

Discussion

The difference in the frequency of figures between panels has been a recurring topic of debate, with theories ranging from thematic relationships with narrative functions to processes of social aggregation at specific locations in the landscape. These theories were not always based on systematic analysis of large numbers of panels, so the relationship between panels of varying sizes and complexities remained unclear. The quantitative analysis performed in this chapter yields three major results. First, a few panels in Bohuslän accumulated most of the figures, including the largest, deepest, and most complex ones. Second, these large panels were located in specific maritime areas of Bohuslän and were usually surrounded by smaller, less diverse panels. Third, the types of figures depicted and their chronological development suggest that large and small panels were not thematically linked.

The accumulation of figures on a few panels may reflect a preferential attachment process: a process in which a certain feature is allocated among individuals or objects

based on how much of that feature they already possess (Barabási and Albert 1999). The well-known "rich-get-richer" effect illustrates this pattern in social contexts, where individuals gain economic or social success in proportion to their initial reputation or wealth (Merton 1968). Many modern cult sites show a similar tendency, attracting social activity in proportion to their prior popularity or meaning. By analogy, the uneven distribution of figures across panels may result from several generations of carvers prioritizing specific panels to depict most figures and the most complex motifs.

I see two competing interpretations for this prioritizing behavior: one emanating from the autonomous decisions of carvers, and the other from institutionalized control exercised by a few individuals. In the first case, the large number of figures in specific panels may simply have resulted from carvers following regular patterns of behavior. Carvers may have prioritized carving panels for their intrinsic properties, their position in the landscape, the symbolic importance of the figures they depict, or the prestige of the person who carved them before. These preferences would have made it more likely that new figures would be added to these panels, further enhancing their popularity and increasing the likelihood of additional carvings in the future. In such a feedback process, individual carvers would have been influenced by their peers and predecessors but were essentially free to choose what and *where* to carve.

This phenomenon should not be underestimated, as many rock art sites across the globe were repeatedly carved or painted because of their powerful ritual significance within the landscape (Whitley 2024). Yet two aspects of Nordic Bronze Age rock art clash with this interpretation. First, some large panels were carved more intensively during the Late Bronze Age or the Early pre-Roman Iron Age (*e.g.*, Brastad 1:1 and Tanum 75:1), which challenges the idea that carvers prioritized panels mainly because of the presence of earlier figures (*cf.* Bertilsson 1987, 92). Second, the interpretation is at odds with the fact that rock art styles across Scandinavia developed synchronously over the Bronze Age (Chapters 5 and 6). While certain locations could have attracted rock art activity because of their social significance, carvers were not compelled to depict the same type of figures. It is therefore unlikely that multiple generations of *independent* carvers produced such consistent themes in the same type of locations over hundreds of years without substantial variation (see also Chapter 5).

If carvers did not act independently, some individuals or institutions may have possessed the authority to decide what, when, and where to carve (*cf.* Goldhahn 2007; Ling *et al.* 2022). In this view, specific individuals would have selected, designed, and regulated the activity as part of the prerogatives linked to their social position. Ethnographic and archaeological examples show that regulated access to rock art sites and knowledge existed in some Indigenous societies (*e.g.*, Hayden *et al.* 2023, 104). They also suggest that as social complexity and stratification increased, (rock) art became increasingly detached from everyday activities and more closely tied to politicized ritual practices used in aggrandizing strategies (*cf.* Trigger 2003, 541–583; Robb 2015, 650; Hayden 2018, 291). But whether similar strategies occurred in the Nordic Bronze Age remains debated (see Ling *et al.* 2018a).

I argue that the results of this chapter suggest that both models may have operated at *different scales*. The *long-term* stability of thematic content, stylistic choices, and spatial distribution suggests that elite groups or individuals managed rock art in Bohuslän. However, they could have chosen different panels and motifs every time they carved. Their consistent choices show a strong adherence to culturally transmitted social norms. Phrased differently, the feedback-driven cultural transmission discussed above may have operated *among* elite groups. These groups may have been seduced into returning to places where successful rituals were performed, where magic was strong and enduring, or where the work of prestigious carvers in the past enabled a connection to ancestral ties (see also Chapters 4 and 5). In turn, repeated visits to these places, interactions with earlier figures, conformity to inherited norms, and adherence to ancestral traditions could have led to shared rock art styles across the region.

These regional contacts may have formed through the itinerancy of carvers and through interactions among different communities at regional meetings—practices well documented in chiefdom societies. For example, young Abelam apprentices in Papua New Guinea sometimes move to other communities to receive technical training in art-making, coming into contact with artists from distant villages and a wide range of artistic styles (Forge 1967, 116–117). Similarly, Senufo carvers from different parts of Côte d'Ivoire can travel several hundred kilometers to meet and perform with their masks in communal funeral celebrations (Förster 2013, 331–332). In a Nordic context, carvers may have exchanged information through regional networks and gatherings that appear to have existed in southern Scandinavia (Horn *et al.* 2024). And given the coastal distribution of most large panels and our current knowledge of the maritime activities of Bronze Age communities, these gatherings were likely maritime aggregation events in which some groups arrived at the sites by boat (Ling 2008, 117–120).

Carvers could have used these events as platforms to exchange knowledge, observe techniques, or copy styles—similar to what has recently been proposed for metalsmiths (Melheim and Nørgaard 2025, 188). Such interactions could, in turn, have encouraged the development of pictorial representations intelligible to outsiders and of shared regional styles (Granito *et al.* 2022). Moreover, if these contacts occurred in ritual contexts—as previous chapters suggest—they would have helped stabilize cultural conventions, strengthen group identity, and reinforced social roles (Henrich 2009; Whitehouse 2025).

Given its importance as a major center of rock art production in southern Scandinavia, Aspeberget is clearly a place where gatherings and rituals must have taken place (*cf.* Ling 2008, 120). Yet the lack of other archaeological material on the hill remains puzzling (Bengtsson and Ling 2007, 49). Although the absence of vegetation and soil around the panels would have hindered preservation, gatherings of this scale should have left traces of activities commonly linked to Bronze Age ritual performance, such as feasting (Bengtsson 2010, 128), boatbuilding and launching

(Ling *et al.* 2024b, 793), or the casting and distribution of metal objects (Melheim 2018, 72). At the same time, the carving of small panels and simple figures in such an important place still requires further explanation.

Although small panels may have been carved in the same context as large ones, what we see today is perhaps the layered outcome of different ritual activities. Combining findings from this and previous chapters, we can conclude that differences in the number of figures cannot be explained by different production rates (Chapter 4), geological or topographical variations (Chapter 5), landscape location (Chapters 5 and 6), thematic similarities (Chapter 6), or compositional links (Chapter 6). Instead, these differences seem related to the significance of the ritual activities performed at each site and carving event. In other words, carvers may have used panels as settings for ritual practices of varying *importance*, even when those rituals involved carving similar figures.

The recurrent presence of ships on many small panels scattered across the landscape points to small-scale ritual practices associated with boatbuilding and launching, typically performed before sailing expeditions (*cf.* Ling 2008, 239–240; Moyano Di Carlo 2018, 73–82). Large panels, in contrast, may reflect large-scale maritime aggregation events that brought together people from different parts of Bohuslän or even southern Scandinavia (*cf.* Ling 2008, 117–120; Melheim and Ling 2017, 68–71; Melheim and Sand-Eriksen 2020, 90; Ling *et al.* 2022, 63). Therefore, there may be no single cause for all carving events, but a shared attitude towards the world expressed differently according to the social setting in which carvers performed (*cf.* Fahlander 2024, 154–155).

In all these settings, carvers would have played a key role in mediating traditions, artistic styles, and ritual practices. Whether enacted in small-scale settings or large gatherings, such mediation would have shaped knowledge transmission between carvers and the development of similar behavioral traits. The following chapter investigates the morphological variability of the figures to identify these traits and the carvers who produced them.

Chapter 7

Tracing the carvers

Chapters 3 and 4 showed how carvers preserved and transmitted the ancestral traditions associated with rock art by reworking earlier figures and maintaining old panels for new generations. Chapters 5 and 6 then suggested that carvers developed this shared knowledge through social learning during small-scale maritime activities and large regional gatherings. This chapter explores the learning strategies they may have used to build this knowledge and how those strategies shaped the morphological variation of the figures.

Introduction

Recent rock art research has emphasized the role of rock art in transmitting cultural information across generations, offering valuable insights into how artists learned to carve, exchanged information, improved technical skills, and developed shared artistic styles (*e.g.*, Zubieta 2022). Nordic Bronze Age scholars have often framed discussions on knowledge transmission, learning practices, and specialization through the concept of "workshop", especially in studies of metalwork (*e.g.*, Sörman 2017; Nørgaard 2018). Applied to rock art, scholars usually assume that the greater the technical or morphological similarity between figures, the higher the probability they were made by the same carver or carvers that worked together (*e.g.*, Bengtsson 2002, 57–58; Kristiansen 2002, 68–69; Ling 2008, 140; Horn and Potter 2018, 378). However, the concept of workshop is not entirely suitable for rock art because it can refer to both a group of workers and the place where they worked (Claridge 2015, 112–113). Since placing carvings was determined by the rocks' natural positions, linking the activity to a fixed physical location is counterintuitive. Instead, the work of a specific group of carvers should be analyzed through traces of their craft and how these traces vary geographically (*cf.* Nørgaard 2018, 1).

Some authors have analyzed these variations through Lave and Wenger's (1991) concept of "community of practice" (*e.g.*, Nørgaard 2018). Although originally developed for modern societies, the concept offers a useful framework for examining the social dynamics that foster cultural transmission within and between groups. Briefly put, communities of practice are groups of people organized through formal or informal structures who share an interest and commitment to a given domain

of practice. As members participate, engage, and learn—whether intentionally or *unintentionally*—they build a shared repertoire of resources and behaviors that shape their practice. These communities operate within broader "constellations of practices", each addressing a specific aspect of a larger endeavor, and are connected through what Wenger (1998, 104–110) called "boundary objects"—such as artifacts, places, or stories—and "brokers", peripheral members who can engage with these communities without being full participants.

The concept of communities of practice can broaden the long-standing discussions among Scandinavian scholars about carvers and workshops. Although some have questioned whether we can detect individual carvers (Kaul 1998, 125; Tilley 2021, 3–4), several scholars have tried to trace their work. The taxonomic analyses of Mandt (1972), Burenhult (1980), or Malmer (1981) revealed significant typological variation across southern Scandinavia, but they lacked the resolution needed to identify individual carvers or inter-group variation at local scales. Coles (2000, 109) proposed that rock art in Uppland was organized into 11 "social units" produced by individual communities, yet did not discuss in depth how many carvers worked in these communities or how they interacted with one another. And Bengtsson (2002) and Toreld (2016) identified individual carvers in Askum and the Hoghem-Fröstorp area through morphological similarity, concluding that the carvers had limited mobility and mainly worked within their settled areas and nearby surroundings. These studies, however, remain too narrow to assess the work of different carvers in Bohuslän and their potential interactions.

Other researchers proposed that carvers can be identified by examining their carving techniques (*e.g.*, Bengtsson 2002; Horn and Potter 2018). Although several experimental studies have tested potential techniques, they focused on defining the type of technique and tools employed rather than assessing how spatial and temporal variations in technique might reflect learning practices and communities of practice (*e.g.*, von Arbin *et al.* 1995; Vourc'h 2011; Lødøen 2015; Liebl *et al.* 2023; Strifeldt Arntzen 2023). Without quantifying how figures varied over time and space, we cannot estimate which learning strategies were used to acquire technical knowledge, how specialized the activity became, and how these strategies shaped the formation of communities of practice in the region.

This chapter addresses these issues by analyzing morphological variation between figures (see supplementary information for technical details). The analysis has three parts. First, it examines carvers' specialization through metric quantification of a ship on Tossene 73:1. Second, it assesses how carvers learned to carve by analyzing partial figures—figures missing one or more usual attributes—and shape complexity, calculated as the perimeter-area ratio after standardizing shape size and orientation with morphometric methods (see below). Third, investigates stylistic variation through an Elliptical Fourier Analysis of 746 ship outlines. Elliptical Fourier Analysis decomposes the outline of a geometric figure into functions known as harmonics to measure morphological similarity and difference between shapes (Bonhomme *et al.* 2014). To ensure a meaningful stylistic comparison, the analysis includes only complete

ships with the same features—prow and stern extensions, keel extension, stabilizer, and hull—and excludes locking planks and crews. Moreover, because the analysis is based on outlines, the hull's internal features are not compared. Nonetheless, none of these excluded features exhibit patterns indicative of communities of practice (see supplementary information).

Measuring carvers' craftsmanship

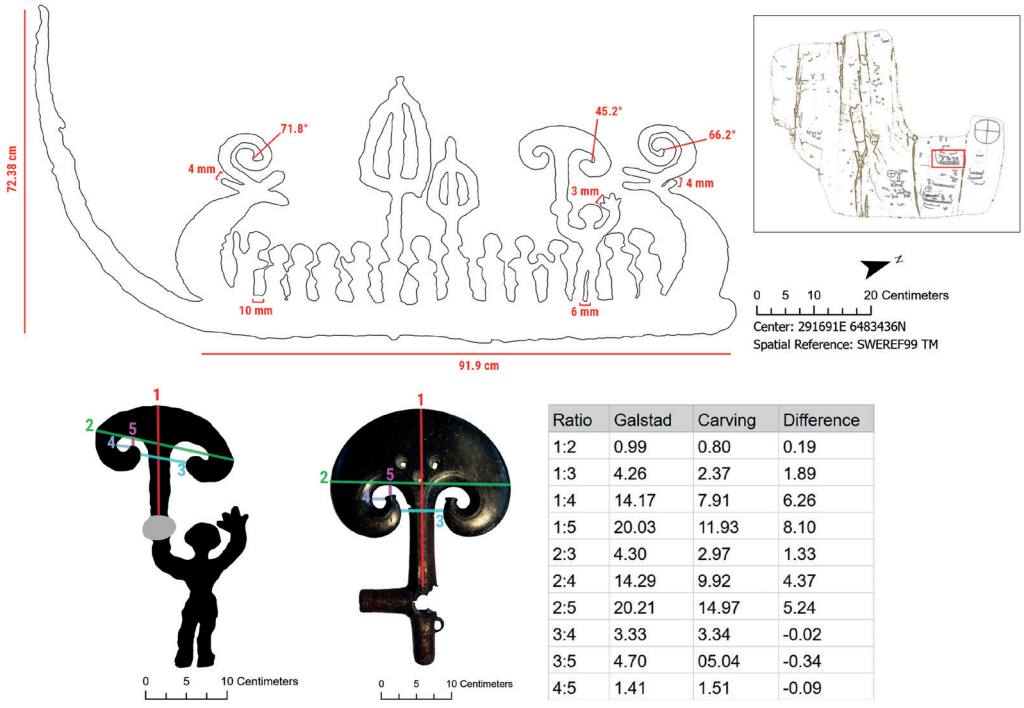
As shown in Chapter 5, carvers needed sophisticated geological knowledge to ensure a successful carving, yet this was only the first of many obstacles. Bohus granite is one of the hardest rocks in Scandinavia, and experimental work indicates that carving was likely a laborious, time-consuming activity. For example, von Arbin and colleagues (1995, 16) required 13 hours of work to carve a shallow 44 × 9-centimeter figure with amphibolite tools and direct percussion. Extrapolating from these results, crafting the largest figures at Aspeberget could have required a carver's full-time work for a couple of weeks. Although our experiments show that bronze tools could have sped up the process and been more efficient for carving small details and sharp edges (Liebl *et al.* 2023), the use of metal tools would have added another layer of complexity and specialization to the activity. Stones could have been collected in the surroundings of the panels and used with little to no modification, while bronze tools would have required a parallel *chaîne opératoire* (*cf.* Nørgaard 2018).

The complexity of these *chaînes opératoires* is crucial in two ways. If carving was time-consuming, carvers would have had to focus on carving at the expense of other social and economic tasks, which would have fallen to others in the community. In other words, increasing specialization in rock art production would have fostered a network of interdependent roles (Chapter 2). Ling and colleagues (2018b, 502–503), for example, have suggested that the shortage of domestic labor driven by this and other related activities may have been compensated with unfree labor. In contrast, if metal tools shortened carving time, specialization would have derived from a different factor. In Scandinavia, metals were imported and probably monopolized by elite groups (Ling *et al.* 2018b, 501–502), suggesting that both the production and use of metal were specialized activities. Whether carvers produced their own bronze tools or received them from others remains unclear (*cf.* Goldhahn 2007), but in both cases the economic and technological complexity of the activity would have been considerable (see also Chapter 8).

Given the complexity of the task, the making of rock art may sometimes have involved multiple people working together—as with bronze production (*cf.* Nørgaard 2018, 292–296). This seems true for the largest and deepest figures, such as the ship carved on Kville 157:1 reaching up to 424 centimeters in length, 4,400 square centimeters in area, and 5,566 cubic centimeters in volume—the latter most likely caused by several re-carving events. Although a single carver could have worked on the figure over a long period, its dimensions suggest the coordinated effort of several individuals.

Not all these individuals had to be expert cavers, but a large ship on Tossene 73:1 shows that some of them could produce small details, complex curves, accurate proportions, and constant distances between grooves (Fig. 7.1). The ship measures 2,332 square centimeters in area and roughly 299 cubic centimeters in volume. If we scale the carving times reported by von Arbin and colleagues (1995) linearly, this ship would have required about 71 hours of work—roughly nine days of full-time labor for a single carver. Even if other tools and techniques had shortened the process, carving a figure of this size would still have been a demanding task.

The figure also shows very elaborate features that demonstrate skill and dedication. The 92-centimeter keel was carved as a clean, straight line with no major deviations. The 72-centimeter vertical keel extension shows striking consistency despite minor irregularities near the middle of the groove (possibly caused by a later update). Its prow and stern extensions were adorned with elaborate horse heads that display four-millimeter-wide mouths and curled muzzles with angles of over 70 degrees.[1] An even more pronounced curve of 45 degrees was needed to depict the ritual axe held by one of the ship's 14 crew members. And the crew members themselves are evenly spaced at roughly one-centimeter intervals.



Ratio	Galstad	Carving	Difference
1:2	0.99	0.80	0.19
1:3	4.26	2.37	1.89
1:4	14.17	7.91	6.26
1:5	20.03	11.93	8.10
2:3	4.30	2.97	1.33
2:4	14.29	9.92	4.37
2:5	20.21	14.97	5.24
3:4	3.33	3.34	-0.02
3:5	4.70	05.04	-0.34
4:5	1.41	1.51	-0.09

Fig. 7.1. Metric analysis of a Phase 4 ship depicted on Tossene 73:1. A) Measurement of features of interest over a high-resolution 3D model, B) Metric comparison of the Galstad axe (Göteborgs stadsmuseum, CC BY 2.5) and the axe wielded by one of the crew members.

If these numbers are not convincing proof of the technical proficiency of the carver or carvers who made this figure, the crew member holding the ritual axe clears all doubt. Unlike the other crew members, this figure stands on the gunwale and includes additional anatomical details, such as legs and a hand with four fingers. The legs are separated by just six millimeters, and the gaps between fingers measure about three millimeters. Furthermore, the axe is an almost perfect replica of the Period V ritual axe from Galstad (Göteborg Stadsmuseum, GAM:47999). That the ratios of various measurements in the Galstad axe closely match those found in the rock art version suggests that carvers had a sophisticated mathematical understanding of scaling and direct access to these objects (Figure 7.1).

Although not all figures show this level of detail, this ship demonstrates that the activity reached a technical sophistication that is hardly achievable by ordinary people without training. Yet no study has detected clear evidence of learning activities on the panels, so where and how carvers gained this knowledge remains unresolved.

Approaching learning practices

The results discussed so far suggest that rock art making was a specialized activity grounded in technical knowledge gained through social learning. Estimating when and how this learning process began, however, is much more difficult. Since the archaeological record provides limited evidence, we can turn to the anthropology of art for some initial insights. Ethnography shows that artists in chiefdom-like societies rarely receive *formal* instruction. Instead, children typically learn by observing and imitating experienced artists, who sometimes are their own parents (*e.g.*, Linton 1941, 45; Forge 1967, 116; Firth 1973, 93; Layton 1991, 221). They usually start by assisting with minor tasks—such as copying patterns under supervision or completing parts started by the experts—until they develop enough knowledge and skill to carry out the tasks independently (*e.g.*, Forge 1967, 117–118; Firth 1973, 95–96). Through this learning process, they not only gain technical skills, tacit knowledge, and stylistic conventions but also grasp, often unconsciously, the meaning of art objects and their function in society (Forge 1979, 117–118).

In a similar vein, novice carvers in Scandinavia may have gradually learned how to identify soft spots in the rock, choose tools and techniques, or perform rituals by observing and imitating experienced carvers. But since observation and imitation do not eliminate the risk of mistakes, one would expect to find some figures with traces of errors. These traces, however, are not evident in the material analyzed in this study, so where carvers practiced remains a mystery.

As shown with runic stones and classical sculpture, learners could have used softer materials to sketch figures, convey ideas, and estimate proportions (Claridge 2015, 110; Kitzler Åhfeldt 2015, 442). In the Nordic Bronze Age, figures nearly identical to those found on rock surfaces appear in other materials, including wood (*e.g.*, Marstrander 1967, 350–352), bronze (*e.g.*, Kaul 1998), and bone (*e.g.*, Frost *et al.* 2019). The softness

and malleability of these materials would have made them ideal for novices, as mistakes could have been easily corrected: wood, bone, or ceramic could be replaced, and metal could be melted down and recast. Mistakes on rock, by contrast, could have only been "erased" by superimposing another figure at the same or greater depth. Therefore, working on wood, bone, ceramic, or metal could not reproduce the challenges of carving granite, so carvers probably learned how to carve *granite* by working directly on granite or similar rocks. If so, the learning process should have left traces on the panels.

The first feature I will consider as a potential trace of learning activities is the rate of partial depiction of the figures. Some scholars have argued that figures were intentionally depicted with different attributes for ritual or narrative purposes (Rédei *et al.* 2020; Horn *et al.* 2022a). Partial figures, for instance, may have been depicted in that way to trigger actions or affect animacies (Fahlander 2020, 209–211). However, our geological research suggests that some figures may have been left unfinished because carvers misjudged the rock's properties (Liebl *et al.* 2023, 122–123). Given that learners would have misjudged more often than experts, partial figures may reflect errors made by carvers who were learning.

Aspeberget, where about 28% of the figures are partial, offers useful data for testing both hypotheses. The rate of partial depiction in figure types with large frequencies (Fig. 7.2a)—those suitable for statistical comparison—is three times higher in ships and humans than in animals (*cf.* Fahlander 2020 for similar results). Since ships and humans were depicted around four and two times more often than animals, the first figure carved by an apprentice was more likely to be a ship or a human than an animal, which could explain the lower number of partial animals. However, even if their absolute *frequency* is lower, the *proportion* of partial animals should approach that of other figure types. Unless apprentices were allowed to carve *only* ships and humans, the differences observed seem too large to be caused by carving errors. Moreover, the rate of partial depiction cannot be explained by geological variation between panels or technological changes between phases, because the percentages of partial figures are similar across panels and phases (Fig. 7.2b and 7.2c). Thus, there is no firm evidence to attribute partial figures to learning practices, and we should conclude that a considerable proportion was intentionally depicted in this manner.

Another way to investigate learning practices in rock art is to examine figure complexity, which may offer insight into carvers' skills. The idea rests on two assumptions: that some individuals were more skillful than others (as shown in many ethnographic studies: *e.g.*, Boas 1927; Biebuyck 1969), and that learners—lacking fully developed technical knowledge—produced, on average, less elaborate figures (Wisher *et al.* 2024). The morphometric analysis of the ship sample mentioned at the beginning of the chapter shows large variation in shape complexity both within and between panels and within and between phases. At Aspeberget, for example, Tanum 12:1 depicts highly detailed figures alongside simpler, roughly crafted ones, and its

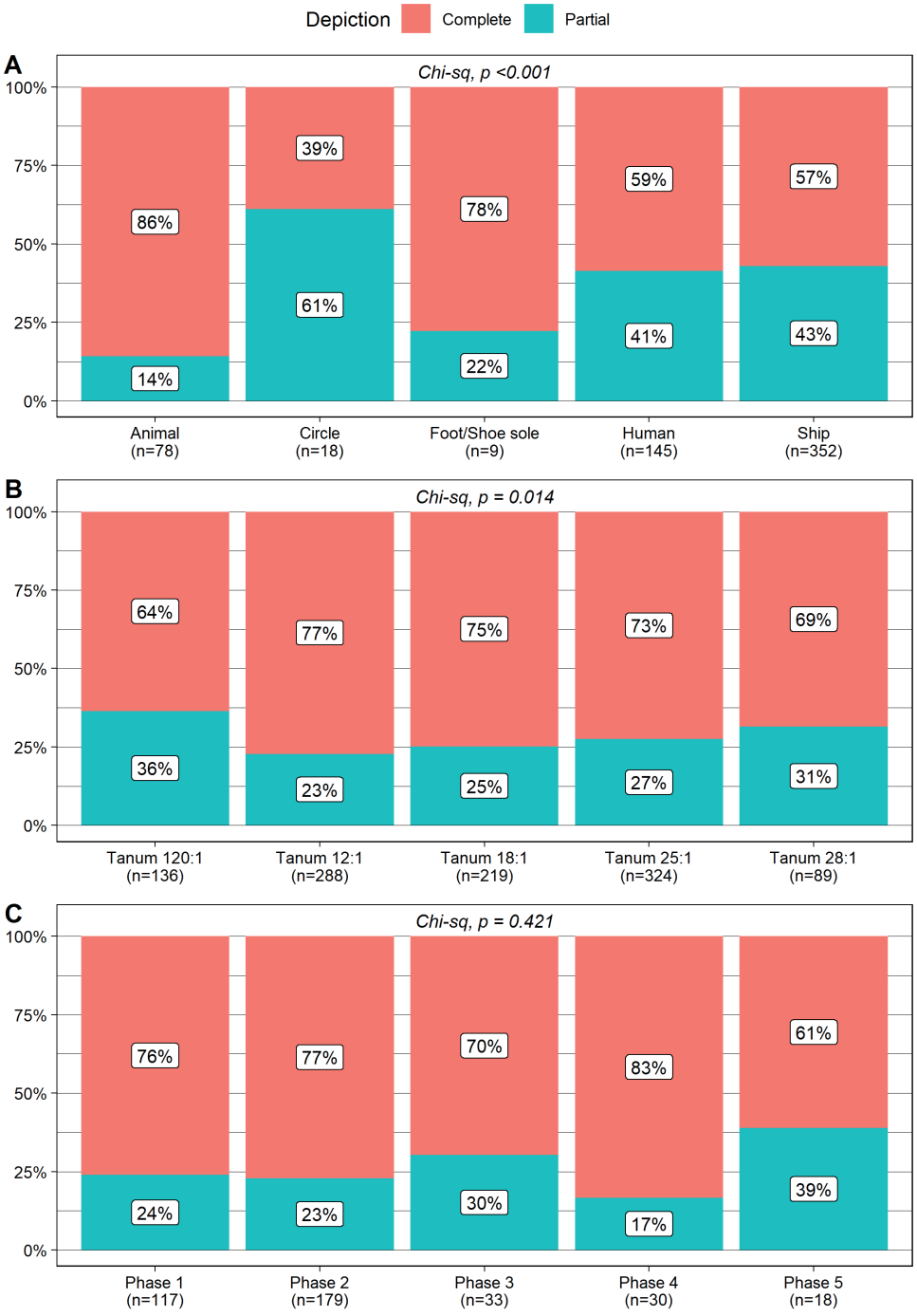


Fig. 7.2. Rate of partial depiction of figures per (A) figure type, (B) panel, and (C) phase. For statistical purposes, only figure types and panels with large frequencies are considered.

overall complexity contrasts with panels like Tanum 119:1, which features few and far less elaborate figures. The key question, however, is whether such differences reflect learning processes, skill variation among experienced individuals, or simply stylistic choices made by the carvers.

Rather than reflecting learning practices, the variation in shape complexity between phases—which peaked in Phase 4 and plunged in Phase 5 (Fig. 7.3a)—illustrates a stylistic shift toward more elaborate figures in the Late Bronze Age and the subsequent loss of complexity in the Early pre-Roman Iron Age (Chapter 3). In contrast, variation *within* phases, which ranges from simple to very elaborate figures (Fig. 7.3a), may indicate differences in skill and hence the work of apprentices. The size of the figures may partially constrain these differences, because larger carvings offer more space to depict details and complex shapes. Since the analysis shows that shape complexity increases exponentially with size (Fig. 7.3b), simpler forms may have been constrained by the mechanical properties of the rock when the figures were small rather than by the carver's skill. Yet figures like the ship on Tossene 73:1 discussed earlier include small details *and* long grooves that posed significant challenges. This suggests that some carvers mastered the techniques needed to depict complex details at multiple scales.

Although these skilled carvers could theoretically have created simple figures for stylistic or ritual purposes, ethnographic evidence shows that artists in chiefdom-like societies create, reinforce, and reproduce their prestigious social positions by displaying artistic dexterity and impressing their audience (Boas 1927, 17–18; Stout 1956, 32; Gell 1994, 46; Hayden *et al.* 2023, 88). Expert carvers would have had little incentive to set aside their technical abilities for purely stylistic reasons, and it is difficult to envision a ritual that would have required figures to be roughly executed. Therefore, given the substantial differences in technical sophistication between figures of similar sizes carved on the same panels, some of the simpler figures could have been made by novice carvers.

That these simpler figures appear on large panels—for example, Tanum 12:1, Tanum 25:1, or Tanum 18:1—suggests that apprentices were not barred from working on panels with high cultural value. However, since the themes and compositions of these panels remained stable throughout the Bronze Age (Chapter 4), their work was likely supervised by experienced peers. The strategies used to supervise apprentices could have been diverse. Beyond imitation, sketching on the surface could have helped learners maintain stylistic conventions (von Arbin *et al.* 1995, 11). Novices may also have hollowed figures outlined by experts, gaining motor skills without jeopardizing the figure's shape. And experienced carvers could have developed standardization techniques, including the use of templates (Kitzler Åhfeldt 2015, 442; Tilley 2021, 99). Regardless of the strategy chosen—imitation, sketching, hollowing, templates, or others—we should find a pattern of similar shapes among carvers who learned together and supervised each other. The following section presents a morphometric analysis that explores this scenario.

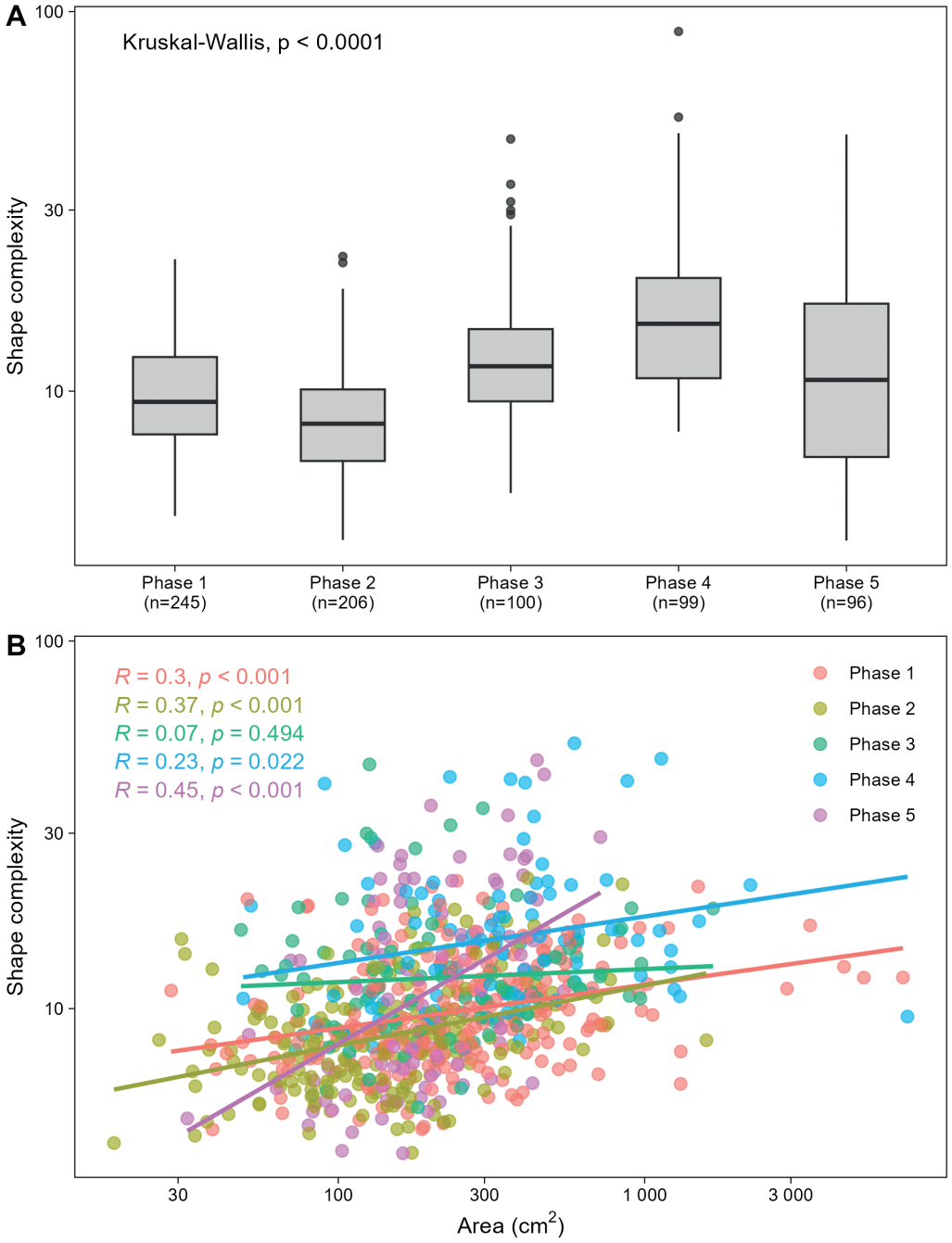


Fig. 7.3. Differences in the morphological complexity of ships within and across phases. A) Frequency distribution of shape complexity per phase (measured as perimeter-to-area ratio after morphometric scaling). B) Association between shape complexity and the size of the figures. Note that some axes are displayed on a logarithmic scale.

Searching for communities of practice

Based on the definition of communities of practice introduced earlier, the learning processes discussed above should have fostered shared practices and resources, including similar tools, techniques, and stylistic choices. If independent groups of carvers coexisted in Bohuslän, their practices should have produced distinct technological and stylistic patterns across the region. This section applies geometric morphometric methods to explore whether the stylistic conventions used to depict ship figures reflect the groups they represented.

As explained at the beginning of the chapter, the morphometric analysis excludes crews and the internal elements of the hull. These features, however, do not seem to reflect any community of practice in the region. The presence or absence of a crew does not correlate with differences in figure shape, geographical location, or chronology. Crewed ships make up around 83% of the analyzed sample and seem evenly distributed across phases and different areas of Bohuslän. Only in Phase 5 does their frequency drop to approximately 57%. Crew size is also consistent, averaging about seven members across phases and areas. However, the distribution is highly skewed, with some ships carrying dozens of crew members (*cf.* Ling 2012).

Regarding the internal features of the hulls, hollowed hulls represent 59% of the sample, followed by outlined hulls (25%) and hulls with strakes/frames[2] (16%). These proportions remain fairly consistent across the region, except in the northernmost part of Bohuslän, where hollowed ships drop below 30%. Their distribution, however, varies markedly by phase. Outlined hulls declined over time, falling from 35% in Phase 1 to 9% in Phase 4, while hollowed hulls became more common during the Late Bronze Age. By Phase 5, the two hull types occurred in roughly equal proportions. As argued before, these variations might reflect shifts in rock art ship style over the Bronze Age and reinforce the idea that some outlined ships from the Early Bronze Age were later hollowed as part of reworking or updates (Chapter 4). However, they do not seem to reveal the stylistic conventions of different groups of carvers in Bohuslän.

Moving on to the analysis of ship outlines, the most significant morphological differences are chronological. As shown in Figure 7.4, the morphometric analysis classifies Early and Late Bronze Age ships well but fails at identifying individual phases within these periods. While ships from Phases 3 and 4 show some morphological differences, the ones from Phases 1, 2, and 5 show higher similarity. Three factors may explain this. First, typological changes occurred gradually and were mediated by transitional periods, making sharp morphological breaks between phases unlikely (Chapter 3). Second, morphometric analyses are not particularly well suited to capturing fine details in shapes, so the analysis is more influenced by the hull outline than by smaller features such as the figurehead, keel extension, or stabilizer—precisely the traits that often allow clearer chronological separation between *succeeding* phases. Third, ships from distant phases may depict similar features. For example, Phase 5 ships featured simple and open prow extensions that resembled the prow

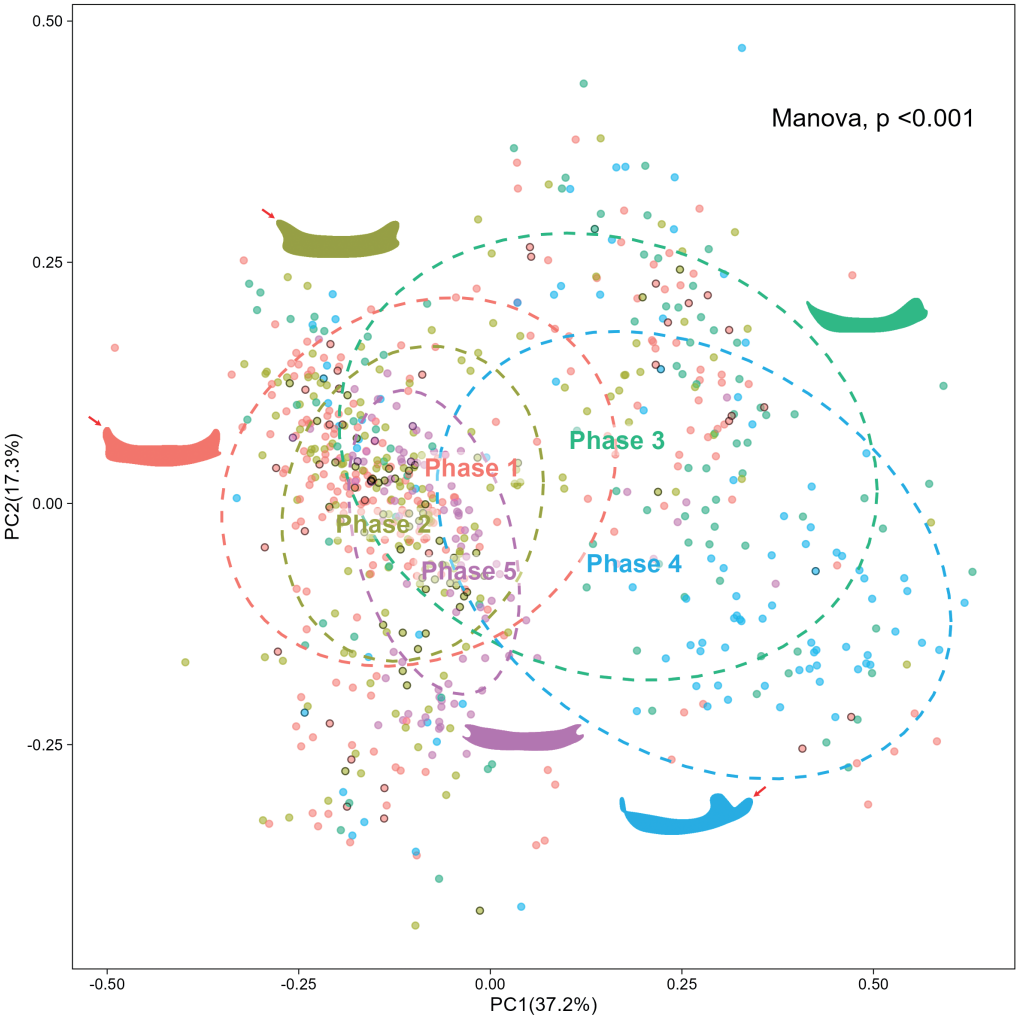


Fig. 7.4. Principal component analysis of morphometric coefficients generated with Elliptical Fourier Analysis in a sample of 703 ships. The first two components account for 55.1% of the variability. Figures are classified by phase. Normal data ellipses calculated at one standard deviation (68.2%). Allometric size correction following Klingenberg (2016). Circles with black outlines represent ships from Aspeberget. Colored outlines represent the median *shape of each phase. Red arrows indicate features of interest in the median shapes.*

extensions of Phase 2 more than the elaborate prows of the Late Bronze Age. Despite these limitations, the results validate several chronological arguments presented in Chapter 3.

The chronological classification, however, does not reveal potential communities of practice in Bohuslän because carvers from the Early and Late Bronze Age obviously did not belong to the same community. If distinct groups of carvers operated in the region

and expressed their practices through different stylistic patterns, those patterns should appear *within* the same phase and, ideally, show some *geographic* pattern. Yet different areas of Bohuslän show no significant morphological differences for the Bronze Age (Fig. 7.5). This is clearly exemplified by the ships sampled at Aspeberget, which exhibit no obvious stylistic differences when compared to ships from other parts of Bohuslän. By contrast, the Early pre-Roman Iron Age (Phase 5) shows a stronger correlation between morphological style and geographical area, with ships from Strömstad and Sotenäs differing significantly from those in Tanum (Fig. 7.5).

This contrast between the lack of geographical clustering in the Bronze Age and its emergence in the Early pre-Roman Iron Age might reflect differences in the morphological variability of the figures. As shown in Figure 7.4, Bronze Age phases show unrecognizable median shapes: the median configuration of a set of outlines that does not necessarily correspond to any single figure but serves as a baseline for comparisons. Although readers familiar with ship chronology may recognize attributes characteristic of these phases—such as the tendency towards inturned prow extensions in Phase 1, everted prow extensions in Phase 2, or larger keel extensions in Phases 3 and 4—these shapes do not resemble any actual carvings. Conversely, the median shape of Phase 5 mirrors the Hjortspring-type ship characteristic of this period. That the median shape is meaningful for Phase 5 but not for Phases 1 to 4 suggests that figures underwent standardization *after* the Bronze Age.

This standardization is further supported by the analysis of disparity by phase, defined as the diversity or spread of the data within the morphospace under analysis (Guillerme 2018). The results show that the diversity of shapes increases over the Bronze Age and then plunges in the transition to Phase 5 (Figure 7.6). Interestingly, this pattern mirrors the chronological trend observed in the analysis of complexity, suggesting that as ship complexity increased throughout the Bronze Age, so did their diversity (compare Figs. 7.3a and 7.6). The next section argues that these results might reveal aspects of the carvers' creativity and the social conventions surrounding their work.

Discussion

As shown at the beginning of this chapter, several studies have attempted to identify the work of individual carvers through stylistic and technological analyses (Burenhult 1980; Bengtsson 2002; Toreld 2016; Horn and Potter 2018). This chapter expanded these approaches in two ways. First, by introducing the concept of communities of practice, shifting the focus from technical aspects to the social processes through which carvers exchanged carving knowledge. Second, by quantifying morphological variation as the primary proxy for identifying potential communities of practice in the region.

Although the results are not conclusive, they provide new insights into how carvers acquired their skills and exchanged information with one another. Variation

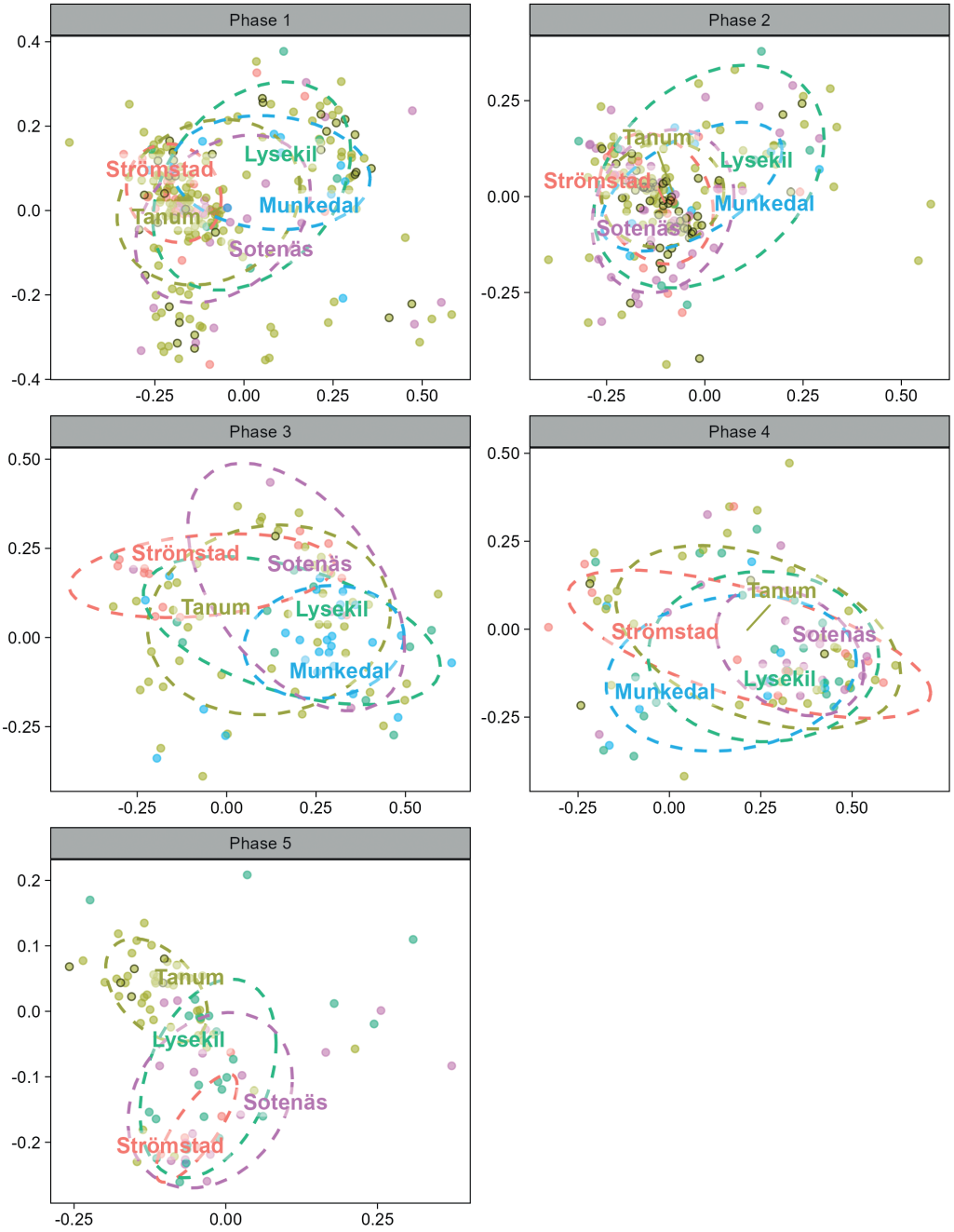


Fig. 7.5. Principal component analysis of morphometric coefficients generated with Elliptical Fourier Analysis in a sample of 703 ships grouped by phase and classified by municipality. Normal data ellipses calculated at one standard deviation (68.2%). Allometric size correction following Klingenberg (2016). Circles with black outlines represent the cases from Aspeberget.

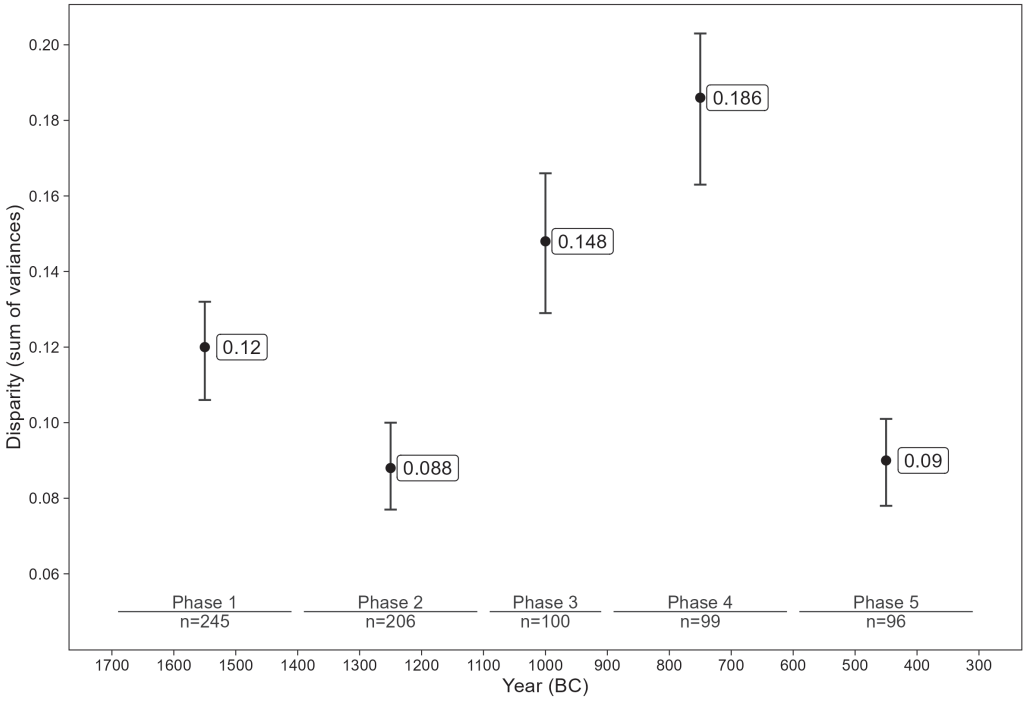


Fig. 7.6. Variation in ship outlines within each phase (Guillerme 2018). The plot shows how much the morphometric measurements differ among ships in each phase, with lower values indicating greater standardization. Confidence intervals at 95% after 1,000 bootstrapped samples.

in figure complexity suggests that carvers with different levels of expertise worked on the same panels and that some of the less elaborate figures may have been made by apprentices lacking fully developed technical experience. Given the lack of obvious mistakes, these apprentices seem to have learned through observation and secondary tasks under the supervision of experienced peers. Metric analysis shows that the work of these experienced carvers reached a high level of sophistication and specialization, likely requiring substantial labor and cooperation. However, despite what might be expected in such a learning environment, the analysis shows no clear evidence of distinct communities of practice in Bohuslän. Except for Phase 5 ships, this seems to result from a general lack of standardization in carving.

The lack of geographical patterns and standardized practices may be explained by three factors: the material properties of the rocks, the regional interaction among carvers, and the social conventions governing rock art making. The lack of standardization may be partially explained by geology, as Bohus granite is a very hard material that varies in its geological characteristics both between and within panels (Liebl *et al.* 2023). Every carving project was therefore constrained by the

properties of the chosen piece of rock, leading to variations in shape even when figures were produced by the same carver using the same tools and techniques. Yet if the morphological variability was caused mainly by rock properties, panels with favorable geological conditions should show lower variation—something we do not observe in the data (Liebl *et al.* 2023). This is evident in the Phase 5 figures, which show greater standardization even when produced under the same geological conditions. Unless the introduction of iron tools during this phase provided a technical advantage in carving granite, Phase 5 figures demonstrate that standardization was not solely linked to rock properties. Part of the observed morphological variability must therefore reflect conscious choices made by the carvers.

The absence of geographical patterns may instead reflect regional mobility. As shown in some ethnographic examples, artists can produce art outside their local regions or collaborate with artists from other communities in meeting places (Forge 1967, 116–117; Förster 2013, 331–332). If similar practices occurred in Bohuslän, the styles of different carvers would have mixed on the same panels, and similar figures would not have clustered in specific areas. However, high degrees of regional mobility cloud blur *geographic* patterns, but personal styles should still show significant *morphological* differences—differences that are absent in our data. The only scenario that would explain the lack of *both* geographic and morphological variation is one in which itinerancy and imitation among carvers led to stylistic convergence across the region (*cf.* Granito *et al.* 2022).

Although regional mobility may have contributed to thematic convergence (see Chapters 6 and 8), it does not seem to explain the morphological variability of the figures. The lack of clear morphological clusters does not reflect shared styles across Bohuslän but large variations in how carvers crafted figures. I think the key factor behind this variation is the social conventions that governed the formal attributes of the figures. This and previous studies assumed that similar figures—either in style or in technical execution—were more likely to have been made by the same individual (*e.g.*, Bengtsson 2002, 57–58; Kristiansen 2002, 68–69; Ling 2008, 140; Horn and Potter 2018, 378). However, for this assumption to hold—and to serve as a reliable tool for detecting communities of practice—carvers would have needed to work in a relatively standardized manner. The results challenge this premise.

Carvers depicted figures within the constraints of the attributes required to represent specific entities—such as boats, humans, or animals—and the artistic conventions governing their depiction. These conventions, however, were likely not equally rigid across all aspects of their performance and the formal attributes of the carvings. Several ethnographic studies show that artists often balance the demands of social conventions with the pressure to perform in ways perceived as virtuous (Boas 1927; Forge 1967; Biebuyck 1969). They can navigate this dilemma because *what* an artwork represents is usually more important than *how* it is depicted, and because some attributes are less constrained by norms. Among the Lega of the Congo, for example, the most important qualities are "the size, material, and gloss

of a piece, and only then its general form and design" (Biebuyck 1969, 14). Because of this flexibility, artists rarely *need* to copy past artworks, their peers, or even their own previous creations (Boas 1927, 156; Linton 1941, 45–46; Forge 1967, 116, 120; Bascom 1969). Although some individuals or groups occasionally copy the artworks of highly regarded artists (Forge 1973, 91), they can choose different styles each time they perform, recombine them in new ways, or express their creativity in parts of the objects that are less susceptible to social judgment (Boas 1927, 157; Forge 1967, 111–112; Bascom 1969; Biebuyck 1969, 18; Firth 1973, 102). The flexibility is such that the look of the final product is sometimes decided during execution (Forge 1973, 94).

In this context, the absence of standardization in Bronze Age figures suggests their *formal attributes*—that is, *how* they were depicted—were less tightly bound to norms and more open to the individual decisions of carvers. This flexibility would have allowed considerable room for personal creativity regarding the *shape* of the figures, including the possibility that a single carver produced multiple versions of the same figure (*cf.* Forge 1973). Furthermore, the high variability in figure complexity suggests that their semantic value outweighed their aesthetic value. In other words, what the figures represented or the function they served was more important than the precision or beauty of their depiction. While aesthetics may have contributed to the social value or prestige of certain carvers and motifs, it does not appear to have been the most important aspect of the phenomenon.

Together with the findings from previous chapters, these results allow us to advance hypotheses about the life history of carvings and the artistic creativity of carvers (Fig. 7.7). The sharp contrast between the morphological heterogeneity of the figures and the homogenous thematic content of the phenomenon (Chapters 3 and 4) suggests that carvers operated between highly regulated stylistic traditions and more freely executed carving practices. This dynamic interplay started with acquiring the tools needed for their work and selecting a suitable rock surface. As discussed in Chapters 4, 5, and 6, this selection was constrained by the proximity to water, the geological properties of the panel, and the presence of earlier carvings. Once chosen, carvers had to decide what to depict on such a surface. Given the limited range of motifs and their remarkable uniformity across time and space (Chapters 3, 4, and 6), they seem to have lacked autonomy in this regard. Instead, these choices were probably dictated by ancestral norms and the cultural expectations of their peers. Carvers then chose a specific place on the rock to carve the figure they had in mind. While this step was partly shaped by geological constraints and the layout of existing figures (Chapters 4, 5, and 6), the wide variety of arrangements suggests that the composition of a panel offered many opportunities for individual expression. Finally, the act of carving itself probably represented the major stage for creativity because, as argued above, neither the mechanical properties of the granite nor the formal attributes of the figures prevented carvers from making individual artistic decisions. This entire sequence—from tool acquisition to execution—was sometimes followed by superimpositions, re-carvings, and updates involving multiple carvers,

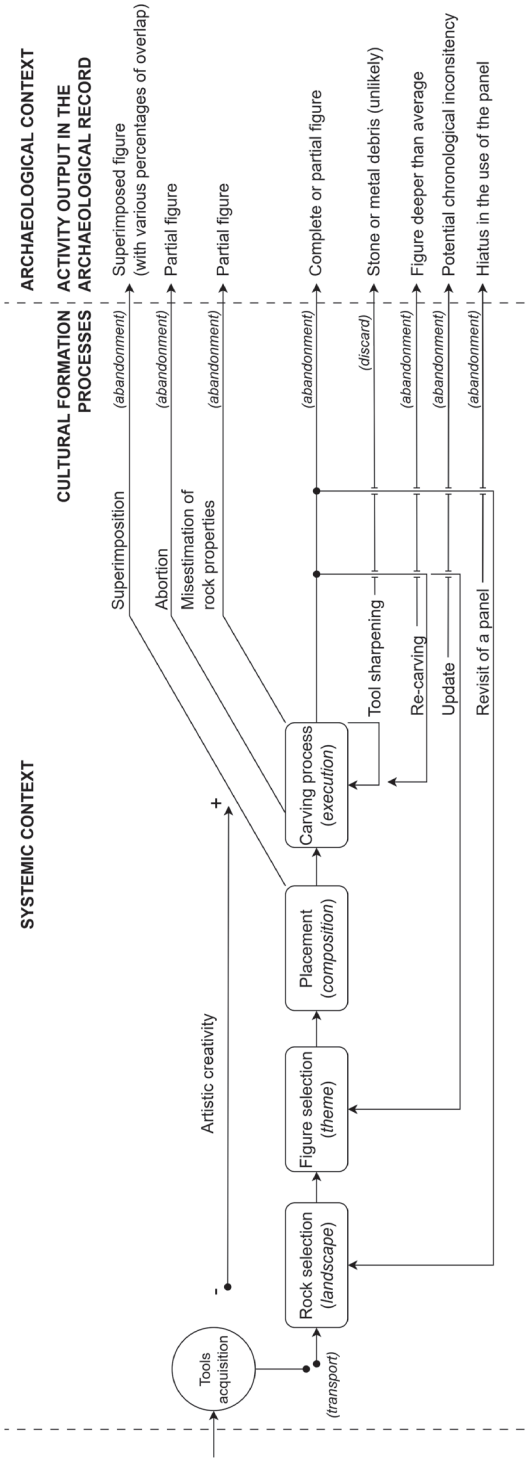


Fig. 7.7. Flow model for rock art petroglyphs in the Nordic Bronze Age in the style of Schiffer (1972). It shows the different activities performed during the life history of carvings and how these activities produced the different types of carvings we see today on the panels.

until carving activity ceased, panels were abandoned, and the figures entered the archaeological record.

In this regard, Nordic Bronze Age carvers seem to have behaved much like artists in other chiefdom-like societies (Boas 1927; Forge 1967; Biebuyck 1969; Layton 1991). When creating art objects, these artists bring their own understanding of the subject, a specific style that reflects their personal preferences, and the technical skills needed to execute the work. However, they are always deeply embedded in their culture, well aware of its values, and committed to meeting the expectations of their peers. As Biebuyck (1969, 11) argued, "the art forms belong to the artist, the meanings belong to the broader community".

Notes

1 The angle was calculated in ArcGIS Pro (v3.4) using the start, mid, and end point coordinates (excluding Z values) of a manually split line derived from figure polygons.

2 This term refers to a series of vertical and/or horizontal lines sometimes depicted inside the hull, which could be interpreted as potential strakes/frames (*cf.* Bengtsson 2025).

Chapter 8

Mastering the rocks

Despite two centuries of research, the demographic characteristics, technical specialization, and social position of rock art carvers in the Nordic Bronze Age remain unclear (Chapter 1). This book set out to clarify these issues by linking role theory with the carvings through the quantification of four dimensions of variability (Chapter 2). The main findings of these analyses show that rock art in Bohuslän developed gradually and remained strongly conservative, likely rooted in ancestral norms and traditions (Chapters 3 and 4). These traditions shaped both the type of figures depicted and their placement in the landscape, typically near water and on rocks with favorable geological properties (Chapter 5). Such rocks served at least two distinct purposes: small panels scattered across the region were likely associated with rituals surrounding the construction and launching of boats, while large and complex panels may have been created during maritime congregations that brought together people from different parts of Bohuslän or even wider Scandinavia. By promoting mobility and interaction, these gatherings may have fostered a consistent style among carvers of different parts of the region (Chapter 6). Carvers seem to have gained the knowledge needed to perform in these social settings through apprenticeship systems guided by experienced peers (Chapter 7). These systems allowed them to develop sophisticated technical skills but also limited their individual creativity, reinforcing the conservative nature of the tradition (Chapter 7).

This chapter combines these results into a final discussion, arguing that rock art in Bronze Age Bohuslän was produced under the patronage of institutions in which carvers played a role as ritual specialists. In support of this interpretation, the chapter revisits the key issues raised regarding the carvers and develops hypotheses about the composition of these institutions, the activities they promoted, and the positions carvers held within them. Importantly, the discussion focuses on how these institutions shaped the role of carvers rather than on the full range of activities they might have fostered.

Identifying institutional practices in Nordic Bronze Age rock art

If we follow Holland-Lulewicz and colleagues (2020, 2) in defining "institutions" as "organizations of people that carry out objectives using regularized practices and

norms, labor, and resources", Nordic Bronze Age rock art shows two features that suggest institutional practice: formality and economic complexity. Holland-Lulewicz and colleagues (2020, 5) define formality as "the reproduction of the same distinctive and specific material or behavioral pattern by repeated practice", and argue that such patterns are more likely to emerge from collective action than individual behavior. This regular behavior is evident in the Nordic Bronze Age, where a remarkably homogeneous cultural expression extends across metalwork styles, burial practices, building traditions, and rock art (Horn *et al.* 2024).

Nordic Bronze Age rock art is especially striking in this regard. Figurative motifs spread unevenly across large parts of southern Scandinavia (Nimura 2016), and their production persisted for more than a millennium without major interruptions (Kaul 1998; Ling 2008, 2013; Mandt and Lødøen 2010; Skoglund 2016). In Bohuslän, for example, boat typology suggests the practice began in Period Ib (*c.* 1600 BC) and lasted at least until the 4th century BC (Chapter 3). Throughout this long temporal span *and* wide geographical extent, the figures exhibit high formalization (Fig. 8.1). This is evident in the gradual and synchronous development of thematic content across panels in southern Scandinavia (Chapter 3) and in their maintenance for centuries without major deviations (Chapter 4). It is also reflected in how carvers from different regions favored similar maritime locations for carving the largest and most complex panels (Chapters 5 and 6), and even in specific depiction choices, such as which figures were superimposed or partially depicted (Chapters 4 and 7).

Such consistent formalization across different temporal and spatial scales is unlikely to have emerged solely from the *independent* actions of dozens of generations of carvers working in a territory of over 565,000 square kilometers. As discussed in Chapter 2, low cultural variation between groups and slow cultural change are more consistent with modes in which few individuals monopolized cultural transmission (Cavalli Sforza *et al.* 1982). Moreover, nearly identical motifs can be found in both rock art and bronze objects (*cf.* Bradley 2015). Such thematic uniformity across artists and materials often reflects controlled and patronized artistic production (Trigger 2003, 547–551).

Another factor pointing to the institutional control of rock art is its economic and technological dimensions. As discussed in Chapters 5 and 7, carving could sometimes be a time-consuming undertaking. Large and deeply cut figures likely required coordinated labor over several days, supported by tools, provisions, and housing. This is especially true if carvers had to travel long distances to carve, because although most locations in Bohuslän were reachable within a day, journeys to other parts of southern Scandinavia would have taken several days (Chapter 6). These journeys would have temporarily reduced the labor available for other tasks in settlements, potentially fostering coordination within and between households. In this context, it seems more plausible that large carving activities were overseen by an institution capable of articulating different roles and mobilizing economic resources.

In addition to labor and coordination, carvers needed tools to carry out their work. Although we still lack direct archaeological evidence of these tools (*cf.* Bengtsson and

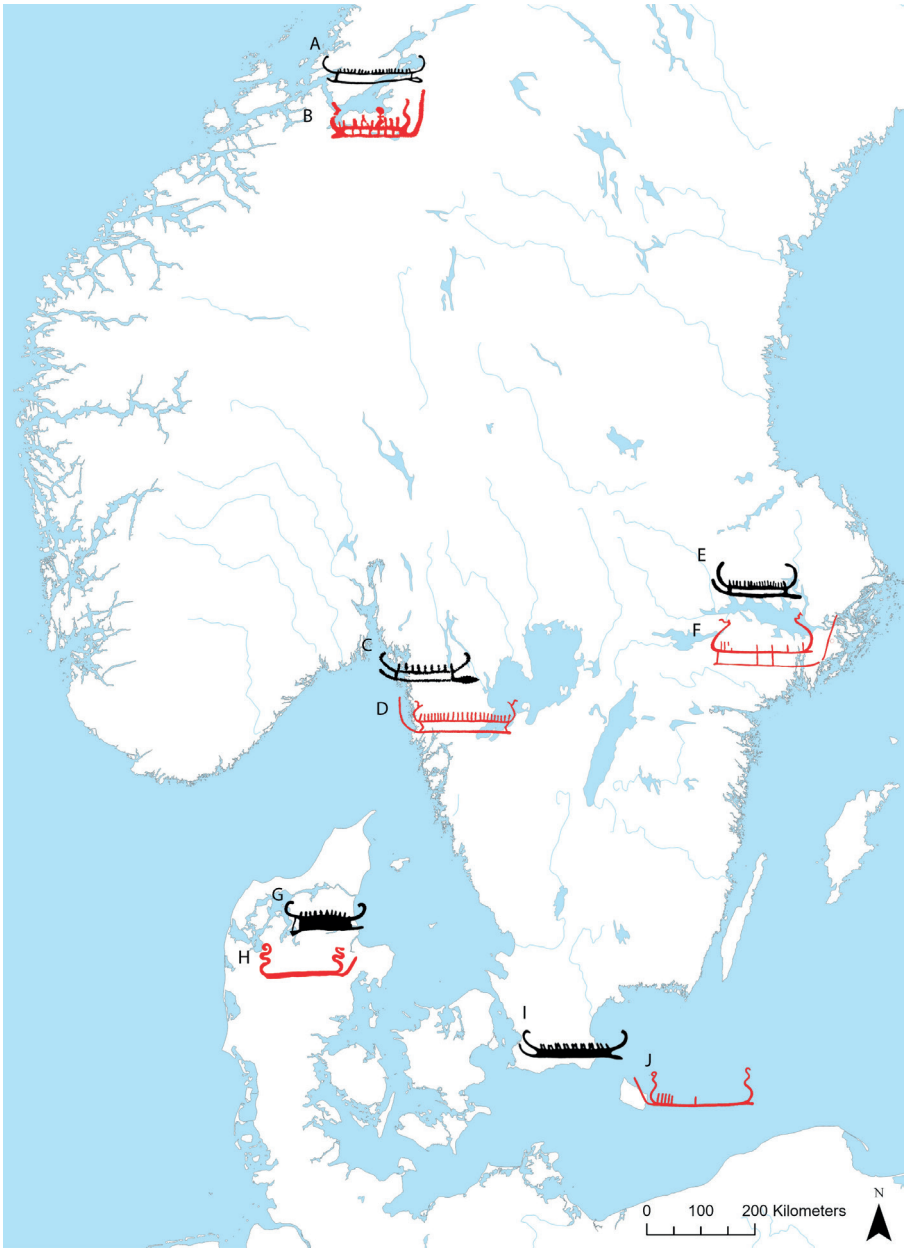


Fig. 8.1. Stylistic similarity between southern Scandinavian ships. Note that between Early (black) and Late Bronze Age (red) ships there is a temporal distance of at least 500 years. A) Hegre VII (after Sognnes 1990, 31), B) Gråbrekk I (after Sognnes 1987, 17), C) Skee 625:1 (Toreld and Andersson 2019a), D) Skee 1524:1 (Toreld and Andersson 2018), E) Boglösa 73:1 (Broström and Ihrestam 2017), F) Villberga 51:1 (Coles n.d.), G) Truehøjgård ship (Kaul 1998, 53.15), H) Gislum razor (after Kaul 1998, 208), I) Simrishamn 23:1 (Burenhult 1972), J) Storlökkebakke Bornholm (after Milstreu 2002).

Ling 2007; Lødøen 2015, 69), they were most likely made of stone or metal (Chapter 7). Experiments on Bohus granite show that stone tools could produce simple figures (von Arbin *et al.* 1995). However, our experiments suggest that carving elaborate, *small-scale* details—such as those found on many of the figures analyzed in this study (Chapter 7)—required pointed metal tools (Liebl *et al.* 2023; Liebl *et al.* forthcoming). This potential reliance on metal tools is crucial because it would have depended on access to bronze, a material that appears to have been monopolized by elite groups during the Bronze Age (Ling *et al.* 2018b, 501–502). Using bronze tools to carve rock would therefore have added an element of exclusivity to the practice, enabling elite forms of prestige display such as conspicuous consumption (sensu Veblen 1912 [1899]).

Defining social institutions through carvings

Although the formal and economic characteristics of rock art in Bohuslän suggest its production was an institutional activity, defining these institutions solely through the analysis of the carvings is challenging. Nevertheless, the spatial and formal variability of the figures offers valuable insights into the potential composition of these institutions and the activities they conducted.

Regarding their composition, this study cannot determine how many carvers worked in the region or how far their activity reached. The spatial analyses in Chapter 6 show that complex panels clustered in specific areas of Bohuslän, but they do not reveal whether one or several groups of carvers worked in these areas (Chapter 7). Even so, producing such large and complex rock art appears to exceed the labor capacity and priorities of the few *individual* households that apparently lived nearby (Horn *et al.* 2024, 16). In this scenario, the activity may have been a joint undertaking by people from different households, forming some type of sodality: a non-kin group organized for a specific purpose and frequently spanning villages or towns (*cf.* Ling *et al.* 2018a).

The thematic homogeneity of rock art across Scandinavia suggests these sodalities operated on a supra-regional scale (Ling *et al.* 2022; Horn *et al.* 2024). Carvers may have used these regional networks to travel and interact with other carvers, familiarizing themselves with their work and adjusting their styles and techniques accordingly (Chapter 6)—much like what has been proposed for Nordic bronzesmiths (Melheim and Nørgaard 2025, 188). Because this study focuses on Bohuslän, it offers limited insight into how these networks functioned, but the mobility of carvers could have been facilitated by local alliances (Horn and Molloy 2025), guest-friendship norms (Kaul 2017), or the confederacies typically created by chiefly institutions (Earle 2021, 4; Kristiansen 2022).

The next question is who joined these sodalities. Certain features of the carvings suggest men dominated these groups. As discussed in Chapter 1, the sex of the carvers has been approached primarily by analyzing sexed attributes in human figures (Mandt 1987; Yates 1994; Skogstrand 2008; Goldhahn and Fuglestvedt 2012; Bevan 2015; Horn 2017). However, we cannot determine which attributes reliably classify figures as male

or female (Fig. 8.2c). And even when we can define such attributes, the depiction of male or female figures does not imply that men or women created them (Yates 1994; Skogstrand 2008; Horn 2017).

Ethnographic studies provide a useful starting point for this discussion. In many chiefdoms, factors such as sex, age, kin, and birthrights shape who acquires certain statuses (*e.g.*, Fortes and Evans-Pritchard 1940; Fried 1967; Service 1975). Artistic activities are usually divided by sex, and even when both men and women create art, they typically specialize in different objects and rarely trespass on each other's domains (*e.g.*, Boas 1927; Linton 1941; Biebuyck 1969). Ritual and ceremonial art, for example, have often fallen under male responsibility (*e.g.*, Boas 1927; Linton 1941; Biebuyck 1969; Layton 1991; Firth 1992). Rock art appears to follow a similar pattern. Although in some societies girls make rock art as part of puberty rituals (Gillette and Greer 2014, 267; Zubieta 2014, 52–56; Whitley 2023, 282), the activity seems predominantly male-dominated (Goldhahn 2007, 105–106; Whitley 2023). This male bias aligns with the themes of Nordic Bronze Age rock art, which center on activities historically and ethnographically associated with men: shipbuilding, sailing, warfare, metalworking, and plowing. Crucially, these activities may have been actual practices that promoted the creation of rock art (Goldhahn 2007; Skoglund 2008; Horn 2018b; Ling *et al.* 2024a). Therefore, the evidence is more consistent with the idea that most carvers were probably men.

Estimating the age at which these men became carvers is more challenging. As argued in Chapter 7, the variation in figure complexity at Aspeberget suggests that novices made some carvings. These apprentices likely learned by observing, imitating, and performing secondary tasks under the guidance of experienced carvers—a learning strategy well documented in chiefdom-like societies (*e.g.*, Forge 1967, 117–118; Firth 1973, 95–96). Through such apprenticeship systems, novice carvers gradually gained the knowledge and skills necessary to assume the role of carver. However, they did not obtain the role simply by carving. While one cannot be a carver without carving figures, carving a figure does not make one a carver—just as ordinary people who created rock art within shamanistic practices did not become shamans (Whitley 2023). Becoming a carver depended, therefore, not only on carving but also on social recognition based on criteria of sex, age, rank, and technical competence.

Given that some societies create rock art in connection with puberty rites (*e.g.*, Zubieta 2014; Whitley 2023), novices may have been recognized as carvers through initiations at a young age, potentially involving the creation of figures (*cf.* Fuglestvedt 1999, 35–36; Ling 2008, 219; Horn 2015b, 39; Nyland and Stebergløkken 2021, 14; Smedberg 2024, 41). In this regard, the frequent depiction of child-sized foot stencils on rock panels provides a plausible material expression of such rites (*e.g.*, Hauptman Wahlgren 2002, 226–277; Goldhahn 2012, 21). Who oversaw these rites, however, is more difficult to know. Although the initiation may have been a collective decision, it is worth noting that some chiefdom-like societies appointed new artists through elite political institutions (Layton 1991, 74).

Having discussed the scope of these sodalities and some characteristics of their members, the next step is to understand why they created rock art. In line with many anthropological studies showing that artistic production in chiefdom-like societies often occurs within ceremonial contexts (*e.g.*, Boas 1927; Linton 1941; Biebuyck 1969; Layton 1991; Firth 1992), ethnographic and archaeological evidence indicate that rock art has always been tied to ritual activities (Whitley 2024). The link between the Nordic Bronze Age and these activities is reflected in the depiction of a narrow range of activities typically charged with ritual symbolism—such as warfare and seafaring (Ling *et al.* 2018a)—and in the presence of similar motifs in graves and on ritual bronze objects (Kaul 1998). Furthermore, Chapters 5 and 7 show that figures were visible only to people standing next to the panels and that simple figures were carved repeatedly on panels of varying sizes and levels of complexity. This pattern suggests that the main purpose of the figures was not representational or aesthetic but performative (Chapter 7). In other words, carving itself served as a ritual act intended to affect both the social and supernatural realms (Cornell and Ling 2013; Fahlander 2024).

Building on insights from the anthropology of art, this interaction with the social and supernatural realm may have been achieved through magic (Gell 1998). In Scandinavia, magic practices were rooted in the long-standing animistic tradition of Mesolithic and Neolithic societies (Herva and Lahelma 2019) and continued to play a significant cosmological role in the Late Iron Age (Gardeła *et al.* 2023). Magic could explain why these groups created rock art and why they depicted specific motifs, because magic can permeate nearly every aspect of social life: love and sex, reproduction, agriculture, navigation, warfare, and more (*e.g.*, Senft 1997). Within this framework, the variety of motifs depicted on the rocks—ships, warriors, chariots, plows, or sex and birth scenes—can all be understood as expressions of the same underlying ritual logic.

Chapters 4, 5, and 6 show that these magical practices were most closely associated with maritime rituality (*cf.* Ling 2008). Ships were not only the most frequently depicted figures at Aspeberget but also the largest and most deeply carved (Chapter 4). Many compositions on the hill centered on these ships, and several generations of carvers deliberately preserved their symbolic importance through repeated re-carvings and updates (Chapter 4). The same maritime emphasis appears in the practice of carving figures on rock surfaces where water naturally flowed and in locations near the Bronze Age shoreline (Chapter 5). As this shoreline receded, rock art production at Aspeberget declined, suggesting a potential link between maritime accessibility and carving activity. This association is further supported by findings in Chapter 6, which show that the most significant rock art hot spots in Bohuslän are in coastal areas with privileged access to bays, fjords, and inlets. Drawing on these results, I argued in Chapter 5 that carvers used rock art to shape a maritime cultural landscape grounded in maritime cosmology and coastal ritual performance (*cf.* Westerdahl 2006; Ling 2008; McNiven and Brady 2012).

Ling and colleagues (2018a, 2020, 2022) have argued that these maritime rituals may have taken place in secluded meeting places where secret societies initiated new members and transmitted the secret knowledge linked to shipbuilding, long-distance sailing, and maritime raids. Although the idea finds support on the ships carved on nearly 90% of figurative panels in Bohuslän, the results suggest that rock art served multiple purposes (Chapter 6). The presence of ships on many small panels scattered across the landscape suggests small-scale ritual practices linked to boatbuilding and launching, rituals that could have been performed only by those involved in these activities. But carvers also created dozens of ships on large panels that seem to reflect large-scale aggregation events bringing together people from across Bohuslän or even southern Scandinavia (*cf.* Ling 2008, 117–120; Melheim and Ling 2017, 68–71; Melheim and Sand-Eriksen 2020, 90; Ling *et al.* 2022, 63). These meetings were likely not limited to the sodalities responsible for producing rock art; they also functioned as *public* events open to other members of the community. Such a scenario is not incompatible with the management of rock art by secret societies—which often organize public ceremonies that attract people from distant places (Hayden 2018, 23–26, 360–361)—but it shows that carvers probably operated in different social settings with specific social expectations.

Reconstructing the specific activities performed during these public meetings remains difficult without additional data. Some ethnographic studies describe maritime gatherings in chiefdom-like societies that involved things like trade, feasts, rituals, weddings, and political negotiations (*e.g.*, Mauss 1966 [1925]; Malinowski 2002 [1922]). Similar events occurred in Scandinavia during the Early and Late Iron Age, when free members of society met to address political and social affairs (Price and Raffield 2024, 54–56). In Sweden, some of these meeting places were close to bodies of water and featured mounds, runestone alignments, and large cemeteries (Price and Raffield 2024, 55). But since excavations around rock art panels in Scandinavia have yielded few material remains (Bengtsson and Ling 2007), the nature of these gatherings during the Bronze Age and their connection to rock art remain open questions that require further investigation.

Understanding the institutional role of carvers

As discussed above, the results support the idea that rock art was created by ritual sodalities embedded within supra-regional networks (*cf.* Ling *et al.* 2022). The primary responsibility of carvers within these sodalities was carving rock art figures, a task that required specialized technical knowledge. Chapter 5 showed that these technical skills were linked to Bohus granite, a hard material with mechanical properties that can vary even within the same panel (Liebl *et al.* 2023, 121–123). Since carvers could not infer these properties from visual cues on the rock surface, they likely learned to detect internal geological variations through social learning, drawing from a pool of geological knowledge accumulated over centuries and transmitted across generations

by experienced peers. This transmission enabled carvers to develop sophisticated technical skills they would hardly have achieved on their own (Chapter 7). Given the complexity of these skills, carvers were most likely rock specialists.

This specialization, however, may have extended beyond the rock. Since rock art making seems to have been embedded in ritual practices, carvers may also have been ritual specialists. In principle, the creation of a rock art figure may have been the collaborative endeavor of a carver and a ritual specialist. Unfortunately, the archaeological record offers no conclusive evidence, and ethnographic parallels support both scenarios: one in which artists perform rituals, and another in which they are primarily artisans. Among the Massim of Papua New Guinea, for example, artisans typically inherit ritual knowledge from previous masters and employ it when performing their work (*e.g.*, Senft 1997, 369). By contrast, communal artworks in some Central African kingdoms are the joint creation of an expert artisan and a ritual specialist—the former crafting the objects and the latter activating their spiritual forces in accordance with normative ritual prescriptions (*e.g.*, Hersak 2010, 40–42).

While both scenarios remain open, the analysis suggests that carvers in the Nordic Bronze Age were also ritual specialists. This is particularly true if, as argued above, the activity was closely tied to magic. Benussi (2019, 2) defines magic as a "set of activities and *technologies* intended to manipulate invisible or immaterial agencies and energies to an advantageous end". As a technology, magic rituals require training in imaginative and affective faculties, spiritual discipline, articulated ceremonies, and ritual knowledge. For example, the rituals associated with rock art activities were probably grounded in knowledge about the specific places where the figures had to be carved and the techniques required for their crafting (Chapters 5 and 7). Furthermore, carving seems to have taken place within a ritual landscape imbued with animacies, animacies that may have lived *inside* the rocks (Lahelma 2010, 52; Whitley 2024, 5). Therefore, the carving process *itself* constituted a direct interaction with the supernatural world, one that was likely mediated by rituals. For these two reasons, carvers should be understood as specialists in a form of "ritual technology": a practice in which their technical skills and ritual behaviors were inseparable (sensu Walker 1995).

Besides their ritual specialization, carvers may have applied the expertise developed in their work to other activities requiring similar skills. Goldhahn (2007), for example, proposed that bronzesmiths—who worked quartz and soapstone when creating molds and crucibles—may also have been capable of producing rock art. This aggregation of tasks is supported by ethnographic evidence showing that artists sometimes perform activities with overlapping technical requirements, such as woodcarvers working both on art objects and canoes (Biebuyck 1969, 6; Layton 1991, 219–220). However, the possibility of occupying multiple technical positions depends on the complexity of the tasks, the time required to gain new knowledge, and the extent to which knowledge can be transferred between domains (Chapter 2).

While both rock art carving and metallurgy involve working with stone, producing rock art required specific knowledge about the internal properties of *granite* and the techniques needed to carve it, knowledge not directly transferable from metallurgical activities. In fact, if we seek fields with closer technical overlap, stone tool makers or other stone workers would provide better comparisons. Yet this line of reasoning risks subordinating rock art to other crafts, as if carving lacked the importance to sustain its own specialists or to influence other economic activities.

This discussion often underestimates the role of social networks in facilitating the circulation of knowledge among different actors, especially when activities operate within an institutional framework. As discussed in Chapter 2, social institutions divide labor into complementary specialized roles and, when needed, aggregate the expertise developed in each of them (Parsons and Shils 1951; Banton 1969). A classic anthropological example is the construction of a sea-going canoe (*masawa*) in the Trobriand Islands, where the owner (*toliwaga*) must gather knowledge and labor distributed among several artisans and magicians (Senft 2016, 246–247). Similarly, Nordic Bronze Age carvers may have relied on such networks to access knowledge from different technical domains without specializing in all of them. Therefore, given that both rock art carving and bronze casting comprised complex know-how (*cf.* Lødøen 2015; Nørgaard 2018), it seems more reasonable to view them as the work of distinct specialists connected through the same institutional framework.

Although carvers likely held specialized roles, this specialization probably did not mean full-time dedication to carving. The low production rate discussed in Chapter 4 suggests that rock art was not created daily, so carvers must have had other occupations. Naturally, they held ascribed positions within their households, which bound them to kin obligations and certain elements of housework. Furthermore, although some ethnographic accounts of chiefdom-like societies note that renowned specialists are sometimes freed from subsistence tasks and supported by other community members (Gamble 2008, 55–57), artists typically work as part-time specialists who sustain themselves through activities like farming, hunting, or fishing (Muensterberger 1950, 8; Firth 1951, 172). Therefore, Nordic carvers likely engaged in the subsistence activities that formed the economic base of the Bronze Age: farming and, to some extent, hunting, gathering, and fishing (Horn *et al.* 2024, 7).

Besides their subsistence work, carvers may also have engaged in activities tied to rock art production. The thematic homogeneity of rock art across Scandinavia suggests that carvers moved and interacted with each other over long distances (Chapters 3 and 6). In this context, they may have joined the maritime trading and raiding expeditions that seem to have occurred across the region (Horn *et al.* 2024). If they took an *active* part in these expeditions, it would be surprising if they lacked basic sailing and fighting skills, so they could also be regarded as sailors and warriors. However, this does not necessarily imply that they held a prominent status in these domains. Their primary role likely remained that of rock art specialists.

Approaching the institutional status of carvers

Building on the argument that carvers were specialists working within sodalities that created and maintained rock art, this section examines their status within such sodalities. As discussed in Chapter 1, scholars have referred to carvers as "druids", "griots", "diviners", "sorcerers", "shamans", "priests", or "chiefs" (Kaul 1998, 16–20; Goldhahn 2002, 56; Kristiansen 2002; Bengtsson 2004, 101; Coles 2005, 12, 120; Fahlander 2024, 126, 130–131; Chacon *et al.* 2025, 124–125). These terms have often been used interchangeably to describe ritual specialists or spiritual leaders. Yet, each label embodies a specific set of attributes and behaviors that, in principle, should have produced *specific* material patterns in the archaeological record (Schiffer 2016). To clarify this discussion, the following paragraphs provide operative definitions of these statuses and assess how they align with the findings of this study. The term "druid" is excluded because it refers to a specific historical context within Celtic culture and largely overlaps with the more general category of "priest".

Starting with the griots, these are troubadours and storytellers in many West African cultures, responsible for preserving the genealogies, historical narratives, and oral traditions of their communities. Given that storytelling is a human universal with a potential adaptive function in human evolution (Smith *et al.* 2017) and given the rich symbolic content of Nordic Bronze Age rock art, some form of social narrative likely accompanied the creation and use of the carvings (Fredell 2003; Ranta *et al.* 2019; Tilley 2021; Horn 2022a; Melheim 2022; Skoglund *et al.* 2022; Lindhé 2025). However, the idea that figures were created *primarily* to tell stories, or that *specific* individuals were charged with such a task, is more doubtful. As discussed in Chapters 5 and 6, the visual properties, arrangement, and association of figures challenge their interpretation as narrative devices. For example, panels across the region display thematic similarity, and their spatial association seems more closely related to chronological factors than to narrative links. Moreover, the long-term additive nature of some panels makes it unlikely that the original links between stories and scenes were preserved over centuries (Chapter 4).

Continuing with the diviner, this figure is usually understood as someone who claims to foresee future events through special abilities, often involving water or minerals. Fahlander (2024, 130–131) has proposed that certain alignments of cupmarks—over which water drains—served hydromantic practices. The widespread connection between rock art and water bodies (Chapter 5), along with the apparent association between cupmarks and water flows (Horn *et al.* 2023, 851), makes the idea of carvers practicing hydromancy (or, why not, geomancy) tempting. Yet Aspeberget lacks such cupmark alignments. Although divinatory practices did not have to be performed at every site, the evidence seems weak for the panels analyzed here. And even if divination occurred, it is unlikely that small-scale societies such as those in Bronze Age Scandinavia supported a *distinct* social status specialized in divination (see below). Therefore, the term "diviner" does not seem to be the most appropriate designation for the carvers.

Turning now to the sorcerer, this status refers to a person who controls and uses malevolent magic to cause harm to others. In Scandinavian rock art, the features that most clearly might suggest these malevolent practices are partial human figures (Fig. 8.2a and 8.2b), because some societies intentionally depict people in this way to injure specific individuals (Sauvet *et al.* 2009, 331). In Chapter 7, I argued that the uneven proportion of partial figures across figure types suggests intentionality. Yet interpreting the rate of partial depiction as sorcery becomes less convincing when we consider the frequent occurrence of partial ships. Although carvers could have used these figures to target the ships of enemies or rivals, ritual practices involving boats are more commonly associated with apotropaic magic—a type of magic intended to ward off harm or evil influences (Moyano Di Carlo 2018, 73–82). Moreover, in his detailed analysis of partial figures, Fahlander (2024, 89) does not interpret partial figures as sorcery. Instead, he proposes that partial figures were used as magical devices intended to affect the supernatural world and to incite other carvers to complete them or take further action. In conclusion, we lack evidence to support the idea that sorcery was a *regular* and *widespread* component of rock art practices.

The next status to consider is that of the shaman, typically defined as an individual who mediates between the community and the supernatural realms through altered states of consciousness. The connection between shamanism and rock art has been documented among both hunter-gather groups (Lewis-Williams 1995; Whitley 1998) and more complex chiefdom-like societies (*e.g.*, Hayward *et al.* 2014; VanPool and VanPool 2021; Harrison-Buck and Freidel 2022; Hayden *et al.* 2023; Chacon *et al.* 2025). In Scandinavia, shamanic practices seem to have extended from the Mesolithic into at least the Late Iron Age (Herva and Lahelma 2019; Gardeła *et al.* 2023), and several authors have linked the creation of hunter-gatherer rock art to such practices (*e.g.*, Goldhahn 2002; Berg 2005; Gjerde 2010; Herva and Lahelma 2019). Although some Bronze Age graves have been interpreted as burials of ritual specialists potentially linked to shamanism (Varberg 2023), it remains unclear whether shamans created Bronze Age rock art.

The shaman is a good candidate for Nordic Bronze Age carvers because the role encompasses many of the practices discussed above. Shamans often combine healing practices with divination (Singh 2025, 56). They can also be considered storytellers, as they frequently recount their trance experiences and spiritual journeys (Stépanoff 2025, 80–82, 130, 152). And although their role usually contrasts with that of a sorcerer, many Indigenous societies fear their ability to control supernatural forces and cause harm or disease (Whitley 2023, 283; Chacon *et al.* 2025, 119–121; Singh 2025, 211). Unlike the previously discussed challenges of combining multiple *technical* roles, shamans could integrate these practices because they all drew on magical knowledge. This makes the shaman a more plausible candidate for encompassing multiple ritual functions within Nordic Bronze Age society, including rock art making. However, inferring these practices from the carvings is highly challenging.

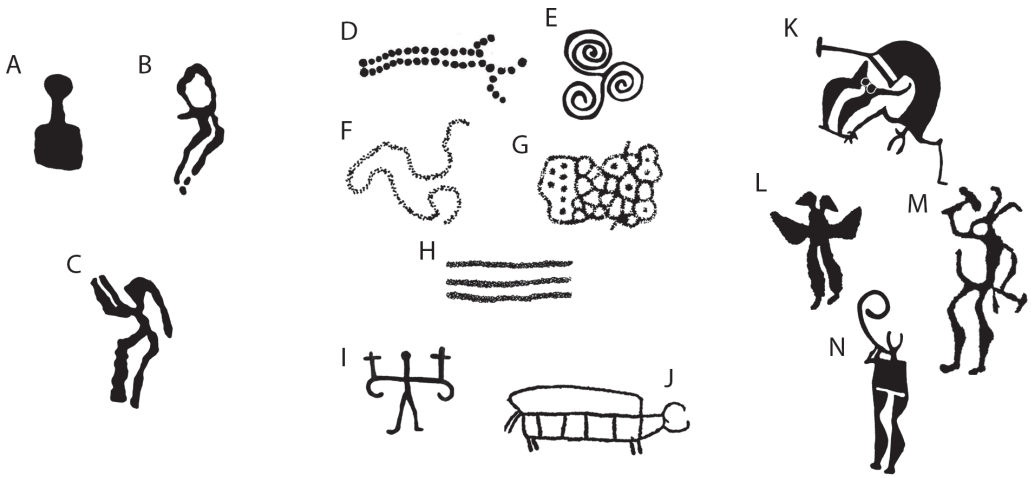


Fig. 8.2. Examples of figures mentioned in the text to discuss partial and sexed figures (left), potential entoptic images (center), and potential portrayals of shamanic practices (right). A) Tanum 18:1, B) Tanum 12:1, C) Tanum 12:1, D) Tanum 66:1, E) Tanum 18:1, F) Svarteborg 596:1 (Andersson and Toreld 2012a), G) Tanum 208:1 (Andersson and Toreld 2016b), H) Tanum 487:2 (Andersson and Toreld 2014), I) Askum 57:1 (Broström and Ihrestam 1997), J) Tanum 311:1, K) Tossene 63:2 (Broström and Ihrestam 2001), L) Bottna 88:1 (after Evers 1970), M) Tanum 321:1 (after Larsen 1982), N) Tanum 248:1. Images not referenced were produced by the author.

The first feature of Nordic Bronze Age rock art that may relate to shamanic activities is the presence of figures resembling entoptic images. Although the link between rock art and entoptic images has sparked controversy (see Lewis-Williams and Dowson 1988; Whitley 1998), these motifs are among the few features that can reasonably link shamanism with rock art traditions without ethnohistorical sources. In Nordic Bronze Age rock art, some arrangements of cupmarks, spirals, geometric figures, or hybrid motifs could reflect entopic experiences or hallucinations, but they are not the most characteristic motifs of Nordic Bronze Age rock art (Fig. 8.2d to 8.2j). As shown in Chapters 4 and 6, most figures, including the largest and most complex, display a degree of naturalism that is less compatible with this type of phenomenon. This is particularly true for Phase 5, where figures show greater standardization (Chapter 7).

The second feature that may link Nordic Bronze Age rock art with shamanism is the depiction of shamanic scenes. Whitley (1998, 31–32), for example, suggested that shamans created rock art as a mnemonic device to recall trance journeys and dreams (see also Gjerde 2010). Since shamanic activities are usually rich in symbolism and often involve distinctive outfits, music, and dance (*e.g.*, Hayden 2018, 45; Singh 2025, 104), one may be tempted to interpret scenes of salient humans dancing, playing music, or wearing paraphernalia and animal costumes as depictions of shamans (Fig. 8.2k to 8.2n). At Aspeberget, however, these motifs are rare and do not play a central role in the compositions—likely because such motifs were more common during the

Late Bronze Age, when carving activity at Aspeberget declined. Therefore, the idea that some figures represent shamanic practices cannot account for the compositions observed at such an important place as Aspeberget, nor for most of the image repertoire depicted during the Early Bronze Age.

Even if shamans were involved in making the carvings, we still need to determine what *type* of shamanism they practiced. As a near-universal phenomenon, shamanism takes various forms. Stépanoff's (2025) studies in North Asia and America, for instance, distinguish between informal, "self-made" shamans operating in heterarchical contexts and more formalized, hierarchical practices in which the status of the shaman was inherited, rituals were liturgical, and practitioners were closely tied to political power. Given the apparent institutionalization of the activity, the making of Nordic Bronze Age rock art would align more with this hierarchical form of shamanism than with the traditional shamanic rock art described by Lewis-Williams (1995) or Whitley (1998). Interestingly, these hierarchical shamans have been described as approaching a form of "priesthood" (Chacon *et al.* 2025, 117), which resonates with other interpretations linking rock art creation to priestly figures (Kaul 1998, 16–20).

Priests have historically operated within organized religious systems, serving as intermediaries between the divine and the community. Unlike shamans, they have more institutional authority and access to the spiritual world, and their training is typically more formal. Such a role would have been more plausible in an organized and institutionalized religious system (Kaul 1998; Kristiansen and Larsson 2005). However, the nature, arrangement, and temporal dynamics of the figures at Aspeberget speak more of ancestor worship and maritime cosmology than a cult of specific deities (Chapters 4 and 5). Moreover, the spatial distribution of the panels, their thematic content, and the constant transformation of some figures seem inconsistent with a liturgical religious practice centered on the depiction of gods (Horn and Potter 2018, 379; Horn 2022a, 139).

Finally, the characteristics of the carvings do not suggest that chiefs were *directly* involved in creating rock art, as Kristiansen (2002) proposed. Given the specialization of the activity, it seems unlikely that chiefs mastered the skills of carving while also fulfilling the social and political obligations of their office. Although chiefs are often intertwined with ritual and artistic affairs, their role typically involves commissioning, overseeing, and ritually sanctioning art production rather than crafting the artworks themselves (Layton 1991; Hayden 2018). Therefore, if chiefly institutions existed in Bronze Age Bohuslän, their main role was likely to guide and shape the work of the carvers (see further discussion below).

As shown above, the evidence linking carvers to any of the statuses discussed in the literature remains limited and inconclusive. Each status contains traits that could relate to carvers' behavior, but none is strongly supported by the analyses (though the shaman appears the most plausible). In the absence of suitable historical or ethnographic parallels, perhaps we should refer to these individuals simply as carvers. This does not mean, however, that nothing can be said about their role within Nordic

Bronze Age society. As discussed in Chapter 2, societies often rank role practitioners by prestige and authority, thereby turning certain individuals into role models whose behavior guides others' actions (Turner 1978; Boyd and Richerson 1985). The results suggest that a similar dynamic occurred among Nordic Bronze Age carvers, who seem to have followed a ranking system in which some individuals held *different* positions and responsibilities.

The evidence for these distinct roles emanates from the spatiotemporal distribution of the carvings. The carvings developed gradually and simultaneously across different parts of Scandinavia, suggesting that the tradition was likely transmitted by a *restricted* number of individuals (Chapters 3 and 4). Figures display considerable variation in the level of detail, with simpler figures likely reflecting the work of less-skilled apprentices under the *supervision* of more experienced carvers (Chapter 7). Many panels were *designed* by additive processes that integrated older figures into new compositions (Chapter 4). And special figures were systematically placed in strategic locations of an apparently *organized* landscape (Chapter 6). Together, these patterns indicate that certain individuals regulated the activity.

Building on this evidence, I propose calling these individuals "master carvers"—individuals who, by achieving a high level of proficiency, gained recognition and assumed a mentoring role within the group (*cf.* Nordén 1925, 143–145; Coles 2005, 9). According to the Oxford English Dictionary (2025), the term "master" carries two main meanings: (a) a person or thing having *control* or authority, and (b) a person *qualified* to teach. Master carvers would have conflated *both* aspects into a role that combined technical and ritual expertise. This expertise would have allowed them to choose carving locations, supervise other carvers, execute figures of special significance, and perhaps officiate at the associated rituals. They may also have been responsible for training apprentices and assistants, ensuring the transmission of skills to new generations of carvers. Decisions about when and what to carve may also have been made by them, although individuals of higher rank, such as chiefs or comparable officeholders, could also have influenced these choices. Given that the activity seems to have taken place in magically charged spaces, master carvers could be regarded as a type of magician. And considering the importance of geology and the sea in the spatiotemporal distribution of the figures, their magical practice appears to have focused primarily on controlling water and stone.

Ethnography offers many examples of masters in artistic and other specialized domains. Among the Nyanga of the Congo or the Marquesas Islanders, for example, master woodcarvers train apprentices and supervise artistic production (*e.g.*, Linton 1941, 45; Biebuyck 1969, 22). These masters are often conceived not as temporary roles tied to the skills of their holders but as enduring offices passed from person to person (*cf.* Goldhahn 2007). Although it is difficult to reconstruct how these statuses were passed down in the past, ethnographic evidence suggests that these individuals were frequently former apprentices of masters, who sometimes were their own parents (*e.g.*, Linton 1941, 45; Forge 1967, 116; Firth 1973, 93; Layton 1991, 221). In this

context, the children of master carvers would have gained early access to rock art knowledge, and sometimes such positions may have developed into family lineages. Yet the results also show that carving was tied to technical and ritual performance, so the status was unlikely to be automatically inherited if these children lacked the necessary proficiency.

Exploring the sociopolitical role of rock art in Bohuslän

This chapter has suggested that carvers—particularly those acting as masters—served as ritual specialists within ritual sodalities. This final section outlines how these roles and institutions fit into the broader sociopolitical organization of Bronze Age Bohuslän. In brief, discussions about Nordic Bronze Age politics oscillate between two positions: one that views these societies as small-scale chiefdoms (*e.g.*, Earle and Kristiansen 2010b), and another arguing that regional communities adopted different coercive or cooperative political strategies depending on the comparative advantages of their local economies (*e.g.*, Austvoll 2020). Horn and colleagues (2024) have argued that these perspectives are not mutually exclusive and that the more hierarchical and coercive societies of Denmark and southern Sweden could have coexisted with more cooperative strategies along the coasts of western Sweden and Norway. For example, the limited agropastoral land in Bohuslän would have fostered a more diversified economy and cooperative social settings (Horn *et al.* 2024, 14).

To situate this study within this debate, we must answer how carvers in Bohuslän organized and managed rock art. Earle (2013, 358) argued that rock art sites were located out in the open and therefore could not have been controlled by religious or political institutions (see also Horn 2022a, 139). Instead, he proposed that individuals carved rocks independently of chiefly authorities (see also Toreld 2016). My results, however, suggest that rock art making in Bohuslän was a restricted and regulated activity. As noted earlier, a long-term, widespread practice driven by multiple independent actors would likely exhibit greater variation in thematic content, formal characteristics, and spatial distribution. On the contrary, rock art in Bohuslän displays a striking "formality" over time (sensu Holland-Lulewicz *et al.* 2020, 5, see above). Across the region, carvers created and *curated* panels by preserving themes, expanding compositions, and re-carving significant figures, actions likely aimed at reproducing and reinforcing their connection with ancestral tradition (Chapter 4). That such practices remained stable for centuries suggests that some form of institution set norms for how carvers had to interact with the rocks.

This institution could have regulated rock art making in different ways. In physical terms, controlling *carving* activities would not have been difficult, considering that carvers in Bohuslän produced about 42 non-figurative and 14 figurative motifs per year on average.[1] Since production was uneven (Chapter 4), the carving of figures—particularly those figurative—likely concentrated in sporadic events that were easier to oversee. Yet the long-term repetition of these events gradually filled the landscape

with panels that became harder to monitor. Physical enclosures could theoretically have restricted access to these panels, but such enclosures are very rare (Bengtsson and Ling 2007, 44). Alternatively, guards could have prevented unauthorized access to rock art panels (*cf.* Hayden *et al.* 2023, 104), but it is hard to imagine individuals guarding the over 3,000 panels that existed in Bohuslän during the Late Bronze Age. These measures, however, were probably unnecessary to preserve the panels. As shown in Chapter 4, the panels show no evidence of figure obliteration, suggesting that norms and taboos may have served as effective controls for both local people and travelers passing through the area. Especially if, as argued previously, the panels were charged with animacy (Chapter 5). For example, some Indigenous societies viewed rock art sites as dangerous places inhabited by spirits that should only be approached by specialists with magical knowledge (Whitley 1998, 29; Hayden *et al.* 2023, 104).

This magical knowledge is, in fact, key to understanding how institutions could have controlled the panels. When conceived as a ritual technology—with its specific tools, knowledge, and ritual behaviors—rock art offered several elements open to regulation. Institutions could have limited access to tools, especially if such tools were made of exotic materials such as bronze. They could have also managed the apprenticeship system and who had access to it. Above all, they may have controlled the technical and ritual knowledge required to carve figures by making that knowledge *esoteric*. As the anthropology of art shows, chiefdom-like societies often use art in esoteric contexts—such as cults, rituals, and initiations—in which artists participate directly (Biebuyck 1969). In some of these societies, ritual institutions control such esoteric knowledge and ritual practices to manage artistic production (Layton 1991; Hayden 2018).

Although several scholars have argued that esoteric knowledge played a role in Nordic Bronze Age rock art (*e.g.*, Bengtsson 2004, 99–100; Goldhahn 2007, 105–106; Ling 2008, 219; Kjeldsen 2017, 101), archaeological evidence for such knowledge remains difficult to identify. Yet the results of this study could support its existence. As shown in Chapter 5, carvers needed to estimate the geological properties of the rocks to carve successfully. Because these properties could not be assessed visually, they had to learn both geological and technical knowledge from other carvers (Liebl *et al.* 2023). Additionally, rock art making seems inseparable from ritual behavior, which likely included ceremonies, formulas, and symbolic offerings. These two domains—technical knowledge and ritual practice—were the main sources of esoteric knowledge that carvers and the institutions behind them could have controlled. In this sense, even if the panels were difficult to control physically, their social control was possible because the creation of rock art rested on a ritual technology grounded in esoteric knowledge.

Importantly, such control was not only possible but also likely *necessary* to maintain the political economy of the region. Consider, for example, the case of watercraft technology. Ling and colleagues (2018b) have argued that political and economic power in the Nordic Bronze Age rested on managing bottlenecks in economic flows.

Institution	Status-set	Role-set
Household	Father, son, husband, etc.	Kinship right and obligations
Farmstead/Village	Farmer, hunter*, fisherman*	To provide family sustenance
Ritual sodality	Carver	To make rock art
	Master carver	To make rock art, to teach and supervise novices, to perform rituals
	Sailor, warrior*	To participate in maritime raids and trade expeditions
Chiefdom*	Follower*	Political right and obligations
Confederacy*	Follower*	Political right and obligations

Fig. 8.3. Tentative model of the role-set of carvers in the Nordic Bronze Age. Asterisks denote a lower level of certainty.

One major bottleneck involved owning boats, monopolizing maritime expeditions, and controlling the wealth they produced. If, as Ling (2008, 240) suggests, building these boats required the performance of apotropaic rituals, then those rituals are an *intrinsic* and *indispensable* part of the boatbuilding process—an interpretation widely supported by ethnography (Moyano Di Carlo 2018, 73–82). Control over maritime expeditions, therefore, depended on building and owning boats, which in turn required control over their associated ritual technology (Moyano Di Carlo 2018, 71–72). Since rock art played a key role in that ritual technology, managing it became essential for regulating economic bottlenecks in the region.

The monopolization of this ritual technology may have enabled elite institutions not only to control rock art making but also to use the carvings as physical instruments to materialize their ideological goals (DeMarrais *et al.* 1996; Hayden 2018). We must remember that artistic expression in chiefdom-like societies is often conservative and designed to express and validate differences in rank, nobility, prestige, gender, or religion (Firth 1951; Lévi-Strauss 1963). Art, therefore, not only reflects the political system in place but also legitimizes and reinforces it (Steward and Faron 1959; Forge 1973; Layton 1991; Hayden 2018). Such strategies would have been especially fruitful if, as argued in Chapter 5, the carvings invoked ancestral traditions, allowing elites to claim ties to the past and reinforce their social authority (Service 1975, 78, 92).

Since rituals are usually perceived as embodying important cultural values (Chapter 2), controlling ritual activities likely granted carvers a prominent role within these political dynamics. By way of illustration, Malinowski (1921, 6; 2016 [1921], 29) noted that artists and magicians occupied an outstanding position among early 19th-century Trobriand chiefdoms because, as the Trobrianders explained, those who control the forces of nature should also control the work of people. In a similar vein, by controlling rock art ritual technology, carvers would have been in a privileged position to acquire, manage, and reproduce esoteric knowledge. This knowledge, in turn, may have been used to aggrandize their social status and that of their peers (Hayden 1995). We can therefore conclude that their position in society was one of prestige and political importance (Fig. 8.3).

Note

1 The calculation considers the 59,331 non-figurative and 19,565 figurative motifs counted for Bohuslän divided by the 1,400 years that these figures may have covered (1700–300 BC).

Chapter 9

Conclusions: the carvers revealed

The question that opened this book was: who were the carvers? Although Scandinavian scholars have long been interested in this question, research has often focused on related issues such as figure chronology, landscape placement, or visual narratives. Consequently, theoretical frameworks have overlooked the issue of social roles and methodological approaches have remained largely qualitative. This study set out to better understand the role of carvers by combining role theory and behavioral archaeology with quantitative analysis of the figures. Together, these approaches provided a theoretical model for exploring the multiple social roles carvers held in the Nordic Bronze Age and an epistemological framework for inferring these roles from rock art patterns. These patterns were detected and analyzed through 3D documentation of panels at Aspeberget, legacy data from Bohuslän, and exploratory data analysis of four dimensions of variability: formal, spatial, quantitative, and associational. The results were then used to assess three major research questions: how carvers acquired their role, how they performed it, and how they transmitted it.

Although the question of how and when carvers acquired their status remains open, the results of Chapters 4 to 7 allow for some hypotheses. Chapters 4, 5, and 6 show that the social rules governing the placement and thematic content of rock art remained stable over time, suggesting that a few individuals regulated the activity (Chapter 2). In addition, the morphometric analyses in Chapter 7 reveal significant variation in figure complexity across panels throughout the Bronze Age. Since this variation does not seem to reflect geological constraints or stylistic choices, it likely reflects different levels of dexterity among carvers, with simpler figures possibly representing the work of novices. Taken together, these findings point to informal apprenticeships in which young individuals observed, copied, and carried out secondary tasks on panels overseen by experienced carvers. Such training allowed these young individuals to gain the knowledge required to be recognized as carvers, likely after completing an initiation (*cf.* Fuglestvedt 1999, 35–36; Ling 2008, 219; Horn 2015, 39; Nyland and Stebergløkken 2021, 14; Smedberg 2024, 41). This initiation, rather than the act of carving itself, conferred carvers their social status (Chapter 8).

Once initiated, carvers worked within the ritual domain. Conceptualizing rock art as ritual technology, I argued that the role of the carver combined water-related magical practices with technical skills for carving granite (Chapters 5 and 8). Given

the complexity of the geological knowledge needed and the levels of sophistication reached in some figures (Chapters 5 and 7), their role was highly specialized (Chapter 8). Although scholars have long interpreted carvers as ritual specialists (*cf.* Kaul 1998; Bengtsson 2004; Coles 2005; Ling *et al.* 2018), this study emphasizes the interplay between ritual and technical practice embedded in that specialization (*cf.* Goldhahn 2007).

As argued in Chapter 8, these ritual specialists seem to have operated within ritual sodalities embedded in supra-regional political networks (*cf.* Ling *et al.* 2018, 2022). As members of these sodalities, they took part in at least two distinct activities. On the one hand, they conducted private, small-scale rituals on panels spread across the landscape in connection with the building and launching of boats. On the other hand, they attended large public gatherings that brought together groups from different parts of Bohuslän and wider Scandinavia, events that encouraged the carving of large, complex panels (Chapters 6 and 8). Given the prominence of ship figures and the coastal location of most panels, these gatherings were closely tied to maritime activities (Chapters 4, 5, and 6). Such maritime congregations facilitated interactions among carvers from different regions, which in turn helped create the thematic homogeneity visible across southern Scandinavia (*cf.* Ling 2008, 117–120; Melheim and Ling 2017, 68–71; Melheim and Sand-Eriksen 2020, 90; Ling *et al.* 2022, 63).

This homogeneity, however, did not permeate every aspect of carvers' work. As discussed in Chapter 7, different stages in the life history of carvings allowed for distinct degrees of artistic creativity. While the choice of carving locations and thematic content seems to have adhered to strict social norms, the composition of panels and the crafting of figures left more room for individual expression. This contrast suggests that Nordic Bronze Age stylistic norms regulated *what* was depicted more than *how* it was portrayed, and that carvers shaped their work according to traditional norms, social setting, carving process, and individual preferences.

Not all carvers, however, enjoyed the same degree of individual freedom (Chapter 8). Through repeated practice and skill development, some individuals—whom I refer to as "master carvers"—gained ranked positions that allowed them to oversee the activity in multiple respects: they decided what and where to carve, officiated rituals and ceremonies, instructed and initiated novices, and monopolized the technical and ritual knowledge associated with the carvings, knowledge that was likely esoteric (*cf.* Bengtsson 2004, 99–100; Goldhahn 2007, 105–106; Ling 2008, 219; Kjeldsen 2017, 101). They also controlled the transmission of this knowledge to future generations and maintained figures and compositions in accordance with ancestral norms, contributing to the conservative nature of rock art in the region and to the formation of a broader Nordic ethos (Chapters 3, 4, 6, and 8).

These findings may interest several groups of researchers. Most directly, they speak to scholars working on Nordic Bronze Age rock art and, more broadly, to those studying the role of artists in prehistory. For the latter scholars, the study offers a theoretical, epistemological, and methodological framework that (with local adjustments) could be reproduced in similar rock art traditions. Beyond rock art

specialists, the results may also appeal to researchers examining the relationship between ritual and secular activities in the Bronze Age, as well as the sociopolitical role of rock art in small-scale hierarchical societies. Additionally, the results may support disciplines concerned with the social dimensions of art, such as the anthropology and sociology of art, by offering insights into how the social dynamics of art production and use have changed over long periods—an aspect often omitted in these disciplines due to methodological constraints. For example, many social dynamics described by anthropologists regarding the social use of art in traditional societies appear to have operated among Nordic Bronze Age communities for centuries.

Readers interested in these topics will find several strengths in this study. The book presents a theoretical and epistemological framework rarely used in rock art research, one that can enrich future theoretical discussions about the role of artists in prehistory. This framework helps clarify how the different roles artists held may have shaped both the stylistic traits of the figures and the broader social function of rock art. The study also offers a clear epistemological and methodological approach for inferring such roles from patterns in material culture, emphasizing the value of cross-cultural comparisons for exploring alternative scenarios of rock art production and the power of quantitative analysis to link such scenarios to archaeological data. This framework can assist researchers who want to shift the analytical focus from technical concerns to the social contexts in which rock art was produced and used.

Another strength of this study lies in its design, which evaluates, compares, and integrates previous interpretations of the role of carvers in Nordic Bronze Age society. Because the study was conceived from the bottom up and relied primarily on numerical analysis, the results allow us to assess which past interpretations are better supported by empirical evidence. In this respect, Aspeberget offers numerous figures, complex compositions, and a wide range of features for evaluating different interpretations and models. In other words, the quantitative data generated by this study provide a "benchmark" that other researchers can use to validate their own interpretations.

Finally, this project has served as a platform for testing how different quantitative techniques can be combined to provide a more comprehensive view of Nordic Bronze Age rock art. These techniques include documenting panels in 3D, systematizing carvings in a geodatabase, and exploring the data using univariate, bivariate, and multivariate statistical methods. The results can guide future researchers studying the phenomenon in deciding which methods to prioritize and how to allocate human and material resources. This methodological approach has also produced a substantial dataset for future research, including 13 new georeferenced 3D models of panels at Aspeberget, digital tracings annotated with quantitative and qualitative information, and a dataset of rock art in Bohuslän with figure frequencies by type across panels (see supplementary information).

Despite these strengths, the generalizability of the results is subject to certain limitations. Although this study sought to mitigate the narrow geographic scope of Aspeberget by incorporating legacy data from Bohuslän, it still cannot provide general conclusions about the role of carvers across Scandinavia. The methodological

approach developed here should therefore be extended to other major rock art clusters in Scandinavia. Incorporating the rock art of Østfold, Norway, would be especially important, as its proximity to Bohuslän suggests it may have been part of a shared regional rock art tradition. Nonetheless, the patterns observed at Aspeberget and Bohuslän seem consistent with broader Scandinavian trends, particularly in themes and landscape distribution.

Time constraints also prevented quantitative analysis of scenes and mobility, both of which pose methodological challenges beyond the scope of this study. Analyzing scenes quantitatively requires a systematic approach to estimating spatial relationships among figures within panels—especially when no clear chronology exists—and linking rock art distribution to mobility patterns requires accurate reconstructions of the paleolandscape and reliable estimates of terrestrial and aquatic movement. While both aspects could provide useful insights into the carvers' role, they were not prioritized because their impact on the overall discussion is arguably lower.

Since the role of the carvers was shaped not only by rock art activities but also by their participation in broader social practices (Chapter 2), this study would also have benefited from incorporating other archaeological features, such as settlements and graves. However, available data on settlements and graves present significant limitations: many settlements lack absolute dates, and many graves have not yet been excavated. Moving in this direction will therefore require a thorough examination of both graves and settlements, including only cases that can be securely dated to the Bronze Age or Early pre-Roman Iron Age. But even without this data, rock art in Bohuslän offers the largest and most comprehensively documented dataset in the region, sufficient on its own to yield reliable and meaningful results.

Finally, the discussion would have benefited from quantitative causal analyses. Considering the wide range of features examined and the coherence of the results across multiple temporal and spatial scales, the study offers a solid first approximation of the causes of the phenomenon. But given the exploratory nature of the work, some interpretations remain hypothetical. Causal inference approaches and simulation techniques could therefore help test and validate these interpretations. The data and results presented in this book provide an ideal foundation for developing such analyses.

Despite its limitations and exploratory nature, this study offers a novel and comprehensive approach to understanding the role of rock art in Nordic Bronze Age societies. The results lead to a central conclusion: the carvings were not merely a byproduct of Nordic Bronze Age beliefs but a fundamental component of the Scandinavian sociopolitical landscape. At the core of this phenomenon stood the carvers—key members of ritual sodalities that, for more than a millennium across southern Scandinavia, produced a remarkably homogeneous cultural expression. Their knowledge, employed and transmitted esoterically, helped reproduce ancestral traditions. Their work, deeply rooted in magical practices associated with water and stone, helped reinforce the ideological order of the time. Far from being peripheral figures, carvers acted as key agents in the ritual machinery of Bronze Age communities in Bohuslän, actively shaping and maintaining their sociopolitical structures.

Appendix

Catalog of panels at Aspeberget

This appendix presents a catalog of chronological tracings for the panels analyzed at Aspeberget. The tracings are based either on 3D models produced by the author or on redrawn versions of earlier documentation. Each figure is color-coded according to its estimated chronology, and only figures that could be assigned to one of the phases discussed in Chapter 3 are included. Figures with only a terminus post or ante quem are marked as "indeterminate" to maintain the readability of the tracings. To check their terminus post and ante quem, see the supplementary information.

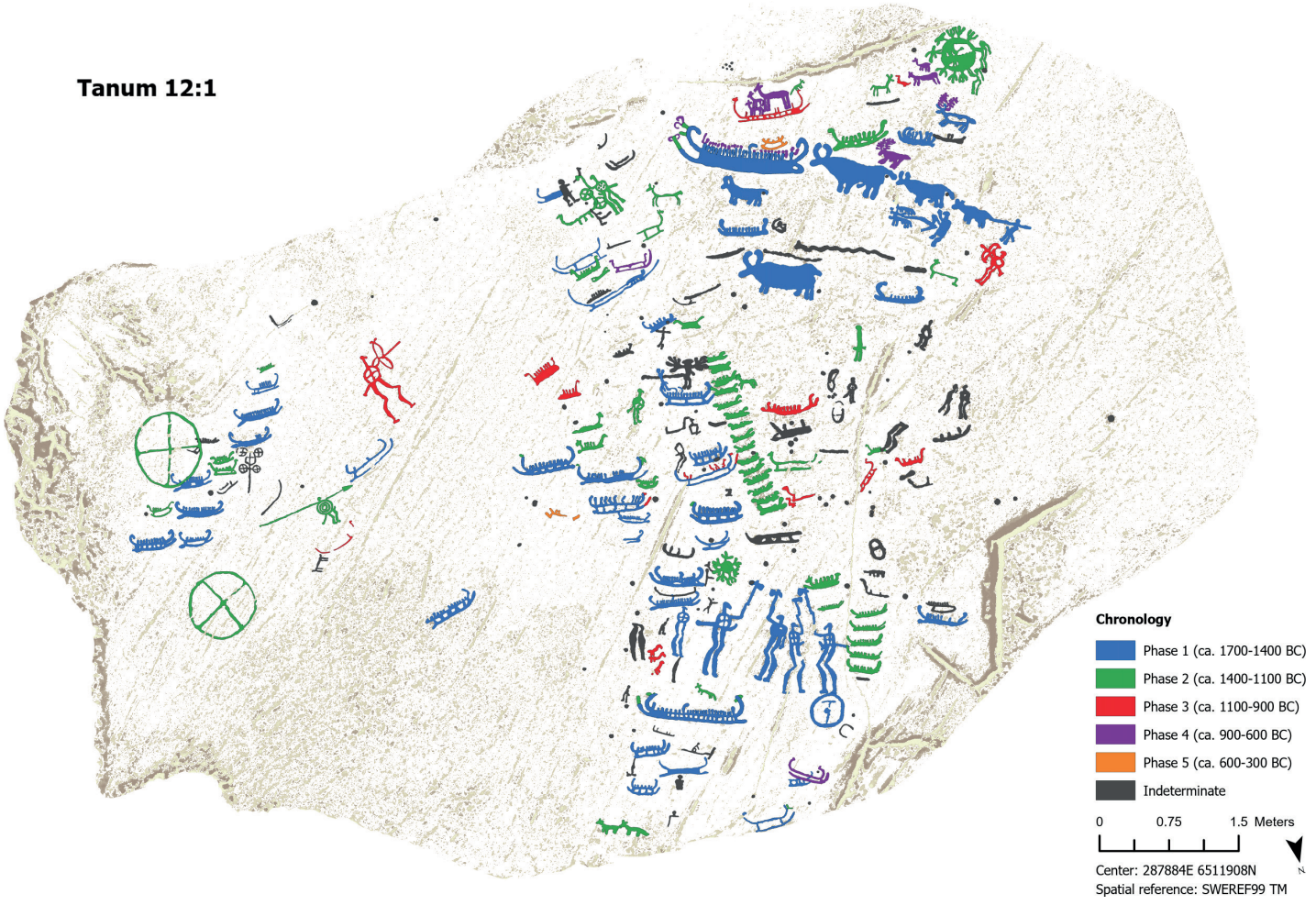


Fig. 10.1. Chronological tracing of Tanum 12:1. Documentation, georeferencing, and drawing by the author.

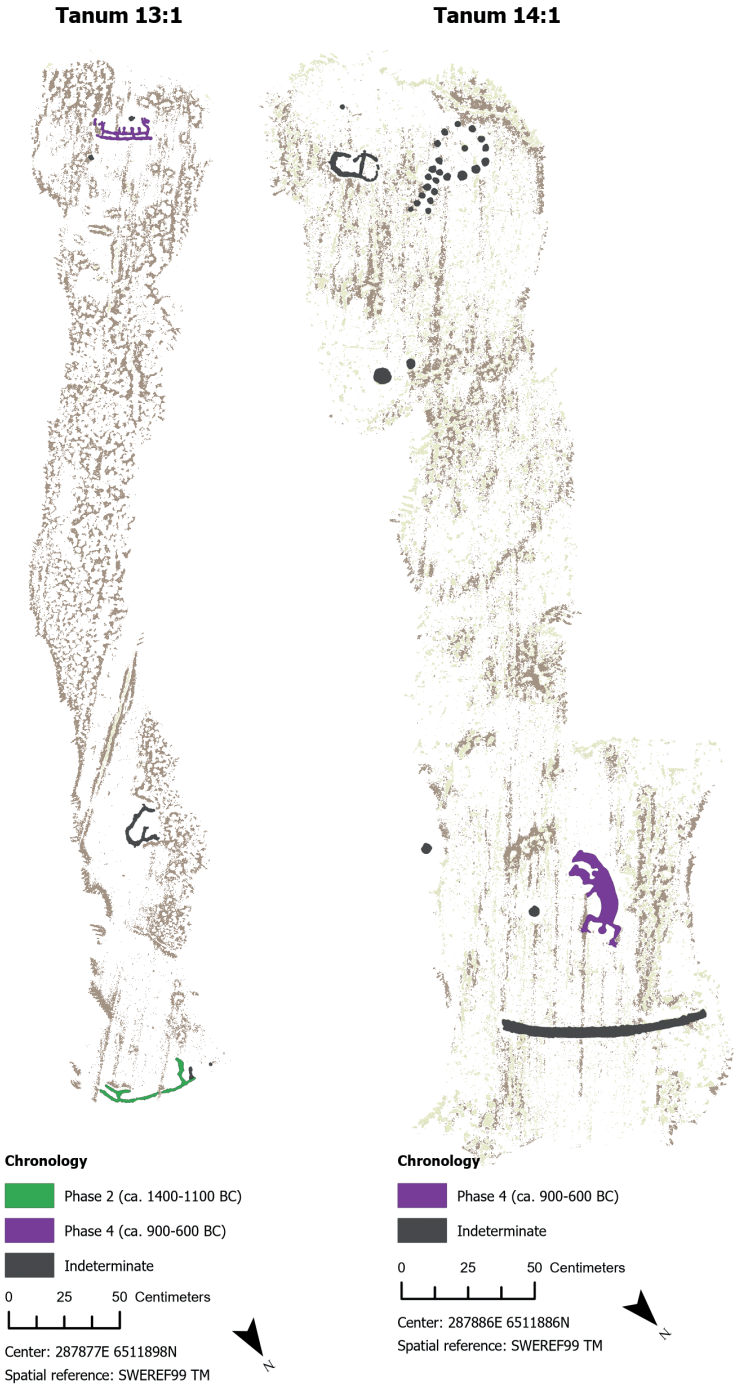


Fig. 10.2. Chronological tracings. Left: Tanum 13:1. Documentation by Zedig (2016g); georeferencing and drawing by the author. Right: Tanum 14:1. Documentation, georeferencing, and drawing by the author.

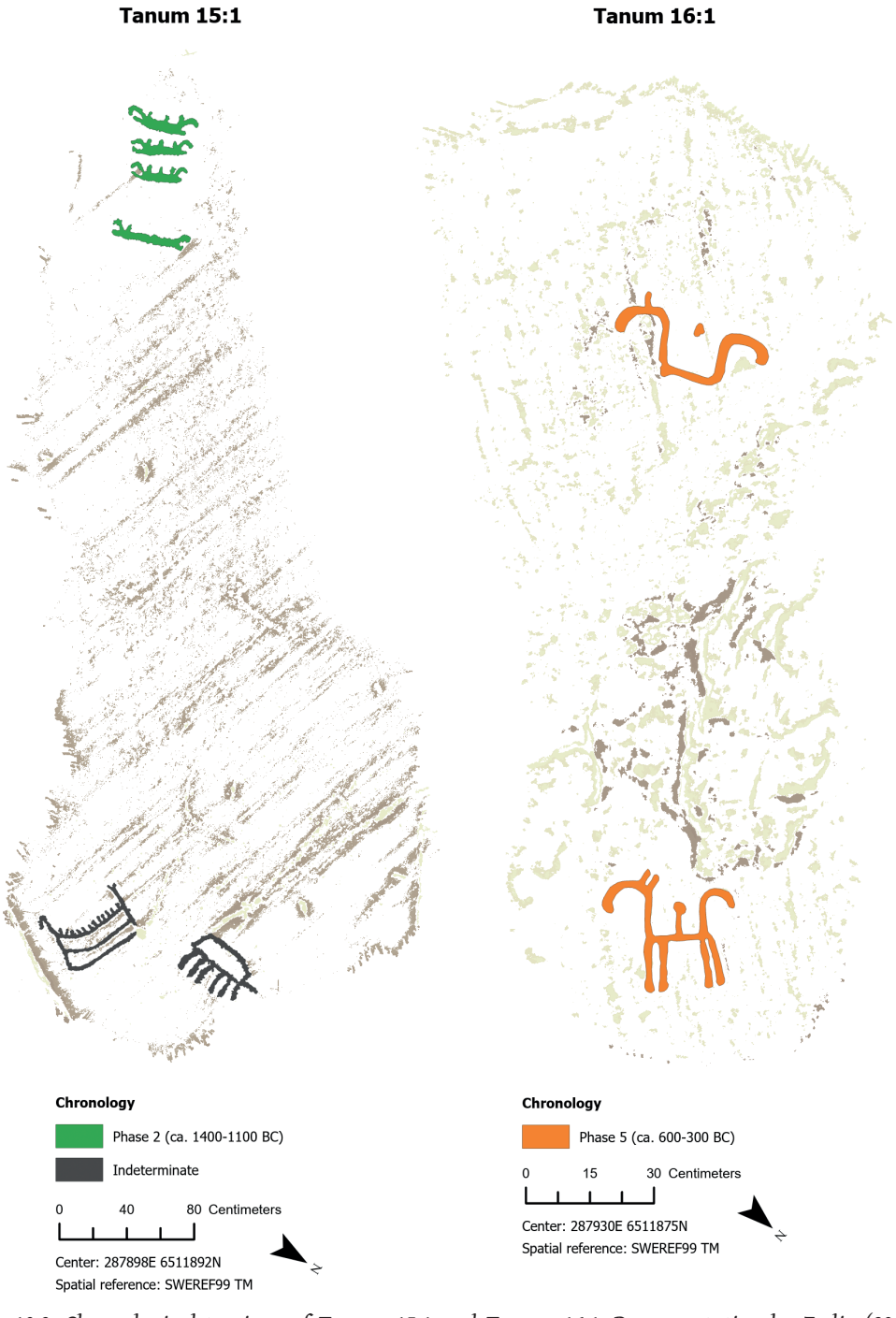


Fig. 10.3. Chronological tracings of Tanum 15:1 and Tanum 16:1. Documentation by Zedig (2016f, 2016c); georeferencing and drawing by the author.

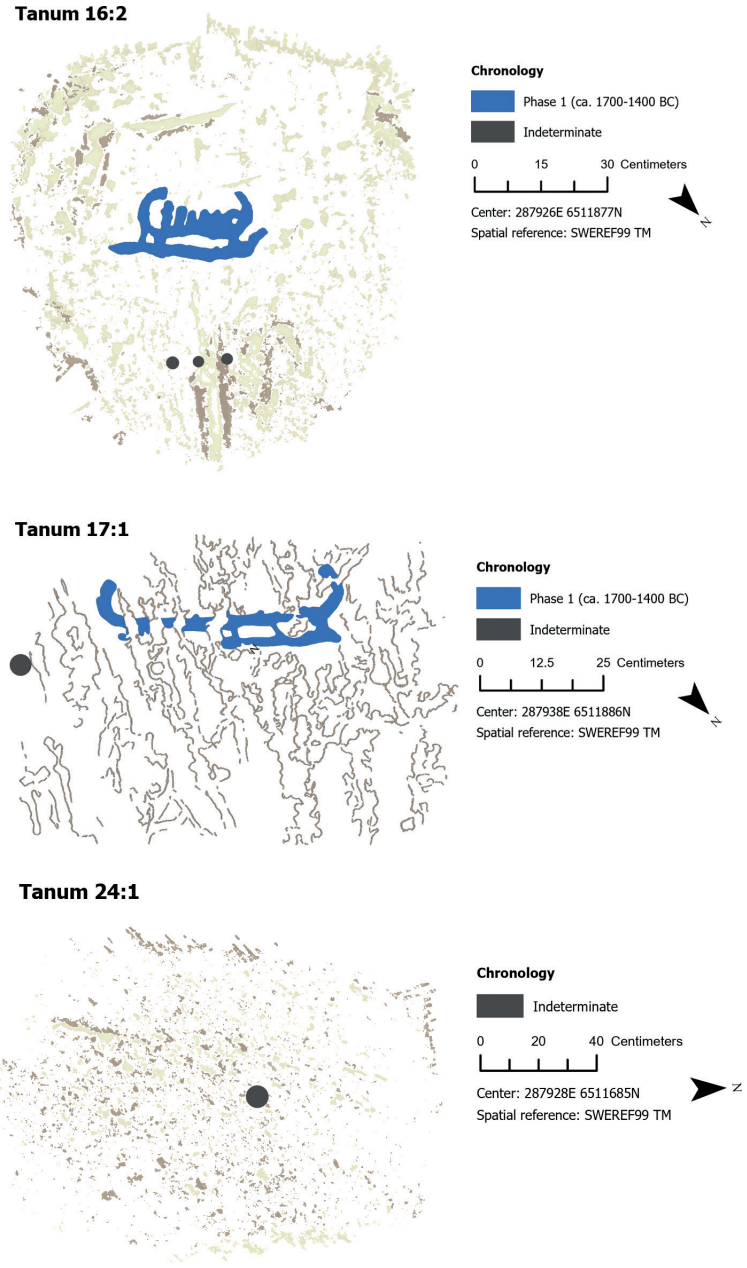


Fig. 10.4. Chronological tracings. Top: Tanum 16:2. Documentation by Högberg (1980); georeferencing, and drawing by the author. Cupmarks added based on information from Riksantikvarieämbetet, but their locations remain uncertain. Middle: Tanum 17:1. Documentation by Hällristningsmuseum (1993); georeferencing and drawing by the author. Cupmarks added based on information from Riksantikvarieämbetet, but their locations remain uncertain. Bottom: Tanum 24:1. Documentation by Zedig (2016h); georeferencing and drawing by the author.

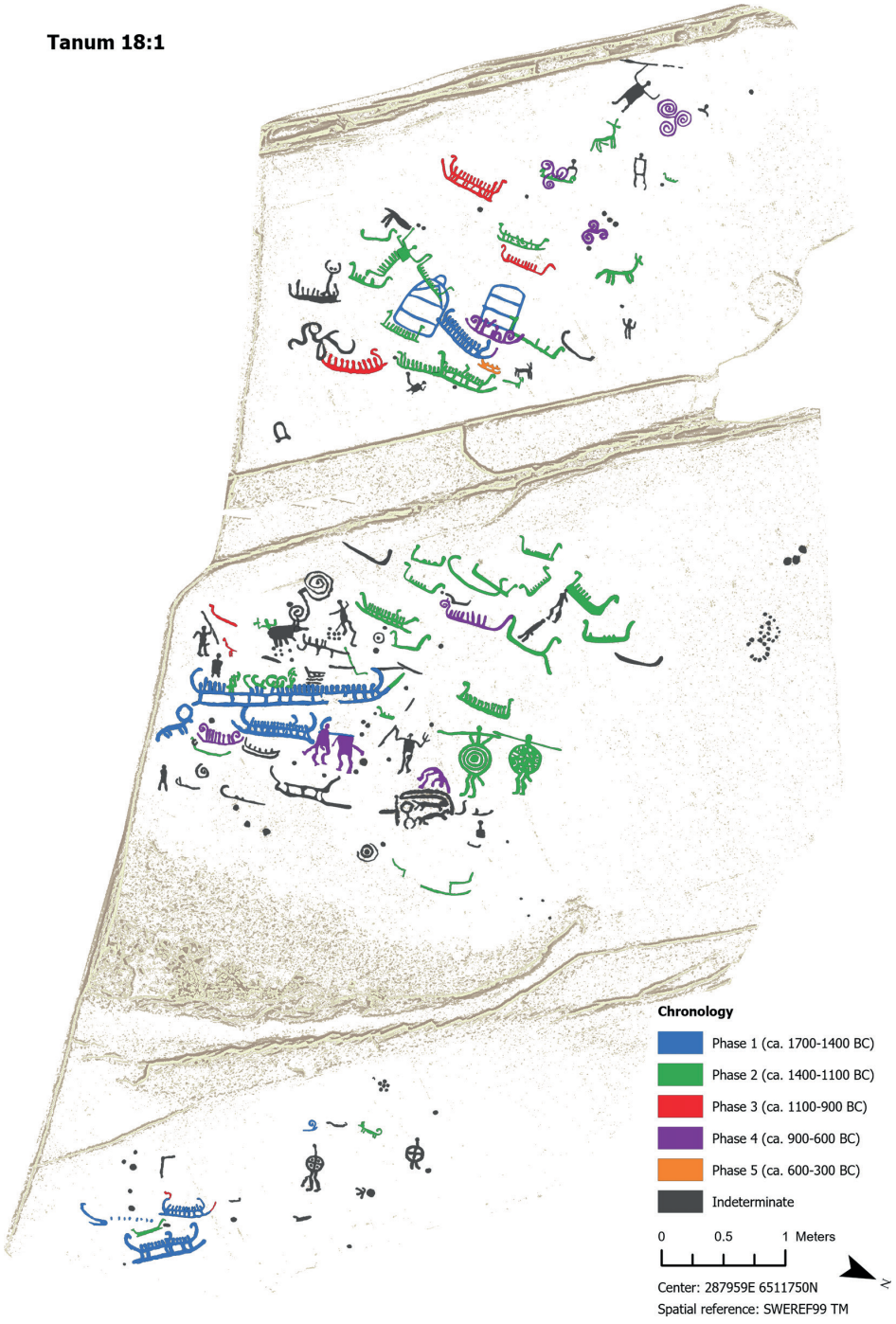


Fig. 10.5. Chronological tracing of Tanum 18:1. Documentation, georeferencing, and drawing by the author.

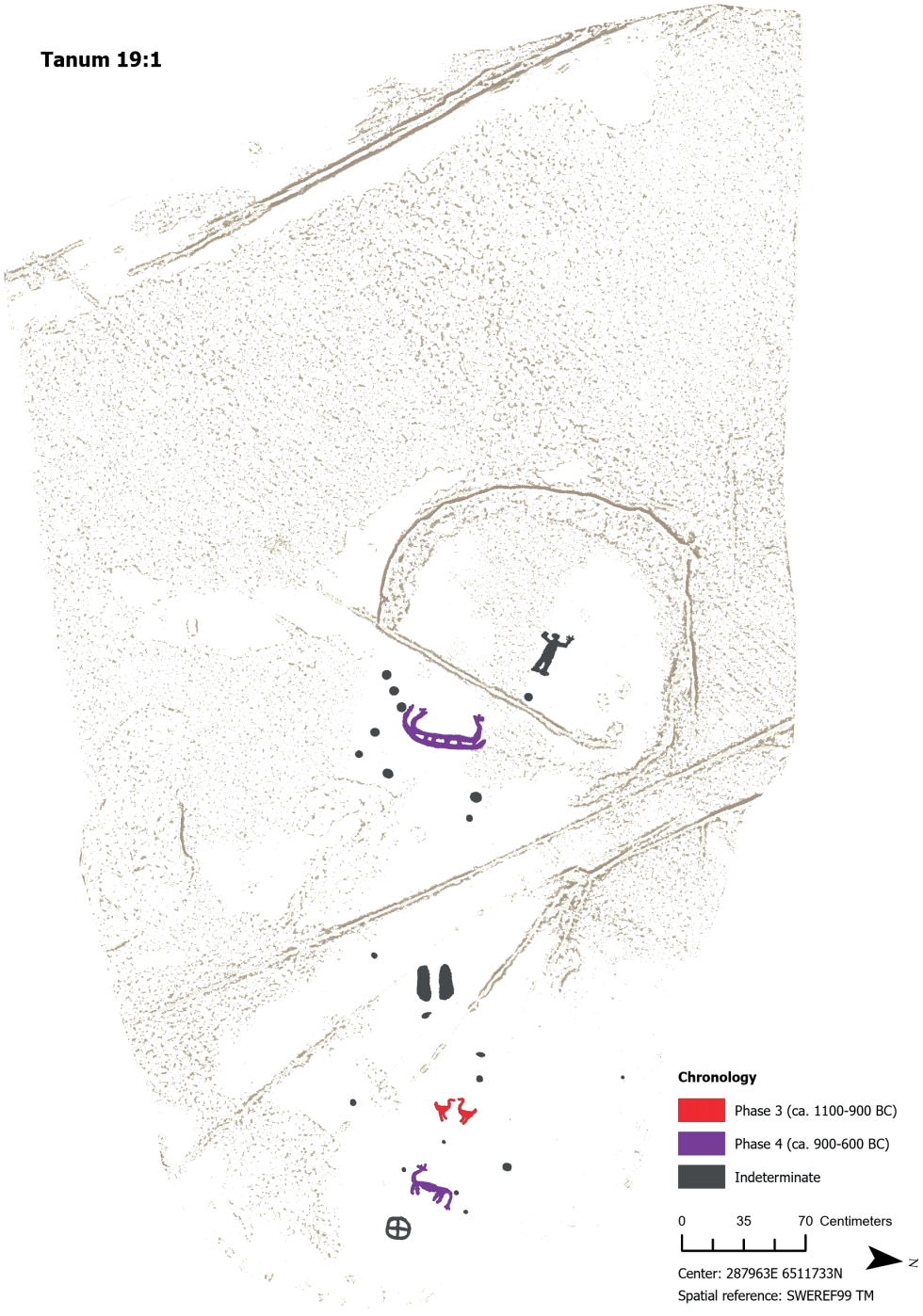


Fig. 10.6. Chronological tracing of Tanum 19:1. Documentation, georeferencing, and drawing by the author.

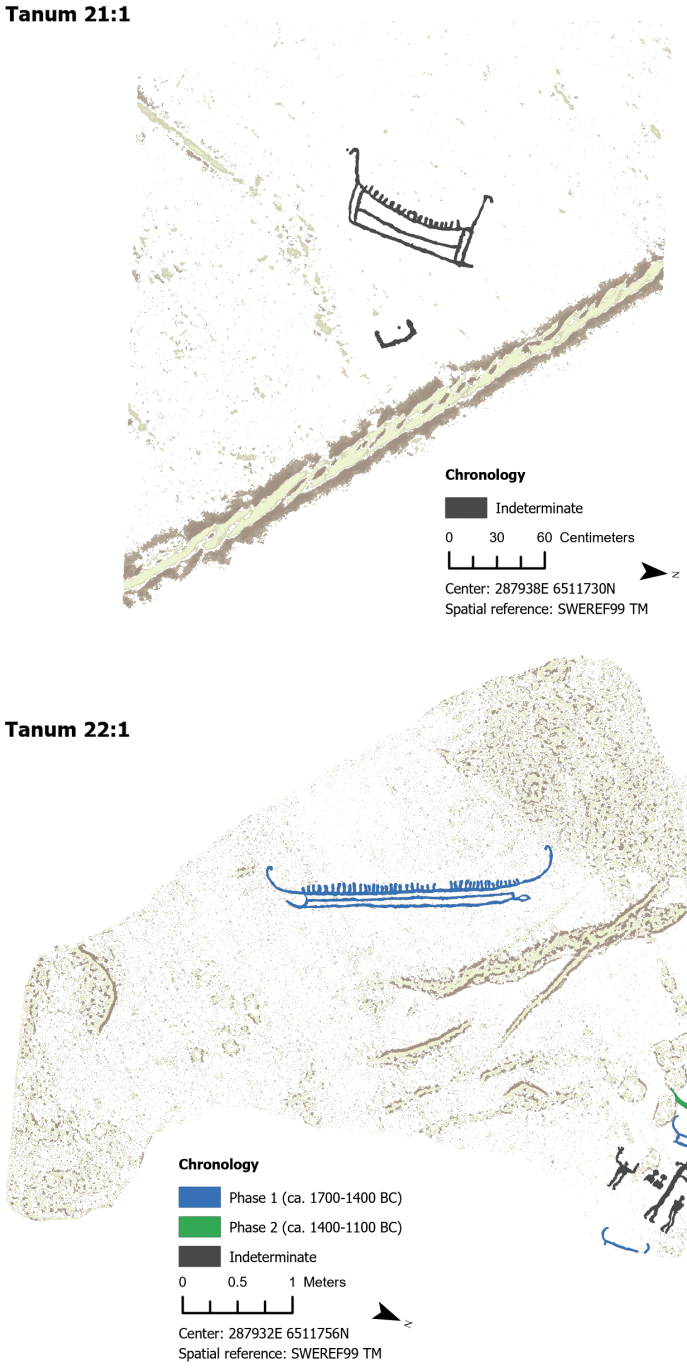


Fig. 10.7. Chronological tracings of Tanum 21:1 and Tanum 22:1. Documentation, georeferencing, and drawing by the author.



Fig. 10.8. Chronological tracings of Tanum 23:1 and Tanum 29:1. Documentation, georeferencing, and drawing by the author.

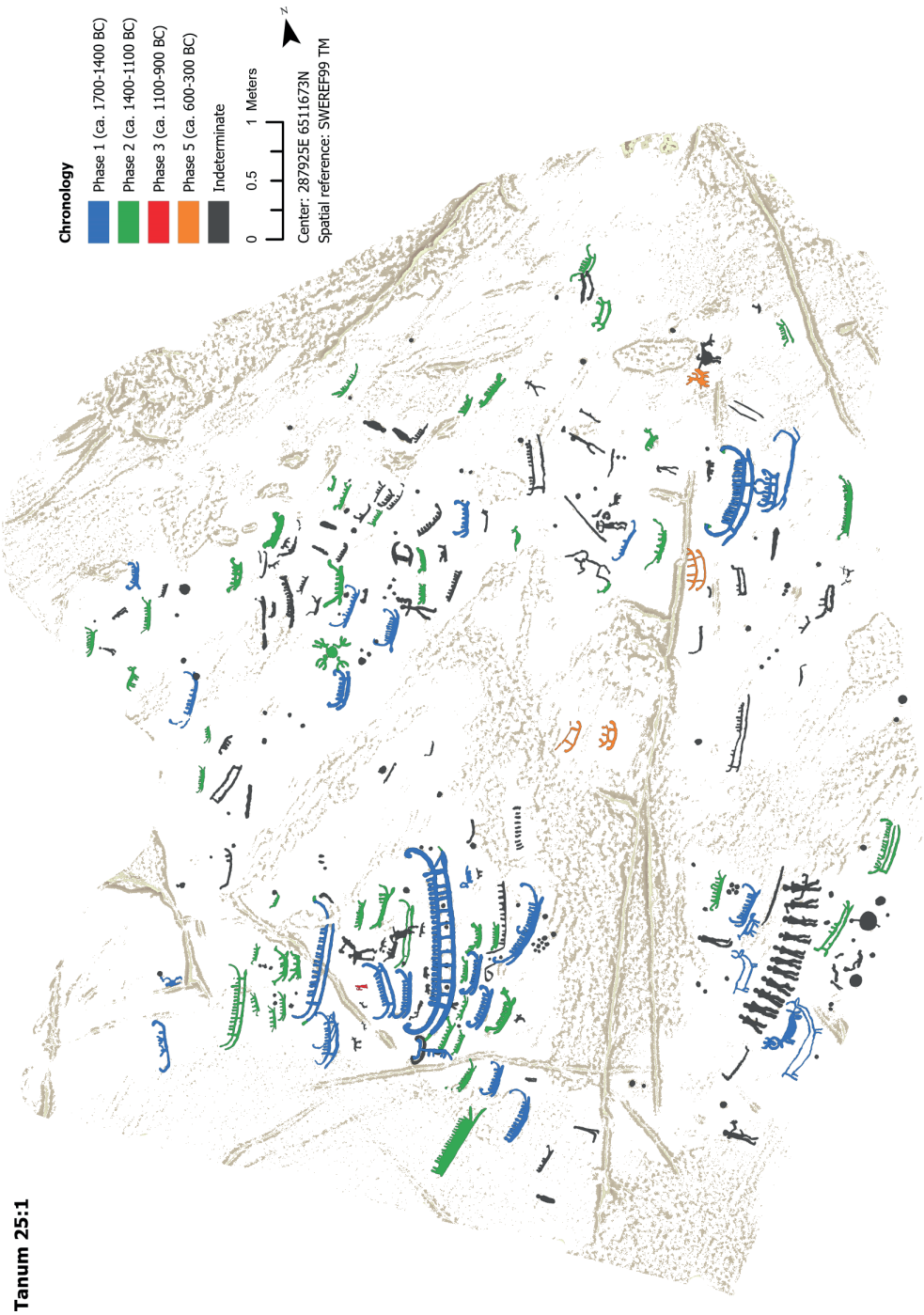


Fig. 10.9. Chronological tracing of Tanum 25:1. Documentation, georeferencing, and drawing by the author.

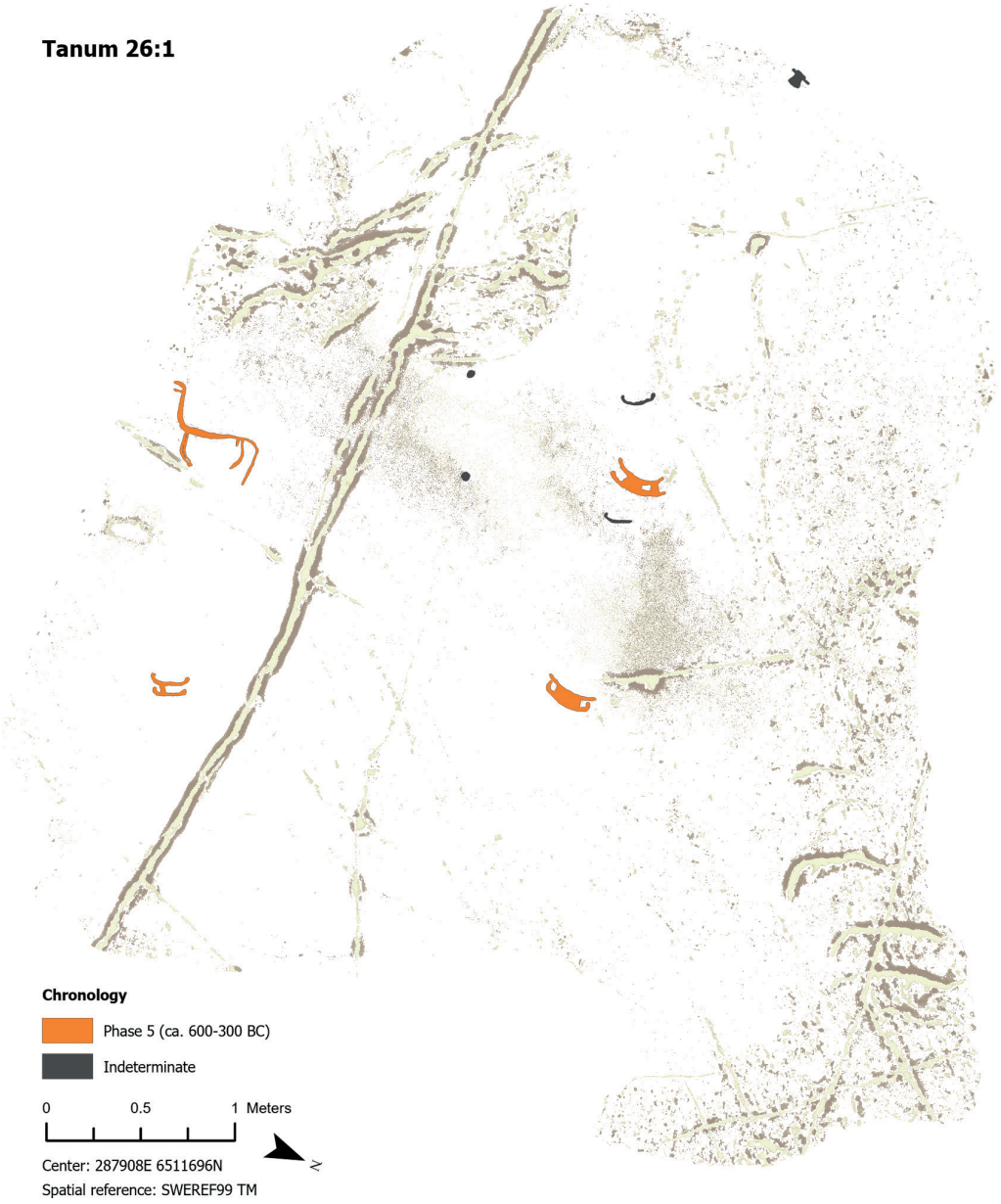


Fig. 10.10. Chronological tracing of Tanum 26:1. Documentation, georeferencing, and drawing by the author.

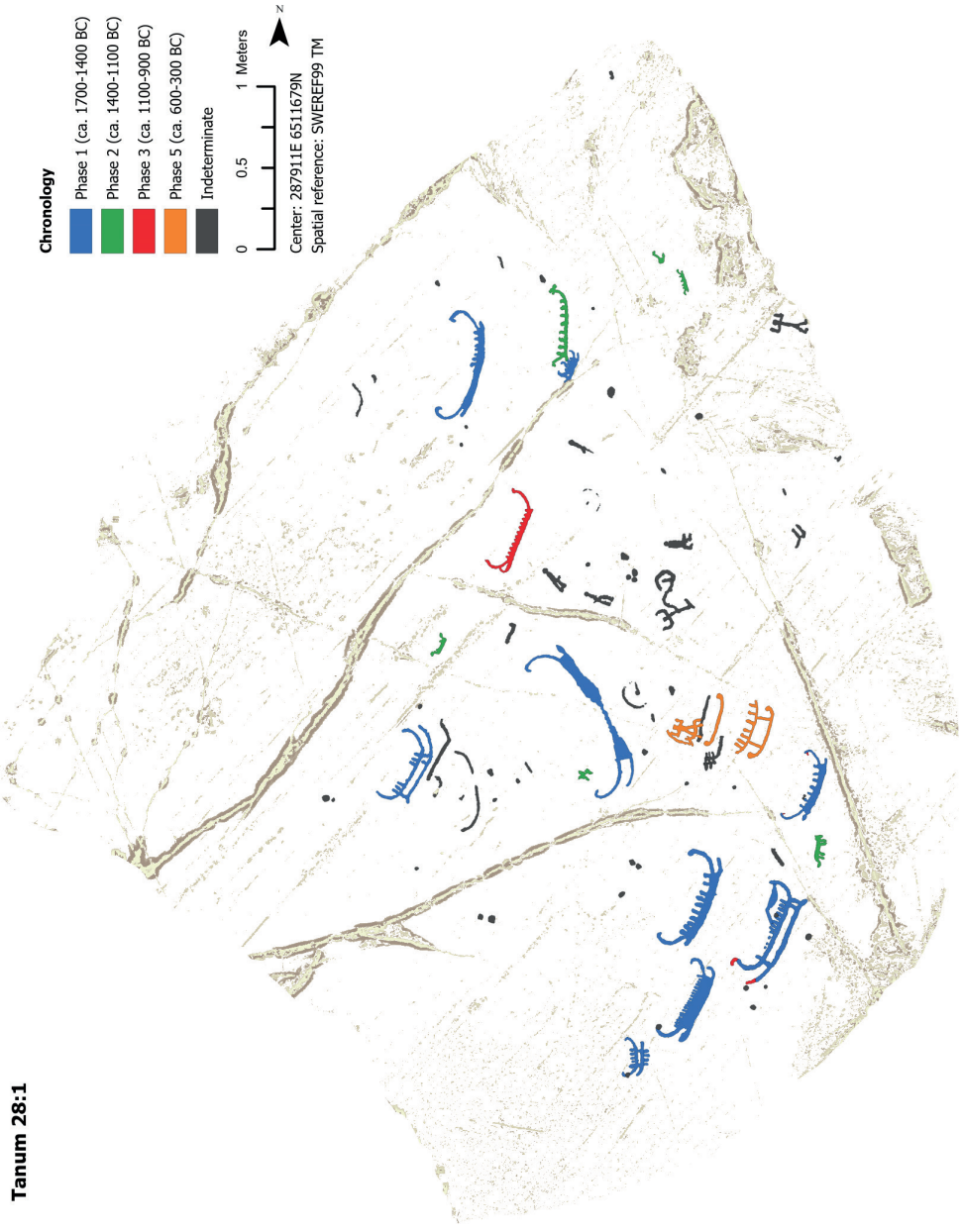


Fig. 10.11. Chronological tracing of Tanum 28:1. Documentation, georeferencing, and drawing by the author.

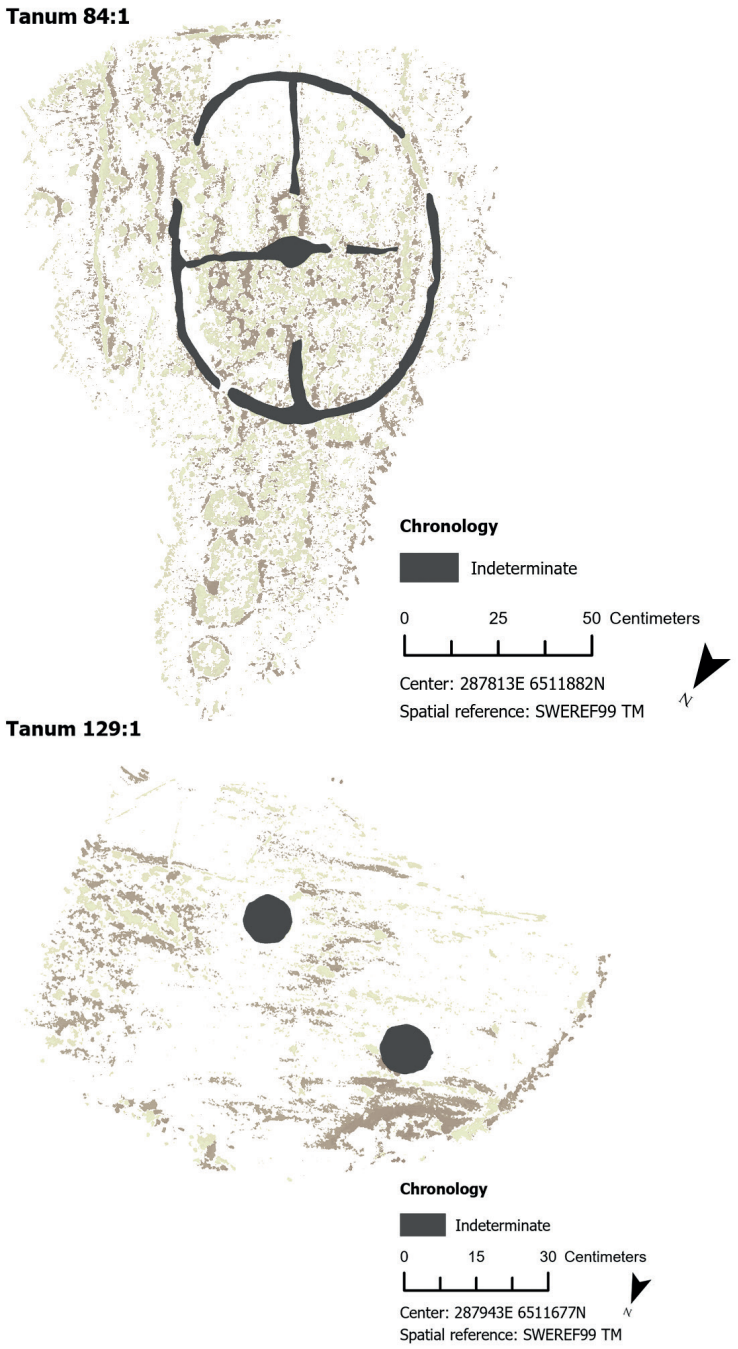


Fig. 10.12. Chronological tracings. Top: Tanum 84:1. Documentation by SHFA (2014); georeferencing and drawing by the author. Bottom: Tanum 129:1. Documentation by Högberg (1986); georeferencing and drawing by the author.

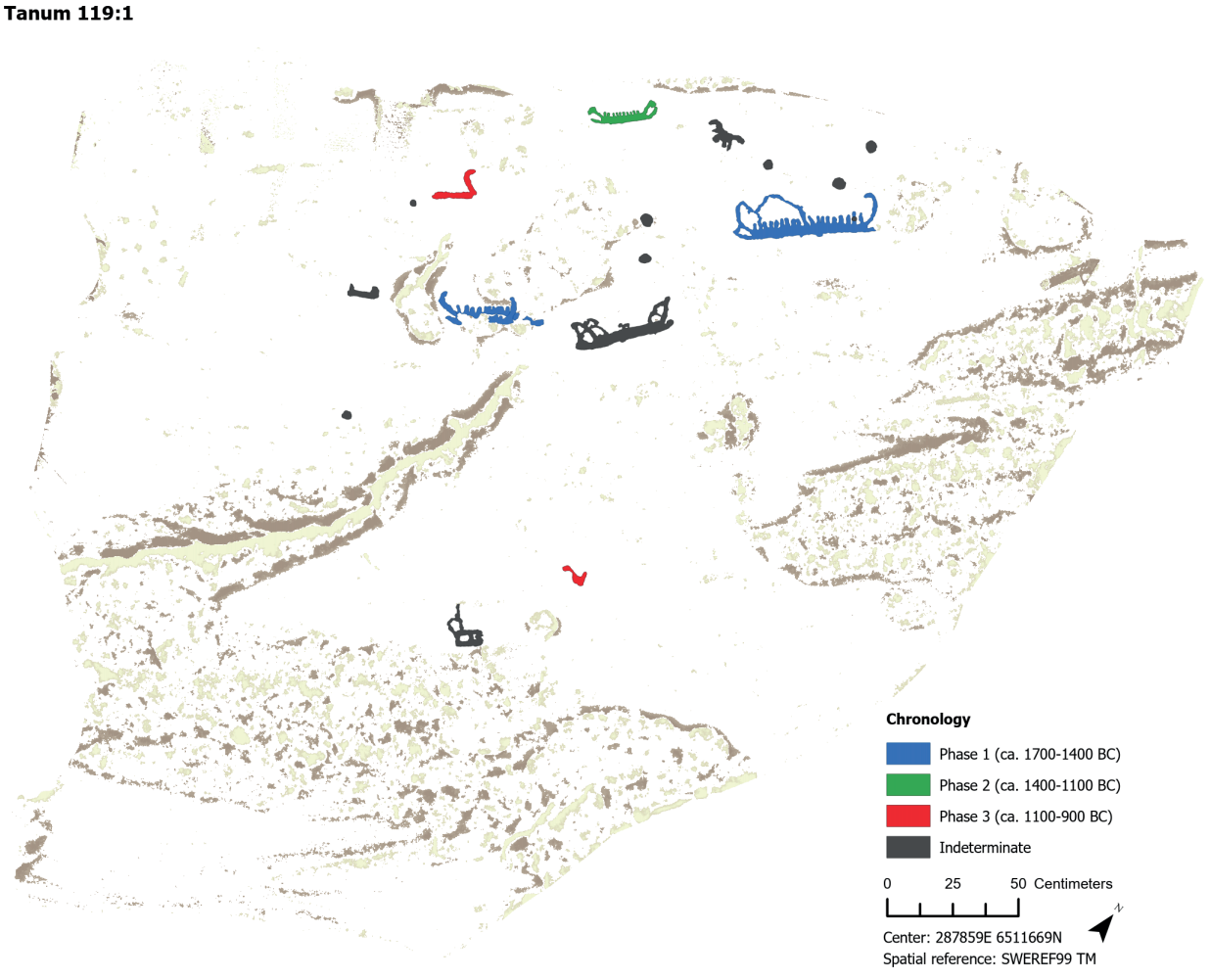


Fig. 10.13. Chronological tracing of Tanum 119:1. Documentation, georeferencing, and drawing by the author.

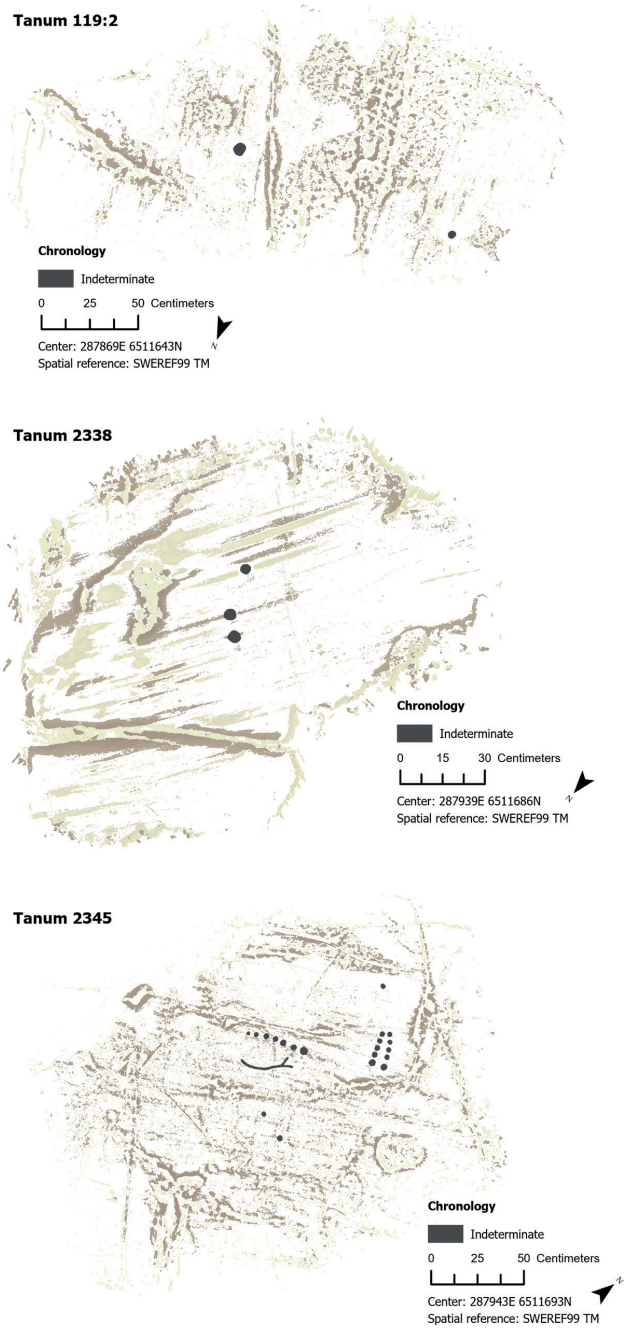


Fig. 10.14. Chronological tracings. Top: Tanum 119:2. Documentation by Zedig (2016d); georeferencing and drawing by the author. Center: Tanum 2338. Documentation by Zedig (2016a); georeferencing and drawing by the author. Bottom: Tanum 2345. Documentation by Zedig (2016b); georeferencing and drawing by the author.

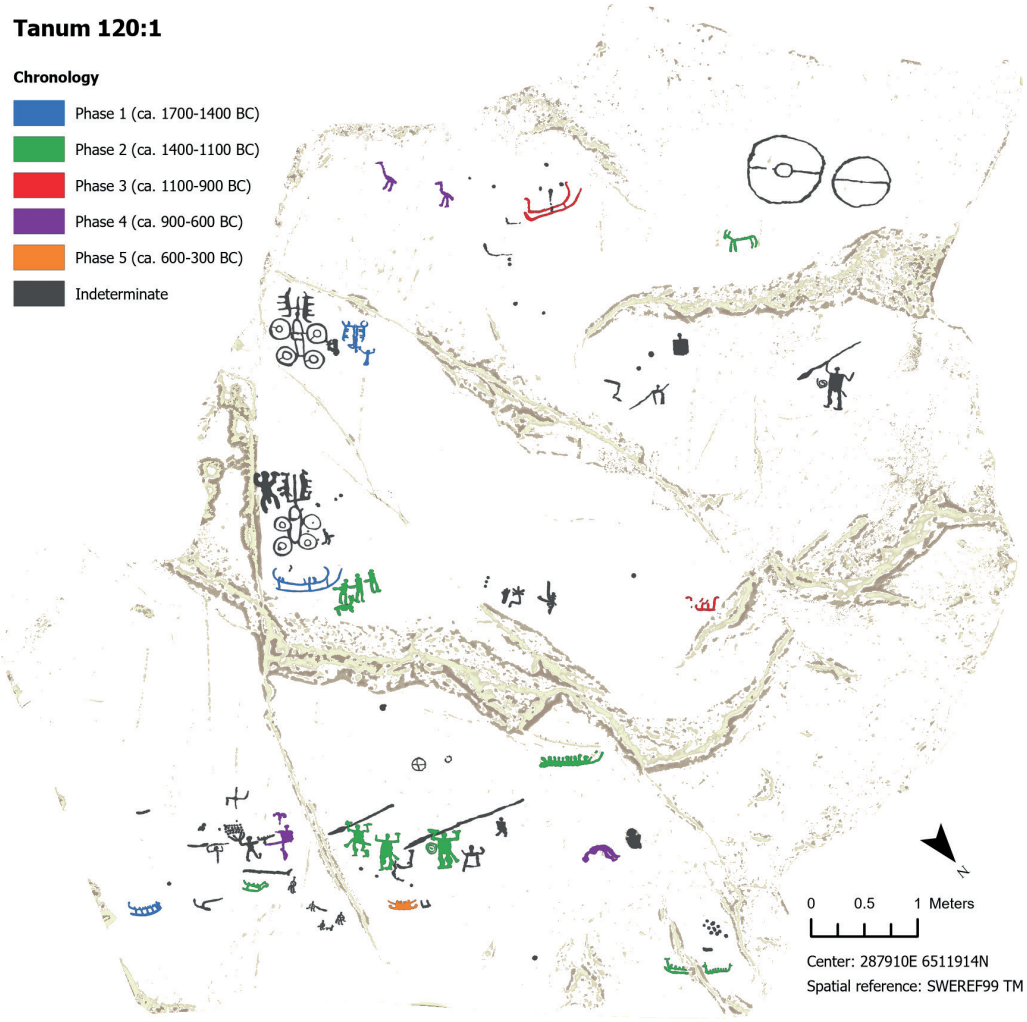


Fig. 10.15. Chronological tracing of Tanum 120:1. Documentation, georeferencing, and drawing by the author.

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