Astronomy, Cosmology and Landscape

Proceedings of the SEAC 98 Meeting, Dublin, Ireland, September 1998

Edited by CLIVE RUGGLES
with FRANK PRENDERGAST *and* TOM RAY

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Contents

Preface

At the time of the SEAC98 conference in Dublin, SEAC was five years old. At the time of writing this preface, it is approaching eight. The proceedings of the various annual SEAC conferences, which are the responsibility of the respective local organising committees, have appeared in a number of different formats and to different timescales. For the Dublin proceedings we decided to adhere to the traditional A4 format that has characterised the majority of the SEAC publications, but also to closely edit the accepted papers in an attempt to achieve a common standard of clarity in language and content, as well as a common house style. This involved seeking a number of detailed clarifications, a rather prolonged process that may, at least in part, explain the three-year gap between conference and publication.

The Société Européenne pour l'Astronomie dans la Culture represents a small but active group of researchers from a variety of disciplines with a common interest in ancient perceptions of the sky. More information on SEAC is available at the time of writing at http://www.iac.es/seac/seac.html. Archaeoastronomy is not only thriving in Europe, as is clear from recent issues of the quarterly *Archaeoastronomy and Ethnoastronomy News*, the creation of the International Society for Archaeoastronomy and Astronomy in Culture (ISAAC), and the re-launch of the Center for Archaeoastronomy's *Archaeoastronomy* journal as *Archaeoastronomy: The Journal of Astronomy in Culture* published by the University of Texas Press, in addition to the long-standing *Archaeoastronomy* supplement to the *Journal for the History of Astronomy*.

SEAC itself has met annually since its formation was agreed at a round-table discussion that took place in Strasbourg, France, in November 1992, following a symposium on "Current Problems and Future of Archaeoastronomy" organised by Professor Carlos Jaschek (Jaschek 1994). The gradual development of European archaeoastronomy can be traced back even further, to two initially distinct roots. The first was the inception in 1986 of a series of regular biannual meetings in Strasbourg organised by Jaschek together with Pierre Erny, resulting in a series of publications under the title *Astronomie et Sciences Humaines*, edited by Erny and Jaschek and published by the Observatoire Astronomique de Strasbourg (ISSN 0989–6236). The second was a conference held in Tolbukhin, Bulgaria, in 1988 (Tolbukhin 1988), which itself marked the start of what were to become a regular series of annual symposia subsequently held in Venice, Italy, in 1989 (Romano and Traversari 1991); Warsaw, Poland, in 1990 (Iwaniszewski 1992); and Székesfehérvár, Hungary in 1991 (Pásztor 1995).

A full list of the ensuing SEAC meetings and publications is given on page viii (see also http://www.iac.es/seac/seac9.html). By the mid-1990s a regular pattern of meetings had been established, alternating between western and eastern Europe, and there were a number of reasons for proposing Dublin as the venue in 1998. One of these was a rise in interest in the archaeoastronomy of Irish Bronze Age monuments following reports at recent SEAC meetings and elsewhere. Another was its proximity to the Boyne valley monuments and in particular Newgrange, itself one of the best known icons of archaeoastronomy. A third reason was the presence in Dublin of Frank Prendergast and Tom Ray, who had volunteered to help organise such a meeting. And a final benefit was the presence in Ireland at the time of Clive Ruggles, then President of SEAC, on a Senior Visiting Research Fellowship at the Institute of Irish Studies at Queen's University, Belfast.

From the outset, the three of us recognised that organising such a meeting presented a particularly important challenge, which was to ensure a strong participation from local archaeologists. One of the problems that has been commented upon time and time again is the need for archaeoastronomical work to be firmly placed in the context of broader archaeological questions, and another is the suspicion with which much work in the field continued then, and continues now, to be viewed by many archaeologists (Ruggles 1999; 2000). In Ireland there are particular problems because archaeoastronomy has acquired a strong public image, which tends to be more influenced by sensationalistic speculations than by better informed and more level-headed scholarship. This theme is elaborated in the paper by Ruggles in this volume, the first part of which is adapted from the second of two opening talks delivered at the symposium.

We were very much gratified, then, when George Eogan, Professor of Archaeology at University College, Dublin and excavator of the passage tomb at Knowth, agreed to give the first of these opening talks, speaking about perceptions of archaeoastronomy amongst Irish archaeologists. Professor Eogan was also kind enough to give us a guided tour of Knowth during the conference excursion to the Boyne Valley. Our thanks are also due to Professor Gabriel Cooney, also of University College, Dublin, for agreeing to give a keynote talk entitled "Reading a landscape manuscript: time and place in prehistoric Ireland."

The theme of landscape perception has provided one of the most important links between archaeo-astronomy and recent developments in theoretical archaeology, through their strong common interest in questions of cosmology and cognition (again, see Ruggles in this volume). It was in view of this fact that "Astronomy, cosmology and landscape" was chosen as the conference theme. Yet SEAC conference themes are not prescriptive, and only a minority of the papers presented at the conference, submitted for publication, and finally published in this volume directly addressed it. Some of the remainder present new field data or interpretations, whereas others address issues varying from theoretical foundations to field methodology. Taken together they typify the wide range of subject matter and approach, and the vibrant mix of disciplinary perspectives, that have come to characterise SEAC meetings.

We were delighted to welcome a further invited talk from an archaeologist very well known in the world of archaeoastronomy: Aubrey Burl. His stimulating keynote presentation entitled "Sightlines out of sight: science or symbolism at Woodhenge?" has not found its way into print here, but a written version can be found in chapter five of Aubrey's recent book *Great Stone Circles* (Burl 1999). Another talk presented at the conference but not submitted for the Proceedings in view of its imminent publication elsewhere was "An integrated Early Bronze Age settlement and ritual complex in the Monavullagh mountains, Co. Waterford", by Michael Moore of Dúchas The Heritage Service, Dublin.

An invited talk of a special nature accompanied a conference reception kindly provided by the School of Celtic Studies of the Dublin Institute of Advanced Studies (DIAS). This was a "light-hearted talk" by Professor Fergus Kelly, Senior Professor of Celtic Studies in the Institute, entitled "The Beliefs and Myths of the Early Irish". This was much enjoyed and Professor Kelly has been also kind enough to provide a written version of his presentation for inclusion in this volume.

We would like to thank both the Physics Department in Trinity College Dublin for hosting the conference and the Dublin Institute for Advanced Studies for its co-sponsorship of the event. A special word of thanks also goes to the secretarial staff of DIAS for their assistance in the organisation. We would also like to thank the Dublin Institute of Technology for use of resources during the conference planning stage.

Finally, we note with great regret that, since submitting his paper for this volume, Carlos Jaschek has passed away. Professor Jaschek was one of the prime movers in the early development of European archaeoastronomy and was a Vice-President of SEAC. While this volume has been in preparation, an appreciation of his contribution to European archaeoastronomy has appeared in the Proceedings of the SEAC99/Oxford VI meeting, which was dedicated to his memory.

CR, FP and TR
Dublin and Leicester, May 2001

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Tolbuchin (1988). Parvi natsionalen simpozium archeoastronomiya [First national symposium on archaeoastronomy]. *Interdistsiplinarni Izsledvaniya [Interdisciplinary Studies]* 15, 1–136.

SEAC meetings and publications

1993

Held in Smolyan, Bulgaria, August–September 1993.

Principal organisers: Vesselina Koleva and Dimiter Kolev.

Proceedings published as *Astronomical Traditions in Past Cultures*, edited by Vesselina Koleva and Dimiter Kolev, published by Institute of Astronomy, Bulgarian Academy of Sciences, National Astronomical Observatory Rozhen, 1996. ISBN 954–90133–1–6. Available from Ocarina Books Ltd., 27 Central Avenue, Bognor Regis, W Sussex PO21 5HT, United Kingdom (http://www.ocarinabooks.com).

1994

Held in Bochum, Germany, August 1994.

Principal organiser: Wolfhard Schlosser.

Proceedings published as *Proceedings of the Second SEAC Conference, Bochum, August 29th-31st, 1994*, edited by Wolfhard Schlosser, published by Astronomisches Institut der Ruhr-Universität, Bochum, 1996. ISBN 3–00–001243–5. Available from Ocarina Books Ltd., 27 Central Avenue, Bognor Regis, W Sussex PO21 5HT, United Kingdom (http://www.ocarinabooks.com).

1995

Held in Sibiu, Romania, August–September 1995.

Principal organiser: Florin Stanescu.

Proceedings published as *Ancient Times, Modern Methods: Proceedings of the third SEAC Conference, Sibiu, Romania, August 31-September 2, 1995*, edited by Florin Stanescu, published by Lucian Blaga University, Sibiu, 1999. ISBN 973–651–033–6. Available from Florin Stanescu (florins@athena.sibiu.ro).

1996

Held in Salamanca, Spain, September 1996.

Principal organiser: Carlos Jaschek.

Proceedings published as *Actas del IV Congreso de la SEAC «Astronomía en la Cultura»*, edited by Carlos Jaschek and Fernando Atrio Barandela, published by Universidad de Salamanca, 1997. ISBN 84–605–6954–3. Available from Fernando Atrio (atrio@orion.usal.es).

1997

Held in Gdansk, Poland, September 1997.

Principal organisers: Mariusz S. Ziółkowski, Arnold Lebeuf and Arkadiusz Sołtysiak.

Proceedings published as *Actes de la V^{ème} Conference Annuelle de la SEAC, Gdansk, 5–8 Septembre 1997*, edited by Arnold Lebeuf, Mariusz S. Ziółkowski and Arkadiusz Sołtysiak, published by Département d'Anthropologie Historique, Institut d'Archéologie de l'Université de Varsovie, Warsaw (ŚWIATOWIT Supplement Series H: Anthropology, vol. II), and Musée Maritime Central, Gdańsk, 1999. ISBN 83–87496–29–4. Available from Arnold Lebeuf (uzlebeuf@jetta.if.uj.edu.pl).

1998

Held in Dublin, Ireland, August–September 1998.

Principal organisers: Clive Ruggles, Frank Prendergast and Tom Ray.

Proceedings published as this volume.

1999

Held in La Laguna, Tenerife, Canary Islands, June 1999. Joint meeting with the "Oxford VI" International Symposium on Archaeoastronomy.

Principal organisers: Juan A. Belmonte and César Esteban.

Proceedings published as

- Volume 15 of *Archaeoastronomy: The Journal of Astronomy in Culture*, guest editors César Esteban and Juan A. Belmonte, published by the University of Texas Press, USA, 2000. ISSN 0190–9940. Available from the University of Texas Press, P.O. Box 7819, Austin, TX 78713–7819, USA (http://www.utexas.edu/utpress/journals/jarch.html).
- *Oxford VI and SEAC99: Astronomy and Cultural Diversity*, edited by César Esteban and Juan A. Belmonte, published by Organismo Autónomo de Museos del Cabildo de Tenerife, La Laguna, Tenerife, 2000. ISBN 84–88594–24–0. Available from María José Alemán (maleman@museoscabtf.rcanaria.es) or Juan Antonio Belmonte (jba@ll.iac.es).

2000

Held in Moscow, Russia, May 2000.

Principal organisers: Tamila Potyomkina and V.N. Obridko.

2001

To be held in Stockholm, Sweden, August–September 2001.

Principal organiser: Mary Blomberg

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CARLOS JASCHEK, who organised the SEAC96 meeting and many previous European archaeoastronomy meetings in Strasbourg, passed away in 1999, shortly after submitting this paper for publication.

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1

Time and space in social systems—further issues for theoretical archaeoastronomy

Stanisław Iwaniszewski

Introduction

Although the aims and scope of archaeoastronomy have changed substantially since its beginnings in the mid-sixties, there is considerable ambivalence about its basic interpretative method and theory. While the "hard" part of our endeavour, which consists of fieldwork practice and armchair calculations seems now to be reasonably firmly based (although there is room for improvement in techniques and procedures), we are still not certain how to interpret our data. Naturally, we are now aware that the aims of our research cannot be limited to data collection, nor do we any longer study and treat alignments as traits attesting to the existence of skilful astronomers in the past, individuals implicitly assumed to have acted like twentieth-century astronomers (see Thom 1971, 106–16). In recent times we have seen a gradual theoretical shift in the way that what now we call astronomy has been conceptualised and understood within the context of modern western science. Terms such "astronomy" or "cosmology" applied to past and/or non-Western societies do not imply that a kind of modern Western science was known to them. (The use of those terms with reference to past or non-Western practices may in fact be misleading, although it is not necessary to avoid or abandon them.) Current debate in archaeology teaches us that such a view bears ethnocentric notions (e.g. Shanks and Tilley 1987, 53–4) and this point is acknowledged by a growing number of archaeologists today. The same growth of discipline awareness is observed in archaeoastronomy. In order to differentiate the "other" astronomy from its modern expression, Clive Ruggles and Nicholas Saunders (1993) on the one hand, and the present author on the other (Iwaniszewski 1990; 1991), developed a concept of "cultural astronomy". Thus, "cultural astronomy" cannot be confused with modern Western astronomy. In spite of this, what is observed in the field of archaeoastronomy is the predominance of studies which aim to analyse cognitive structures of astronomical and calendrical lore rather than its social and symbolic dimensions. This approach has now come to rely on those indigenous concepts, beliefs, practices and terms that are associated with the natural world and which, in our society, would fall under the domain of scientific astronomy. This attitude reveals an emphasis on native descriptions and categorisations of the world, which are traditional domains of ethnoscience, i.e. the study of the cognitive aspect of culture. This attitude tends to treat archaeoastronomy as a vehicle leading to the reconstruction of ancient or non-Western mental models. Nevertheless, although the need for such an approach cannot be denied, in order to avoid distorting interpretations localised in a particular historical moment, we must move well beyond the limits of strictly cognitive studies.

Archaeoastronomical concerns with cognitive systems create problems of data verification. Particularly important in the history of archaeoastronomy has been the fact that whenever an astronomical target for a given alignment was discovered, this was considered as a sufficient criterion to probe its intentionality. This leads us directly to the "green" versus "brown" archaeoastronomy debate of the 1980s. According to Anthony F. Aveni (1986; 1989), "green" archaeoastronomy emphasises the importance of rigorous approaches which combined with a statistical methodology, lead to the establishment of an objective[1] set of data attesting to astronomical alignments. "Brown" studies, on the other hand, use a broad variety of cultural evidence (ethnohistoric or written sources) produced within societies to validate the existence of deliberate alignments.

First of all, we see that both types of archaeoastronomy are based on the presupposition that astronomical alignments exist; they merely disagree on the criteria by which scholars can determine the reality of particular examples. The “green” approach assumes that this can be tested (falsified or refuted) using statistical formalism. In the social sciences however, the reliability and objectivity of statistics may be questioned (see Shanks and Tilley 1987, 56–9) and in this vain Clive Ruggles (1994; 1995; 1996) proposes to use a Bayesian perspective which seems to be more suitable in that case. But even if we manage to avoid pitfalls in the interpretation of statistical analyses, we may well be trapped in our scientific logic which establishes “objective” criteria for the validation of our hypotheses. Thus in the 1970s, because of its claims to scientific objectivity, the approach based on mathematical formalism was given legitimating power (Shanks and Tilley 1987, 58–9) and greater validity. The “brown” approach, on the other hand, tends to infer the existence of astronomical alignments from a knowledge of other cultural facts. Thus, if we know that a given society was engaged in observations of a certain body and find alignments which can be related to that body, then it is precisely this previous information which validates the alignments, and their existence is considered to be proved (see also Ruggles 1994, 498).

Since I believe that one can only understand the (cultural) appropriations of astronomical events and phenomena by careful social and historical (archaeological or ethnohistorical) contextualisation, I cannot agree with both types of testing of archaeoastronomical hypotheses.

Second, notice that the first perspective reassesses astronomical data by the use of scientific logical criteria, while the second one validates them by the culturally mediated evidence. From the anthropological standpoint this debate may be situated within the etic or emic perspective. The term “etic” refers to the situation when a society is described and analysed by an external observer and the term “emic” refers to the situation in which a society produces its own explanation of some fact. Thus the “green” approach may be roughly equated with the “etic” perspective and the “brown” one with an “emic” standpoint. Following this reasoning, we can view the “green” versus “brown” debate as a conflict between two different epistemologies, the “etic” versus the “emic”, or, in other words, the objective versus the subjective.

Third, while a value-free, completely objective viewpoint is an impossibility and the categories of both the society being studied and the scholar who studies it are equally subjective, it is necessary to re-think the criteria for some sort of evaluation of our data. Unfortunately, the debate between “green” and “brown” archaeoastronomies has obscured the need for such a reassessment. Trapped within conflicting epistemologies, we need to make arbitrary choices between different ways of validating our interpretations. Instead of looking for a new sort of integrated approach which can bridge both epistemologies, as Ruggles (1994) proposes, we need to have a theoretical framework which would enable us to make balanced and objective interpretations of our data.

Fourth, the crucial problem archaeoastronomers face is not that of whether or not astronomical alignments exist. What is missing here is a theory which explains why different peoples, from the past and present, encode astronomical alignments in their architecture. Archaeoastronomy still takes for granted the idea that peoples orient material objects, buildings included, towards astronomical targets. Obviously, the mere existence of such an unquestionable dogma justifies the need for archaeoastronomy and legitimises its existence among other scientific disciplines; nevertheless, if our research is to be valid, we must produce an adequate theory which will offer methods to study the practice of making astronomical alignments, and their developments and transformations in different social and historical contexts. Only such a theory will allow us to transcend the green/brown dilemma.

Dealing with time and space

Since all human activities occur in time and space, the permanence of a society is achieved through some organisation of time and space. Every society possesses its own conception of time and space and this conception “stabilises” social relationships and makes possible the reproduction of social practices and a society as a whole. The manner in which it conceptualises its perception of time and space is not incidental or casual; these are totally structured categories. This means that neither time nor space can be depicted as types of independent category, nor can they be viewed as system parameters (see the discussion in Shanks and Tilley 1988, 119–26). Instead, they should be seen as dimensions of a society's activities (Giddens 1995, 143–75; Simonsen 1996, 505; also Shanks and Tilley 1987, 128; 1988, 119-20, 178). Both categories combined with a principle of structuration offer a framework for social practices: they both enable and constrain any social practice, acting as structuring factors (Giddens 1979, 64) or as operators involved in the construction of social actions (Thrift 1983). As they define the situated character of social practices, they should be considered as social time and social space.

Although time and space are constituted as imaginary constructs which generate the rationality of the relationship between people and their actions, their particular conceptualisations can find a material existence. The manufacture of material objects involves a certain amount of labour, which should be situated in (proper) time as well as in (proper) space. Moreover, they embody mental operations (Shanks and Tilley 1987, 129) and processes which both constitute and rely on symbolic processes of time- and space-structuring and thus reveal the establishment of particular temporal and spatial norms (cf. Nowotny 1990a, 9–12, 25).

Naturally, different groups of people use different natural references upon which they can map their conceptions of time and space. Following Hägerstrand one can say that both time and space are embedded in nature. For example, in order to configure time it is possible to rely on the movements of celestial bodies, seasonal changes in nature, generation changes related to life cycles from birth to death, or even on the need to make some scheduling of activities. In a similar manner, the configuration of space reflects the perception of the world through bodily movement, the organisation of activities (related to bodily displacements) in the best-known piece of space, namely the domestic sphere, or it can draw upon a particular set of forms and configurations chosen from an infinitude of possibilities and according to which the totality of space elements will be evaluated and classified. In this mode, the natural environment may be symbolically converted into a constructed environment. Notwithstanding their symbolic character, time and space are embedded in material culture and social life.

However, the structure imposed upon the natural environment and experiences of time is not simply a reference system assembled to facilitate people's orientation in social reality; it is primarily an effort to find value and meaning in the world and to locate them at particular places. As Parkes and Thrift (1978, 119–28) observe, the meaning of particular places is acquired by corresponding patterns of time use and time allocation: it is time which makes the structuring of space possible. The meaning of a place does not exist in itself, it is revealed through human practice. In this sense, actions performed by social agents involve the construction of temporal and spatial structures. Otherwise, their activities will lose their meaning and significance.

From this discussion it follows that social spatiality and social temporality are inherent elements of social activities. Social practice is always performed in a particular spatio-temporal context, and this context is directly involved in the constitution of social practices. Actions are, however, constrained by specific predispositions which have been created and "learned" through past practices. These predispositions towards particular practices and perceptions in specific contexts are durable and produce structures of *habitus*. According to Bourdieu (1977, 72), *habitus* is a structured structure which both constrains and enables the performance of practices. *Habitus* cannot be equated with rules; rather, it should be considered as a type of discourse with which individual and situated agents are confronted. On the one hand, human practices are shaped in accordance with structures produced in the past and, through constant repetition, may become routine (Giddens 1995). On the other hand, however, as Bourdieu (1977, 76–8) observes, whether particular practices are reproduced depends upon the perceptions and experiences of agents as they are subjected to different situations. In some contexts they can be transformed instead. Social agents cannot be considered merely as passive subjects able to reproduce certain practices in certain contexts. When the context of social practice changes, the *habitus* also is transformed (Bourdieu 1977, 78). In consequence, the structures of *habitus* shape social practice and at the same time are shaped by it. Since human practices are situated in specific temporal and spatial contexts, then the people who share a common *habitus* also share more-or-less common conceptualisations of time and space. As a result, particular societies construct distinct networks of temporal and spatial nodes, *locales*, which are structured and even ranked (Parkes and Thrift 1978, 128); and social agents "know" how to act in accordance with the prescribed movements in particular time and space. In cases where time and space become homogenous and non-significant, there exist so-called "non-places", where social agents lose their identities and remain in anonymity (cf. Augé 1996).

In social practice, however, agents do not only act according to the temporal and spatial structural constraints imposed upon them; they also take an active part in shaping and structuring time and space. In general, a society acts as a total entity which creates, co-ordinates and integrates particular temporal and spatial frames, while particular agents (individuals, or larger social groups) develop strategies to cope with those constraints (Nowotny 1990b, 35), reproducing or transforming them for their own benefit. In this sense the time-space frame cannot be isolated from social discourse: on the contrary, it constitutes a symbolic field which creates, defines or mediates social relationships. Since social agents determine the structure, symbolic use and form of specific times and spaces, then particular times and spaces are loaded with particular meanings. Those meanings are constantly produced and reproduced through discursive practices, which, in turn, are formed in the context of particular times and spaces. The meanings attached to particular time-space frames constitute the knowledge of how to act, but we can extend this notion to the knowledge of how the whole world works. This knowledge is being constantly negotiated by different social agents. Those of the agents who impose particular meanings as dominant, represent their particular conceptualisations of time and space as objective and universal; they try to replace the commonly shared cultural models of the world (world-views) by legitimising particular and sectional interests and ideologies.

The human body constitutes a kind of microcosm upon which all other classifications of the natural and social world are drawn. This "socialisation of nature' is nothing more than the constant and arduous labour of classifying perceptions, processes, events and objects in order to create a meaningful exterior world. Human practice, when applied to the natural or social world, imposes order very effectively. The principles generating an ordering are most likely modelled upon human bodies and their divisions, because a body is the best known object to every human being. The human body, then, provides a framework for cultural classifications, but different divisions of the body may generate different ordering principles. Symbolic logic is created and made objective through human practice, and this in turn constitutes the principles which serve to impose order on an active society. Although the range of potential bodily divisions is wide, only some became meaningful, and this meaning is created, negotiated, manipulated and made objective through the logic of practice (Bourdieu 1991, 131–65).

Generative principles modelled upon body divisions are incorporated into inhabited space (Godelier 1984; Hallpike 1986, 269–70; Bourdieu 1977, 89, 91–4; Tuan 1987, 51–4).

Here again I will turn to Bourdieu (1977, 89) who observes that "inhabited space—and above all the house—is the principal locus for the objectification of the generative schemes; and, through the intermediary of the divisions and hierarchies it sets up between things, persons, and practices, this tangible classifying system continuously inculcates and reinforces the taxonomic principles underlying all the arbitrary provisions of this culture". This material world is occupied by particular actors moving along trajectories in time-space and their daily paths are constructed with reference to an architectural or natural landmarks and temporal guide-marks. The self-evidence of the world manifests in the movements of knowing agents through built environments and measured times, as they know how to act in particular context and through their practice the presence of the ordered world is acknowledged and reaffirmed, and made, in this sense, objective.

A framework for alignment studies

At this point I will turn to what is important for alignment studies. From what has just been said it can be deduced that material culture in general, and the built environment in particular, contain structures invested with meanings which are acknowledged and reaffirmed through human action. Moreover, they are modelled upon structures of social relations, so they are both constituted through human agency and, simultaneously, are a (material) vehicle of such constitution. Material culture is both the medium and the outcome of shared dispositions of *habitus*, or shared systems of knowledge of how to act. The meanings attached to material culture are objective in the sense that they produce practices "which tend to reproduce the regularities immanent in the objective conditions of the production of their generating principle" (Bourdieu 1977, 78). Since the dispositions of *habitus* contain long-term practices, practices which are totally compatible with objective requirements, then the most improbable practices are eliminated (*ibid*., 77). If material objects represent the established order, that is, they are ordered according to systems of classification that are modelled upon generative principles, then the ways in which one object contains within itself relations with other objects, including human agents, must be objectively compatible with those generative principles. So, if we deal with astronomical alignments encoded in architectural structures, it means that we propose a hypothesis linking a particular structure with astronomical targets on a distant horizon. We want in fact to create a hypothetical link between that structure, the distant horizon and an astronomical body; so that through our knowledge of durable generative principles which both structure and are structured by human practice, we may deduce whether the principle of orienting particular architectural structures towards astronomical events agrees with the prevailing classificatory system and its symbolic logic.

Obviously, scholars embedded in their own time-spaces should not impose their own conceptualisations upon the concepts of "other" societies. Archaeoastronomy exists within Western society's concepts of time and space and our experiences of time and space may interfere in our interpretations of other societies' concepts. So the strategies leading to the validation of astronomical alignments cannot be defined by our Western-scientific ("green") standards. However, this does not mean that high standards of evidence should be abandoned. In order to confirm or refute an astronomical alignment hypothesis, it is necessary to examine how past and non-Western societies conceived, used and manipulated time and space categories. The hypothesis cannot be simply confirmed by the fact that a given celestial body's importance is demonstrated in a different cultural sphere (e.g. mythological, religious, iconographic, etc.): rather, it must be shown that the use of a particular astronomical referent in architecture corresponds to the generating principles created and re-created through *habitus* and is in accordance with that culture's symbolic logic. If the hypothesis encounters an antagonistic principle, it becomes incompatible with the culture's symbolic logic and then should be dismissed. This position implies that the objectivity of astronomical referents encoded in material objects is context-dependent and can only be established where there are repetitive practices. Astronomical referents have no values nor meanings *per se,* but are revealed, created and re-created through human agency. Therefore, what seems to be objective to knowing individuals, is not acknowledged by those who do not share the same logic of practice. In scientific practice we are acting as those who do not know the proper logic. To make sense of astronomical referents requires some preliminary knowledge of the social totality in which they play an active role. If we understand them more-or-less properly (e.g. moving within a hermeneutic circle), they became objective. I suggest that in this way we may overcome the dichotomy between "green" or "etic" and "brown" or "emic" archaeoastronomy.

Having arrived at this conclusion, it reveals that there is considerable potential for the development of an adequate methodology in archaeoastronomy. Above all, it represents an effort to move from a static cultural description of archaeoastronomical evidence to a more dynamic phase. It requires that we consider cognitive and symbolic cultural patterns and the relationship between social agents and their world. In practice, this approach necessitates a much wider range of phenomena to be examined. If we, as archaeoastronomers, can manage to use those implications for the design of new research strategies, we will be in a better position in our understanding of culture.

Acknowledgements

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Note

1 There is insufficient space to discuss the problem of the objectivity of statistical testing and, more generally, of what constitutes a scientific procedure. During the last fifteen years archaeologists have started to explore the way their own discipline operates, paying attention to the historical, sociological and political factors that can affect the practice of archaeology. Archaeologists seem now to be aware that even the so-called "value-free", objective viewpoint is theory-laden. While this state of affairs appears to be accepted by a general audience, in the practice of archaeoastronomy, it continues to be controversial.

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2

The winter sun in a Palaeolithic cave: La Cova del Parpalló

César Esteban and J. Emili Aura Tortosa

"Seasonality and Motherhood also became part of the Creation." Edwin C. Krupp (1996)

Abstract

In this paper we present the results of an archaeoastronomical study carried out in the Palaeolithic cave-sanctuary of *El Parpalló*. We have found that, for present-day observers, a remarkable phenomenon of illumination takes place in the innermost chamber of the cave soon after sunrise on the winter solstice. We have estimated the visibility of the phenomenon during the period of occupation of the cave (the end of the Gravettian to the end of the Magdalenian), and find it very probable that the phenomenon could have been observed in a fairly similar way, although this depends upon the degree of alteration suffered by the rocks of the entrance, which is unknown. On the other hand, the innermost chamber is briefly illuminated, without any remarkable phenomenon occurring, for a period of up to one hour soon after the local sunrise, during a longer wintertime period. This certainly happened in a similar manner in Palaeolithic times. We briefly discuss these results in the context of accepted ideas on Palaeolithic religion and conclude by proposing that the cave can be interpreted as a sanctuary devoted to fertility and the seasonal cycles of nature.

Skywatchers in the Palaeolithic?

The first indications of the use of calendars—or, at least, records of the passage of time—seem to come from systematic notations carved on bones by Ice Age people in the Upper Palaeolithic period 20,000 to 30,000 years ago. Marshack (1972, 1978) examined markings on certain decorated bones dating from the Aurignacian to the Magdalenian periods, finding that they were carved using different tools and, probably, at different times. By considering the number and arrangement of the markings, Marshack interpreted them as records of the visibility period of the moon and emphasizes that these markings are symbolic and quantitative (but not necessarily exact) references to the passage of time. He also reports (Marshack 1972, 1995) the presence of rich imagery relating to seasonal elements in certain Palaeolithic decorated bones from Southern France, indicating that the cyclic renewal of nature was represented in Ice Age art.

Some authors have also claimed that celestial bodies were represented in European Palaeolithic rock art. A well-known example is in the Aurochs, the largest picture in Lascaux, which is dated to the Magdalenian era (18,000 to 10,000 BP). Six points floating on the back of one of the aurochs have been interpreted repeatedly as the Pleiades cluster (e.g. Baudouin 1916; Antequera Congregado 1994; and more recently Rappenglück 1997).

Unfortunately, the arguments purporting to demonstrate the existence of some sort of "Palaeolithic astronomy" are all far from definitive. In this paper we present a different approach to the problem of the existence of an interest in astronomy in Palaeolithic times, which is based on the application of the techniques of archaeoastronomical fieldwork, in our case applied to a Palaeolithic cave-sanctuary: *La Cova del Parpalló*.

La Cova del Parpalló

La Cova del Parpalló (in Catalan, the Cave of the Big Eyebrow) is located on the Mediterranean coast of Spain, in the autonomous region of Valencia, near to the modern town of Gandía. It is situated in a mountainous landscape at 600 m above sea level. Archaeological interest in this cave dates back to the last century (Vilanova i Piera 1893), and the Spanish archaeologist Luis Pericot excavated the cave completely between 1929 and 1931 (see Pericot 1942). Reanalyses of this work have been undertaken by several authors, the most recent being Aura Tortosa (1992), who has undertaken a detailed re-examination of the stone and bone artefacts found on the *Talud* (talus) zone of the cave, which date mainly from the Magdalenian.

The analysis of the artefacts found in the cave has established one of the most remarkable Palaeolithic sequences in European prehistory. The chronology of *El Parpalló* covers an unusually long time span within the Upper Palaeolithic, from the end of the Gravettian period at 21,000 BP, through the entire Solutrean, right up to the end of the Magdalenian, in other words the end of the Upper Paleolithic and the accepted time of abandonment of the European cave-sanctuaries. The cave was evidently in continual use throughout the Solutrean and Magdalenian periods.

The most remarkable feature of *El Parpalló* is the discovery of more than five thousand stone plaques with carved or painted animal and geometrical representations from all the periods of occupation of the cave. A large fraction of the plaques belong to the Solutrean period. The presence of such an astounding number of plaques at a single site makes this cave unique in Spanish prehistory. Most of the plaques contain depictions of animals, as is generally the case in European Palaeolithic rock art, the most frequent amongst them being horses, bulls, goats and deer. But a significant fraction contain geometrical forms such as rectangles (very common elements in Solutrean art in Europe), triangles and circles.

Apparently, *El Parpalló* did not have an important funereal use; in fact, only few human remains have been found in the cave. Of those, the most remarkable is a single human skull, belonging to a young female Cro-magnon dated between 20,500 and 18,000 BC. Aura Tortosa (1995, fig. IV.5b) has analysed the density of stone tools, plaques and bone artefacts found in the most carefully excavated zone of the cave (the *Talud*, see *ibid*., fig. X) as a function of the period of occupation. His diagram indicates that the density of plaques is larger than that of the other kinds of artefacts during the first centuries of occupation (from the Gravettian to the Middle Solutrean). In contrast, the density of domestic stone tools increases dramatically from the Upper Solutrean onwards. This result indicates that the cave can be considered basically as a sanctuary during the earlier phases of occupation, but was dedicated more intensively to domestic uses during the later Upper Solutrean and especially during the Magdalenian epoch.

Fig. 2.1. General view of *the cave entrance.*

Archaeoastronomy in *La Cova del Parpalló*

In Fig. 2.1 we show a general view of the entrance of the cave. This is a huge vertical opening, much taller than it is wide, and about 10 m high. It is oriented to the south-east towards an open horizon which stretches from the east to the south. In Fig. 2.2 we show the plan of the cave. Its complexity is due to the relatively small horizontal dimensions (about 20 m from the entrance to the innermost chamber) in comparison with the height (about 15 m at maximum). There is a spacious central chamber just within the entrance and two small galleries at different levels. The main gallery is about two metres high and has a small chamber at its end (hereinafter "the innermost chamber"). In Fig. 2.3 we show the entry point to the main gallery as seen from the outer entrance.

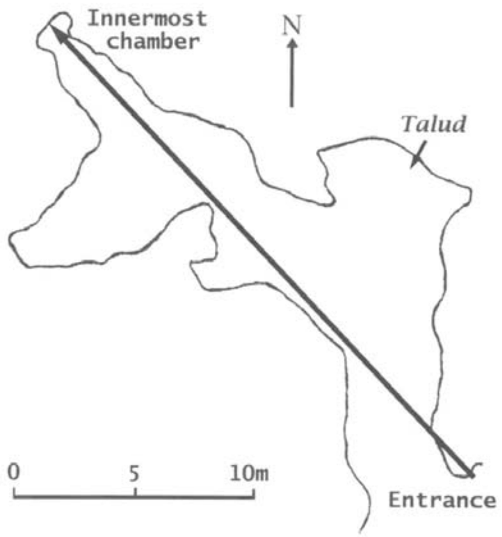

Fig. 2.2. Plan of La Cova del Parpalló*. The different parts of the cave commented upon in the text are indicated. The line shows the path of the sun's rays at winter solstice sunrise.*

On the basis of a simple inspection of the site plan, we had already suspected, before our visit, that there was a possible astronomical relationship between the orientation of the main gallery and the winter sunrise. To check this, we visited the site twice: once in the winter of 1996, in order to obtain our own measurements of the cave and horizon; and again on the morning of the winter solstice of 1997 (December 20) to observe the sunrise directly at the site.

We obtained a sequence of photographs following the pattern of illumination produced by the sunlight inside the gallery and the inner chamber after sunrise. In that sequence we can see a patch of light illuminating the ceiling of the main gallery and penetrating to the interior as the sun rises in the sky. About 40 minutes after the local sunrise, a blade of light touches the rear wall of the inner chamber producing a striking phenomenon, which can be seen in Figs 2.4 and 2.5. Fig. 2.6 shows the same moment looking in the opposite direction (taken from the innermost chamber). As can be seen, the sun appears in a narrow area of the sky just at the bottom of the entrance. After this, and as the sun continues to rise in the sky, the narrow patch of light widens and becomes diffuse, illuminating the inner chamber for about another hour.

Fig. 2.3. View of the interior of the cave from the entrance. The cavity is the entry point to the main gallery.

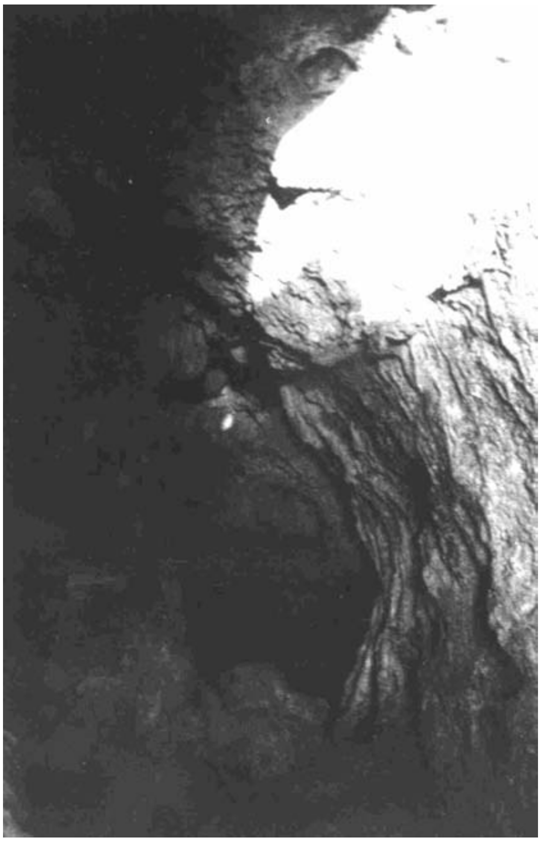

FIG. 2.4. The first rays of sunlight touch the rear wall of the innermost chamber after sunrise at the winter solstice.

FIG. 2.5. Picture taken a few seconds after Fig. 2.4. The change of shape of the patch of light can be clearly seen.

Of course, this vivid description of the sunlight phenomenon comes from observations made at the end of the twentieth century. The obvious question is, what happened at this moment of the year in Upper Palaeolithic times? In Fig. 2.7 we show the results of recent calculations of the long-term variations of the obliquity of the ecliptic, taken from the compilation by Berger (1984). From the diagram we can see that the obliquity did not change by a great deal even during the whole of the extraordinarily long period of occupation of the cave, owing to the almost sinusoidal nature of the variation in this parameter. In fact, the obliquity when the cave began to be used was about 22°·9 (±0°·1), about half a degree (a solar diameter) less than the present value. Moreover, during the Solutrean period, when there are clearer indications of the cave's use as a sanctuary, the obliquity changed only from 22°·9 to 23°·5, a value slightly larger than the present-day one. Therefore, for naked eye observations, the position of the sun for the first users of the sanctuary was not too different from that for present-day observers.

In Fig. 2.6, we indicate the size of the solar disc in order to permit some rough estimates of the visibility of the phenomenon in Upper Palaeolithic times. If we consider a value of the obliquity of 0·5 degrees less that the present-day value (in order to match the value at the end of the Gravettian period, about 22°·9, the sun should still appear in the narrow area of sky visible through the entrance of the cave from the inner chamber and, therefore, the phenomenon could be observed in a fairly similar way.

On the other hand, the relatively large area of the sky covered by the entrance (as viewed from the inner chamber) means that the sun crosses the wide upper open area of the entrance for 30 to 60 minutes after rising for about 56 days before and after the winter solstice. Therefore, for a relatively long period during autumn and winter, the inner part of the cave is illuminated by the sun after its

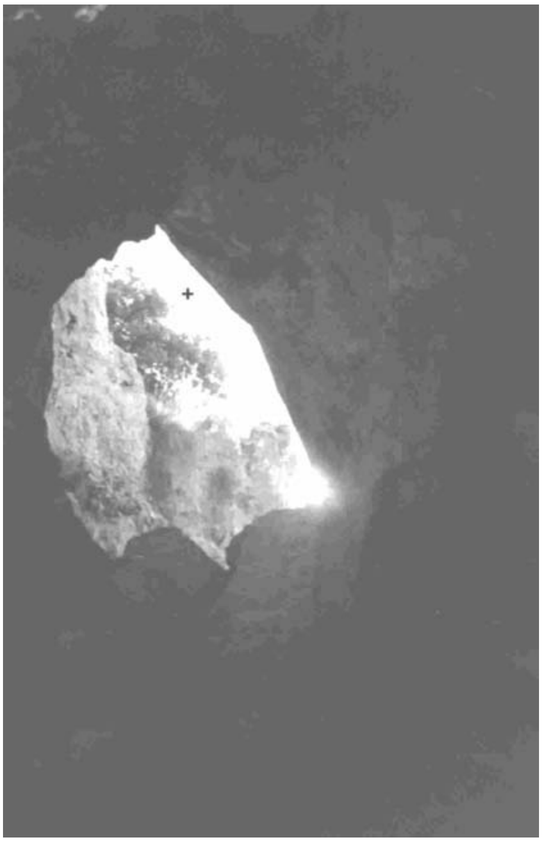

FIG. 2.6. View of the sun entering the cave as seen from the rear wall of the innermost chamber. This picture is taken in the opposite direction from Figs 2.4 and 2.5. The cross indicates the size of the sun's disc.

rising; but this is only in principle, and does not produce a distinctive illumination effect. The period of visibility of the curious phenomenon we have described, where a narrow patch of light is projected onto the interior, is observable only for a few days around the winter solstice.

We are aware that structural changes in the cave from Upper Palaeolithic times to the present-day could have affected the nature of the astronomical phenomenon. Unfortunately, there are no detailed geological studies available for the cave, although some hints can be inferred from the archaeological reports. However, we can say that, the sediment layers excavated give no indication of any major collapses in the structure of the cave or its entrance. In particular, the southern wall (on the right in Fig. 2.6) is original. In fact, the remains of sediments and archaeological material still adhere to the surface. On the other hand, we cannot rule out the possible alteration of the rock at the entrance (a limestone) that delineates the left part of the narrow open area that produces the sharp patch of light on the inner chamber (see Fig. 2.6). Natural and artificial erosion has surely affected the shape of this feature, to an unknown extent. If the changes have affected no more than a few centimetres of the surface of the rock, then it is still possible that the phenomenon was observed in Upper Palaeolithic times, although in a different position (more to the north) on the rear wall of the inner chamber.

In summary, although the present-day phenomenon at the winter solstice is striking, we are not completely confident that it occurred in Upper Palaeolithic times. However, even if not, the plain illumination of the inner chamber certainly did take place during a period of autumn and winter in much the same way as at present.

A possible interpretation of *La Cova del Parpalló*

If the illumination effects at La Cova del Parpalló that we have described really were observed and perceived as significant by Ice Age people, then this would imply that the seasonal changes of nature and the sky were appreciated at very early times. If this astronomical relationship really was noticed and taken into account, then surely it would have been charged with an extraordinarily strong symbolism that we should strive to understand in the light of the few currently accepted concepts and ideas about Palaeolithic religion.

It is broadly accepted by scholars that the concept of fertility was an important aspect of Palaeolithic religion. This is well illustrated by the discovery of numerous representations of females with marked sexual attributes dating back as far as the Gravettian period. These are the famous "Venus" figurines which vanished from European Upper Paleolithic mobiliary art with the appearance of the Solutrean peoples. During this last period, representations of animals replace anthropomorphic images in the cave-sanctuaries. Yet, according to many authors (e.g. Leroi-Gourhan 1994, 41) wound marks are unusual in Palaeolithic representations of animals, and there

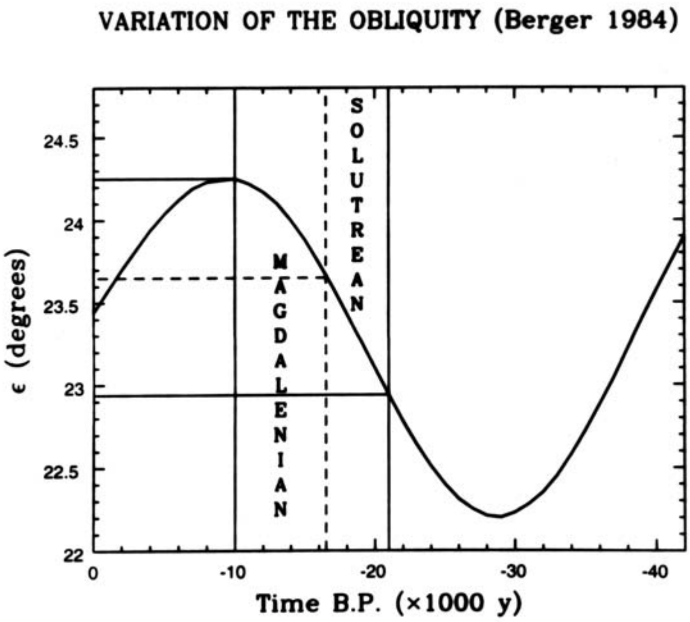

FIG. 2.7. Long-term variations of the obliquity of the ecliptic, after Berger (1984). The vertical lines indicate the beginning and end of the Magdalenian and Solutrean epochs. The vertical lines give the value of the obliquity at those moments.

are no depictions of hunting. This fact, in addition to the lack of correlation between the frequency of representation and the frequency of consumption of particular species (e.g., in the case of Parpalló, Villaverde Bonilla 1991–92) suggests that these images had a totemic function. On the other hand, scenes of animal motherhood and mating are also very common in European Upper Palaeolithic art, including some of the plaques at *El Parpalló*. This leads Marshack and other researchers to propose that the images of animals are in fact symbols of nature's seasonal cycle of renewal and rebirth (e.g. Marshack 1972). Another recurrent element in Ice Age art is the representation of female vulvas, images of which are directly related to the concepts of fertility and reproduction. A wonderful example of this is in the Magdalenian paintings of the *Chapel of the Vulvas* in the Cave of Tito Bustillo in Cantabria (northern Spain). There is also a possible image of a vulva in one of the oldest plaques from the Gravettian of *El Parpalló* which comprises an inverted triangle on a "chess board" rectangle, probably representing the earth (Jordá Cerdá 1990). In this sense, it seems remarkable that the shape of the entrance of *El Parpalló* (see Fig. 2.2) closely resembles a huge vulva. Moreover, if we view the point of entry to the inner chamber from the entrance of the cave (Fig. 2.3), it bears an astounding resemblance to the anatomy of female genitalia. A similarly shaped entrance is found, for example, at the well-known Palaeolithic cave-sanctuary of Font-de-Gaume in France, which is called the "capital of prehistory" (see Krupp 1996, 116–25). The entrance here faces west and the cave has a long corridor flanked by bison and other animals which leads to a chamber with many more paintings of bison. Taking into account the particular shape of the cave and the location and arrangement of the paintings, Krupp (*ibid*.) speculates that the cave-sanctuary could have symbolised a place where the seasonal renewal of life was perceived as taking place on the earth.

The remarkable astronomical fact that the winter sun illuminates the inner chamber of *El Parpalló*, a cave with a "female architecture", undoubtedly has strong symbolic potential. This is especially true in the context of a simple naturalistic religion focussed upon the fertility of the earth, animals and humans, as the Palaeolithic religion is thought to be. The illumination of the inner part of the cave (at the end of a long and narrow gallery) by the morning sun could have had powerful overtones of fertilisation. Moreover, the occurrence of the phenomenon in winter, the most critical period of the year for the survival of the community and of nature in general (especially during the Ice Age!), and the fact that it recurred annually, reinforces the idea that *El Parpalló* was a sanctuary reflecting and reinforcing the concepts of fertility and the seasonal cycles of nature. We believe that the results given in this paper are very suggestive, but they only represent a first step in the difficult task of demonstrating that humans observed the sky and its cycles as far back as the Palaeolithic. More evidence of this kind is needed, as only statistical results can give a definitive answer.

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3

Hunting the European sky-bears: on the origins of the non-zodiacal constellations

Roslyn M. Frank and Jesús Arregi Bengoa

"Galdera egokirik ezak ekartzen baitu, sarritan, erantzuna aurkitu ezina." Joxe Ramon Zubimendi (1995, 117)

"Nearly every culture perceives the stars to be in groupings of constellations due to the uneven distribution of stars across the celestial sphere. Throughout time people have imposed order on the stars, as they perceive the heavens in terms of their own value systems." Trudy Griffin-Pierce (1986, 62).

Abstract

Theories put forward previously to explain the origins of the non-zodiacal constellations are examined in the light of new evidence drawn from the project "Hunting the European Sky Bears". At this stage a reassessment of the research models used in the past is in order, particularly in view of the conclusions brought forward over the past ten years concerning residual Bear Ceremonialism in Europe and related social practices (Frank 1996a; 1997; n.d.b; Frank and Patrick 1993). The review of the literature begins with the model proposed by Maunder in 1908 (Maunder 1922[1908]), moves on to those of Ovenden (1966), Roy (1984) and Gingerich (1984), and concludes with a discussion of the most recent synthesis of the research, the model proposed by Rogers (1998a; 1998b). More specifically, the assumptions underpinning the previous models are subjected to scrutiny, as are the premises implicit in their methodological approaches. In the final section a revised research model and methodology are proposed along with a modified set of assumptions. The result is a slightly altered research model although one that still builds directly on conclusions derived from previous investigations. We suggest that once the new data are introduced, the earlier research paradigm takes on added meaning. In short, by only slightly altering the nature of the underlying set of assumptions a much more profitable and comprehensive approach to the data can be developed.

Introduction

Over the past fifteen years researchers have increasingly turned their attention to the question of the origins of the classical constellations, the forty-eight star figures passed on to us by the Greeks (Gingerich 1984; Gingerich and Welther 1984; Gurshtein 1993; 1994; 1995; 1997; Krupp 1991; 1995; Ridpath 1988, 1990; Roy 1984; Rogers 1998a; 1998b).[1] Nevertheless in these works there has been little discussion of the assumptions underpinning the models utilized. In other words, until now the underlying premises of the methodology employed to analyze the problem have not been subjected to close scrutiny. At this stage such a reassessment of the research models is in order, particularly in the light of new information brought forward in the past ten years concerning the European Sky Bears and Bear Ceremonialism. Our paper, divided into four parts, begins with an overview of these new data and then proceeds to examine the methodological premises intrinsic to the existing models, including our own, for determining the temporal and spatial limits of the data. In reference to the scope of our discussion, it should be made clear from the onset that we will limit ourselves almost exclusively to questions related to the origins of the non-zodiacal constellations. Moreover, our comments will focus only on a limited group of these non-zodiacal star figures.

As Rogers (1998a) and others have demonstrated, the zodiacal constellations trace their genealogy back to Mesopotamia where they evolved progressively from the fourth to the first millennium BC. These solar-oriented constellations could not have been transmitted from Mesopotamia to the west before the first mid-first millennium, because the zodiac itself was not complete until then. These zodiacal constellations were eventually combined with other non-zodiacal ones whose origins are unknown, to form the classical sky map. According to Rogers (1998b, 81), this almost certainly happened in Greece itself between about 540 and 370 BC. In this paper our focus will be on those non-zodiacal constellations whose genealogy is far less clear.

The purpose of the second part of our study will be to briefly summarize other pertinent literature on the topic of the origins of the ancient constellations and, in the process, to examine the assumptions inherent in the different positions taken and their methodological approaches.[2] That review begins with a discussion of the model we shall call Uniformist. This model was first articulated by Maunder[3] in 1908 and then reiterated some sixty years later in Ovenden's provocative lecture given in 1965. That discussion brings into focus Maunder's key contribution to the research model in question (1913, 1922 [1908]). Indeed, it should be recognized that Maunder was the first to set up the terms of the debate. In the process he managed to frame it in such a way that there would be a scientific method for estimating the time and place from which at least one set of the ancient constellations were projected onto the sky. As we shall see, the same problem-solving strategies laid out first by Maunder were taken up by Ovenden (1966) and later by Roy (1984). Briefly summarized, the Uniformist Model argues that (1) the classical constellations were created at a single place and time and that (2) both the temporal and spatial aspects of the data can and should be specified with relative precision. Furthermore, that model alleges that the design of the constellations and their position in the sky is the result of the deliberate efforts of a highly inventive team of astronomer-priests. Finally, the Uniformist Model assumes that the motivation behind the invention of the star figures was purely "scientific", namely that the designers intended them to serve as a coordinate system for celestial navigation.

In his model Ovenden speculates that "the constellation-makers were Mediterranean sailors" and, moreover, that they would have chosen an island with a good sea horizon to make their observations. The island he suggests is one now called Stampalia (local name "Astropalia"), at latitude 36 1/2°N and longitude 26 1/3°E (Ovenden 1966, 15). In brief, Ovenden identifies these sailor-astronomers with the Minoan civilization based in Crete. In 1984 Roy takes up Ovenden's hypothesis and elaborates it further, speculating that Eudoxus' star-globe, the one used by Aratus, was a relic from the wreck of a Minoan ship that survived the disastrous volcanic eruption on Thera and made its way to Egypt. However, Roy is more circumspect than Ovenden in his speculations, for in his variation on the Uniformist Model he does not fully conflate the navigators who would have employed the celestial coordinate system with the astronomers who designed it:

> The navigator people and the constellation-makers could have been the same people or two different peoples. The navigator people could have lived at a later era than the constellation-makers, even if they were of the same race. Thus the constellation-makers may, over many centuries have observed the heavens, projecting on the random patterns of the stars figures of their people's legendary heroes and heroines, monsters and more familiar animals as a useful method of memorizing the heavenly panorama (Roy 1984, 181).

The third part of our paper centres on the most recent reframing of the debate, namely, the arguments brought forward by John Rogers (1998a, 1998b) in a two-part article on the origins of the ancient constellations.[4] The Gradualist Model, as we shall call it, has been set forth by Rogers who argues that "the classical sky-map was synthesised from several unrelated sources…" (Rogers 1998b, 80).[5] His approach coincides closely with that of Gingerich (1984). Its underlying hypothesis alleges that the classic constellations are "a long-evolved mixture including elements from very ancient cultures…" (Gingerich 1984, 220). In reviewing Rogers' arguments we shall demonstrate that at certain junctures the conclusions are marred by methodological contradictions inherent in the earlier models themselves.

In the concluding section a different working model and methodology are brought forward along with a revised set of assumptions. The result is a slightly altered research model although one that still builds directly on conclusions derived from both the Uniformist Model and that of the Gradualists. In elaborating the alternative methodological framework we attempt to integrate findings from the project "Hunting the European Sky Bears". In other words, the final part of the paper demonstrates that once the Hartzkume data are introduced, the earlier research paradigm takes on added meaning. Indeed, we assert that by slightly altering the nature of the underlying set of assumptions a much more profitable and comprehensive approach to the data can be developed.

Hunting the European Sky Bears

We shall begin this section with a summary of the findings of the research project called "Hunting the European Sky Bears". Our central claim is that the pan-European cycle of orally transmitted folktales known collectively as "Bear Son Tales" is astrally coded. In terms of their value as a database, it is significant that these tales represent the most widespread motif of European folklore (Cosquin 1887; Frank 1996a). They are complemented by a rich legacy of performance art in which chapters from the tales are re-enacted: concrete scenes from the saga are acted out in song, dance and mime (Frank 1998 and references therein; n.d.c). The fact that some of the most ecocentric[6] of these materials are found in Euskera (Basque) and/or in zones where Euskera was spoken in historic times, suggests that we are dealing with relatively ancient cognitive artefacts (Fig. 3.1). (This is because Euskera is classified as a pre-Indo-European language and, as such, pertains to an earlier cognitive layer of Europe.) Moreover, the popular theatrical pieces still performed today in this region are perhaps the most complete in terms of their cast of characters, musical repertoire, dances and animal miming. Yet the widespread distribution

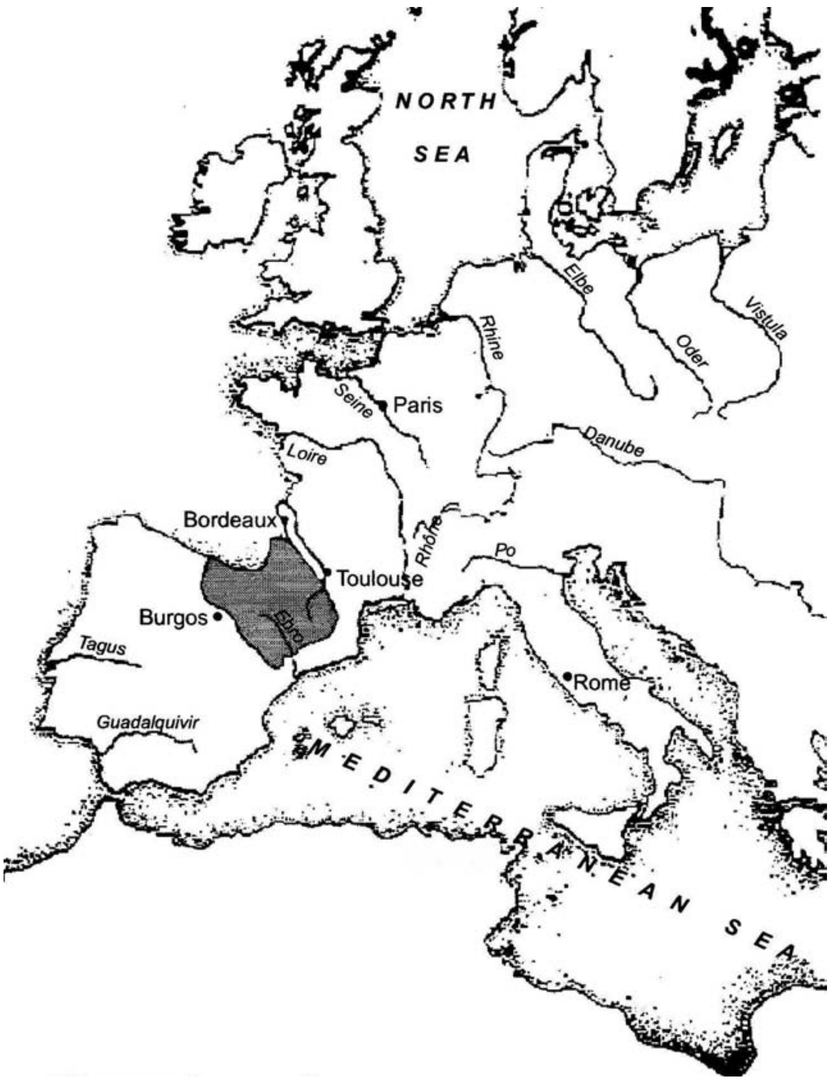

FIG. 3.1. The Basque-speaking zone in the first century AD. After Salvi 1973; Bernard and Ruffié 1976.

of the tales—they are found in all European languages (Cosquin 1887, 1–27)—as well as details associated with the performances themselves lead to the conclusion that we are dealing with astrally coded materials. They are grounded in the earlier pan-European ecocentric belief that humans descended from bears, a belief that has continued alive and well in the Pyrenees into the twentieth-century (Peillen 1986).

Another indication of the archaic nature of the artefacts in question is their strong shamanic flavour. For example, there is the half-bear, half-human hero Hartzkume ("Little Bear" in Euskera) who begins his journey to the End of the Earth with a "vision quest". In it he acquires his "medicine bundle" and, as a result, gains the ability to change shape. This episode occurs soon after the initiate has encountered a Great River. Since the shaman apprentice cannot cross over it, he chooses to follow a path along its edge. It is near that path that he acquires his four Spirit Animal Guardians: a mountain cat, a dog (perhaps earlier a fox), an eagle and an ant. The tale's complex plot later requires the hero to change shape into each of these animals in order to carry out a set of formulaic actions. The latter are understood as ritual battles intended to bring about the death of the Serpent-Snake's (Twin) Brother and, in the process, bring the first Serpent-Snake back from "immortality" so that he, too, is able to enter the endless cycle of life and death.[7] The ecocentric nature of the combats is underlined by the fact that they represent re-enactments of commonplace predator-prey encounters. In these, the shaman apprentice plays the role of the hunter and his shaman opponent, the hunted. In the narrative the shaman initiate, who is already part bear—his father was a Great Bear and his mother a human female—is pitted against another shaman who appears in the figure of Herensuge, the Serpent-Snake. It is the latter's (twin) brother who changes shape, taking on the outer form of the prey.

These formulaic encounters comprise a strictly ordered, paired series in which the competition between the two shape-shifting shamans is played out. The matches are between a mountain cat and a giant porcupine, a dog and a hare, and finally an eagle and a pigeon.[8] The magic formula stipulates the following sequence of events. First, the second Serpent Brother appears in the guise of a Giant Porcupine. At this point the challenger, the young hunter apprentice, must shape-shift into a Mountain Cat. Once the Porcupine is killed, a Hare appears and the hero must turn into a Dog. Next, when the Dog kills the Hare, a Pigeon appears and the hero has to shape-shift into an Eagle. The Eagle pursues the Pigeon and kills it. Finally, the hero in the shape-shifted form of the Eagle must remove the Magic Egg from inside the pigeon and break it on the forehead of the second Serpent-Snake. That act, according to the story line, will cause the Egg in the head of the first Serpent-Snake to break and he will "die". Although many details have been omitted from this summary, based on the evidence presently available, a strong case can be made for the ecocentric nature of the tales. For example, the fact that the characters themselves are animals is readily apparent in the most archaic versions of the stories (the most obvious exception being that of the main character's mother, who is always portrayed as a human female).

Overall these heterarchical versions—that is, ones that do place humans at the top of a hierarchy of animals—are the most ecocentric in nature and, consequently, in them the shamanic elements are the most pronounced. For example, there is the role of the female Eagle who also rescues the hero from the Under World where he has become trapped and flies him back to the Upper World. She agrees to do so because, as she explains, the hero's actions saved her eaglets from the Serpent-Snake who was trying to eat them. Subsequently, while they are still in flight, the pieces of meat that the hero has brought along to feed the female Eagle, at her request, run out. At this juncture the hero begins to slice off pieces of his own flesh from his thigh. However, once they arrive at their destination, the female Eagle shaman touches the hero and miraculously cures him, making him whole again.[9] Other Spirit Animal Guardians include the Grey Mare who, near the end of the tale, aids the shape-shifted hero in killing his nemesis, the female Black Wolf.[10]

In the extant tales one of the most obvious structural variations is the marked cognitive shift away from the original heterarchical and ecocentric text to a more hierarchical anthropocentric one. This variation is readily detected in the vast corpus of extant variants (cf. Shepard (1992) and Shepard and Sanders (1992) for additional commentary on Bear Ceremonialism and the ecocentric nature of its astral mythos). Moreover, the shift itself is well documented, appearing as it does repeatedly, especially in tales collected outside the Pyrenees. In the prototypical version of the tale, early on in the story, as we have noted, the hero runs into the four animals who become his Spirit Guardians. These animals ask him to perform a division of a dead ass (sometimes a dead ox). And when he does so successfully, each animal awards him a talisman. These objects come to form his medicine bundle, allowing him to shape-shift and acquire each animal's abilities as well to take on its physical form. In the later versions of the tale, the four helper animals disappear from view, although sometimes the Ant continues to play a minor role. In their place there appear three humans, most often men of gigantic proportions whose strength almost rivals that of the hero himself, although the latter is always portrayed as being more powerful than the rest and equipped with a giant club.[11]

By comparing the many extant variants of the tales it is clear that we are talking about two stages in the evolution of the narrative text. The first represents the earlier ecocentric phase where the vision quest of the shaman apprentice is clearly delineated: namely, the episode in which he acquires his medicine bundle from his Spirit Animal Guardians. In these texts the fact that the hero himself has an ursine lineage is emphasized. The second stage is characterized by the disappearance of the aforementioned episode along with the four Spirit Animal Guardians. In their stead we discover several anthropomorphic male figures, whom the hero encounters early on along the road and who are then portrayed as the hero's helpers, many times even as his brothers. Nonetheless, it should be noted that even in these later versions, narrative clues can be found indicating that the characters portrayed now as the hero's purely anthropomorphic male "helpers" were once wild creatures.[12]

Yet a caveat must be expressed: it is not clear whether the alternation in the text is simply the result of a narrative transformation of the Spirit Animal Guardians into two or three male giants who then accompany the hero on his adventures. It would be better to state that while there appears to be a connecting link between the two sets of Helpers, the exact nature of the relationship is not entirely apparent. Indeed, other factors might have come into play in bringing about the narrative transformation in question. For example, the confusion might have arisen because in the ecocentric antecedents of these versions the identity of the Spirit Animal Guardians was not expressed directly, but rather through kennings, a form of poetic metaphor.[13] In any case, this narrative shift shows the reworking of text's ecocentric discourse by a far more anthropocentric and patriarchal mindset. In short, this change in the text is an excellent example of the way in which the narrative frame of the tellers has been altered over time: the animal characters disappear from view and are replaced by human figures.[14] Furthermore, since there is reason to believe that the Spirit Animal Guardians are portrayed as females in the prototypical version, the role inversion that results in male giants taking their places is even more striking.

Another intriguing aspect of the Hartzkume tales are the hints found in it concerning the existence of some sort of a terrestrial-celestial coordinate system. For example, the emplacement of several of the adventures is indicated by means of numeric coding. The coding suggests a cognitively backgrounded cosmography: a spatially ordered mapping. And that in turn indicates that the material could have been transferred iconographically onto shaman healers' drums and/or portrayed ritually in some another fashion. The use of a similar type of numeric coding is characteristic of shamanic beliefs in Siberia (Kalweit 1992, 42–5). There the locations appear to correspond to different cosmic levels through which the shaman healers pass on their skyward journeys. In the Hartzkume materials the celestial counterparts of certain locations, such as "Three-times-Nine Land" and "Seven-times-Seven Land", are not clear. Yet there are strong indications of a direct correspondence between the number assigned to the "Land" where the adventure in question occurs and the hero's movement: the higher the number, the further away the hero has moved from his starting point. In addition, there is a hint that the highest numbers correspond to locations nearest the place where the combat between the Grey Mare and the female Black Wolf takes place, namely, "beyond Seven-times-Seven Land" (cf. Frank 1997, n.d.a). The latter location itself appears to correspond in some fashion to the "seventh-mansion" or "seventh-house" of the Under World where the hero ends up finding himself trapped. It is in this region that somewhat later the female Eagle appears to him and flies him back to the Upper World (Frank 1997).

Additional clues that we are dealing with some sort of numerically coded text lie in the fact that in the Basque language materials and performance pieces there are two sets of characters known collectively as "Fourteens" and "Thirteens". Specifically, Hartzkume, the Bear Son, is also called Hamalau "Fourteen" while in the performance pieces he has a helper called Hamahiru "Thirteen". This pattern is further corroborated by the fact that in some versions of the stories two of the hero's Helpers are referred to as "Twelve" and "Thirteen" respectively, while the hero continues to be called "Fourteen" (Frank, n.d.a).

The full significance of these numbers is still unknown. There is, however, reason to believe that the hero's name, Hamalau or "Fourteen", may be significant. It appears to be linked in some fashion to a remarkable coordinate system that has survived in Euskal Herria (the Basque Country). Remnants of the same system are found in abundance across much of the Atlantic Façade of Europe (Frank 1999a, 1999b, n.d.a; Frank and Patrick 1993; Zaldua 1996). Moreover, there is evidence that the system itself, used for celestial and terrestrial mapping, dates back at least to the early Middle Ages and quite possibly beyond (cf. Couch's (1988, 1989) comments on the role of mathematics as a form of information technology in orality). Indeed, the research demonstrates that linked to this coordinate system was the use of a latitudinal position of 41·4°N as a benchmark in the design of the scale on sailing charts and maps in the Middle Ages. As a result there were at least two competing latitudinal positions in use for celestial navigation (Frank 1999b, n.d.a.). The first was the commonplace setting of 36°N that passed through Rhodes which was regularly used in constructing celestial globes from the time of Geminus of Rhodes onwards.[15] This setting is the one with which we are most familiar since it was the one passed on to the members of the numerate elite of Europe. Yet it appears that there was another setting, that of 41·4°N, which was preserved orally by innumerate people such as ship's pilots and other members of the general populace.[16] The parallel in question passes just north of Madrid, Spain, extends across the Mediterranean slightly south of Rome and then eastwards through Thessaloniki, Greece (Frank 1999b).

Of interest to questions related to the dating of cognitive artefacts is the fact that the septarian metrological traditions and coordinate system to which the above setting belongs are linked to those utilized in the layout and design of the Basque "stone octagons" (Frank and Patrick 1993; Frank 1996b; Zaldua 1996). These structures in turn have been carbon-14 dated to the second century AD. Yet the date determined from an excavation at the base of one of the centre stones, called *(h)austarriak* or "ash-stones" in Euskera, does not correspond to the date when the design of the figure and its metrological traditions first came into use. It only demonstrates that the tradition of building stone octagons was already in place by the second century AD (Zaldua 1996). Furthermore, detailed studies of the emplacement of the extant "stone octagons" reveal several other possibilities":

1. in Euskal Herria their builders were pastoralists;
2. the same people who built the stone octagons were also involved in constructing other stone structures commonly found in close conjunction with them, namely, cromlechs and dolmens;
3. the stone octagons themselves were centres for social practices with a ritual dimension, namely, reenactments of scenes from the Hartzkume stories; and
4. the reenactments were performed as a regular part of ceremonies intended to maintain the health and well-being of the collective as well as the cosmic order (Frank, n.d.c; pp. 144–8 of this volume).

At this point we can summarize the results of the Hartzkume research in terms of its possible significance to the question of the origin of certain of the non-zodiacal constellations. First, we see that the tales integrate what appear to be the most archaic celestial figures in the sky, the two Sky Bears themselves, Great Bear and Little Bear. These are portrayed in the coils of Draco, whose narrative counterpart is perhaps the first Serpent-Snake Shaman who in many versions of the tales is seated at the foot of a fruit tree, the Sky Tree, in which Hartzkume is hiding after having shape-shifted into an Ant. As we have noted there are other episodes in which the two shamans reappear in their shape-shifted forms as well as episodes in which one or more of the animal helpers reappear. Since the tentative assignment of the celestial counterparts of these episodes has been discussed elsewhere in much more detail (Frank 1994, 1996a, 1997, n.d.b; pp. 133–57 of this volume), at this stage we shall simply summarize the ancient constellations that might have been implicated in addition to the aforementioned trio of Draco, Ursa Major and Ursa Minor.

The following listing corresponds to the possible celestial counterparts of other characters and scenes found in the most archaic and hence ecocentric versions of the tales: the Great River (Eridanus); the first encounter represented by the hunting battle between the Giant Porcupine and the Mountain Cat (among the stars of Orion, the Great Hunter); the Hare being pursued by the Dog (Lepus and Canis Major); the Dove/Pigeon flying from the Eagle (in the region of Puppis); the Magic Egg smashed on the forehead of the Serpent-Snake brother (Procyon near the head of Hydra); the Grey Mare killing the Black Wolf (Centaurus and Lupus)[17] and; finally the Eagle saving Hartzkume and carrying him out of the Under World (Aquila flying along the Milky Way).

For our purposes the narrative structure of the Hartzkume saga is especially significant. It reveals not only an archetypal *Bildungsroman*, but also a narrative incorporating key components of a vision quest, including the hero's acquisition of his medicine bundle. While these elements alone do not indicate the presence of astral coding, we need to consider the following facts. In recent years our knowledge of ritual astronomical practices in traditional cultures has been greatly enhanced. Today we recognize that initiation rites of youth are often understood as a "recreation" of an archetypal quest. That journey, in turn, is often retold in the form of a narrative, while astral counterparts of the tale's Spirit Animal Guardians as well as the path taken by the hero(ine) are sketched onto the sky screen. In addition, it is assumed that prior to undertaking his/her own vision quest, the initiate has acquired an acceptable level of knowledge and understanding of the celestial landscape in question, so that, for example, he/she has become familiar with the ritual pathways through the stars. Finally, as documented by recent ethnoastronomical studies (Cajete 1994, 42–73; Farrer 1992; Griaule and Dieterlen 1986[1965]; Roberts 1987–8), in widely separated traditional cultures initiation rituals are often presided over by more knowledgeable elder members of the collective. Indeed at times, as part of the ritual reenactment, the symbols of different celestial bodies encountered along the journey are drawn or (re)painted on objects and/or the initiate's body (Rockwell 1991; Speck 1945).[18] In conclusion, the narrative structure of the Hartzkume saga fits neatly into this larger genre of astrally coded initiation tales. Hence, by analogy its cognitive grounding, also, should be sought in social practices that required knowledge of ritual as well as observational astronomy on the part of the practitioners.

The narrative itself also reveals to us its ultimate grounding in a cognitive framework more characteristic of a hunting-gathering culture, although there are also strong traces of pastoralism in many of the Basque versions of the tales. Moreover, the natural habitat of the Spirit Animal Guardians themselves suggests that the authors were projecting the tales onto (and from) a temperate landscape, perhaps with a transitional zone of alpine or highland meadows and pine forests (the latter is suggested by the presence of the Giant Porcupine). Nonetheless, there are many references to what appear to be relatively inaccessible, snow-covered peaks. It is not entirely clear whether the ritual geography of the tale included one or two of these zones. There is one location associated with the female Black Wolf referred to at times as Crystal Mountain and at others as Glass Mountain. In addition there is evidence for a place called Ice Mountain that may be a reference to a totally different region of the symbolic landscape or, perhaps, it is simply a different term for the location known as Crystal or Glass Mountain.[19]

In terms of the chronology of events that would have led to the projection of the contents of the Bear Son (sacred) tales onto the sky screen, we must first imagine a prior stage, a much earlier phase during which the narratives themselves were slowly crafted by the story tellers into complex verbal representations. As often happens in the case of oral cultures, the set of tales would have incorporated, in an implicit fashion, the ecocentric value system of the communities in question and served to transmit it from one generation to the next. To fix the chronological axis of that stage of development is simply not possible, for it lies beyond the conceptual horizons of our model. Stated differently, the origin of the stories featuring a Bear Son shaman initiate and his vision quest could date back many millennia to much earlier stages of Bear Ceremonialism in Europe, perhaps to the Mesolithic or even the Upper Paleolithic (Marshack 1991). There is no way to determine the actual time-depth of such oral narratives. Nor can we fix the location in which the stories first arose; other than to say that in all probability it was in a region of Europe where bears abounded.

However, once the stories started to be projected skywards we have a better chance of determining the temporal and spatial coordinates of those involved. Specifically, we must imagine a scenario that required a long period of gestation for observations, perhaps several millennia, in which those involved became increasingly familiar with the night sky. Indeed, perhaps the first step in that process was to draw the figure of their Serpent-Snake onto the sky screen, curled around the north celestial pole of that time and then to trace out beside it the figures of the Bear Ancestors. That would have been the easy part, especially if we assume that these non-zodiacal constellations were only the first of a series of illustrations to be projected skywards. The next steps would have been done very carefully since the final result was to be a highly useful set of constellation figures, whose risings and settings could also employed as time-keepers as well as for celestial and terrestrial mapping. In addition, once the constellation figures were projected skywards, those who saw them towering above would have been able to gain a sense of self-identity.[20] The stars acted as guides, allowing those who knew the stories to dance and mime the actions of the hero on the ground. And the shaman-healers themselves, just as the hero Hartzkume, would have had their star-charts to guide them on their otherworldly journeys as well as in supervising the choreography of reenactments performed, perhaps, in ritual sanctuaries on earth.

As has been stated, the period of time over which these preliminary observations were made and tested could have lasted several millennia. However, in our model at some point a decision was taken by these Europeans to project their cosmovision onto the heavens. This would have represented a major scientific undertaking for them, not just a ceremonial one.[21] Indeed, in all probability a variety of approaches were utilized initially in order to test the fit of the star figures they were constructing and the viability of the celestial coordinate system that they must have been developing simultaneously. Furthermore, given the magnitude of such a collective enterprise, it would not be surprising if we were able to detect a period of increased interest in celestial phenomena in the archaeological record. Let us consider, for example, the archaeological record of western Europe during the two-thousand year interval from approximately 4000 BC to 2000 BC. A close examination of it reveals a flurry of construction of megalithic complexes throughout the zone. This could be taken to be indicative of an increased preoccupation on the part of the general population and, more specifically, the architects of the megalithic complexes with celestial events.

Hence, the questions that need to be posed become the following. First, should we allege that the builders of those structures and the proto-astronomer architects who must have supervised their overall design, played a role in developing various techniques and cognitive strategies necessary to project the Bear Son stories onto the sky screen in a systematic fashion? Or should we assume the following scenario: that first, using the narrative materials found in the tales, a basic coordinate system was constructed from them. Its accuracy might have been tested in some fashion—over a period of some centuries—before it was finally definitively accepted as workable. At that point it would have been projected skyward from a given geographical location and that latitudinal position would have functioned as a benchmark for the placement of the southernmost star figures. These would have utilized stars abutting the designers' own "zone of invisibility". Then, perhaps stretching out over a period of another millennium, there would have been subsequent attempts to map more northerly terrestrial locations, e.g., ritual centres lying further to the north, by means of this same coordinate system and the possibilities of terrestrial mapping that it would have afforded them.

Although we cannot determine with any great precision the location from which these early observations of the sky were carried out, we can state that the observations were ones that would lead to the choice of certain groupings of stars over others. Furthermore, our model assumes that the cast of characters in the Hartzkume tales included not only the circumpolar stars of Draco, Ursa Major and Ursa Minor, but also the southern constellations known to us as Eridanus, Centaurus, Lupus, Canis Major and Lepus. At this point we discover that these are constellations abutting the much-discussed zone of invisibility (or "zone of avoidance") within which no star figures from the set of ancient constellations appear. The absence of such star figures in this area of the sky results from the fact that those who designed the constellations abutting it, could see no further. Their horizon plane must, therefore, correspond roughly to the unmapped region in question. Hence, at first glance it would appear that once one adjusts for the shift caused by precession, it would be a relatively easy matter to reconstruct the limits of the empty circular zone in question, determine the celestial south pole and extrapolate the latitude of observation. However, there are several major problems in such an assumption, all of which leads us to the second section of our paper where such methodological issues will be addressed in more detail.

Competing models

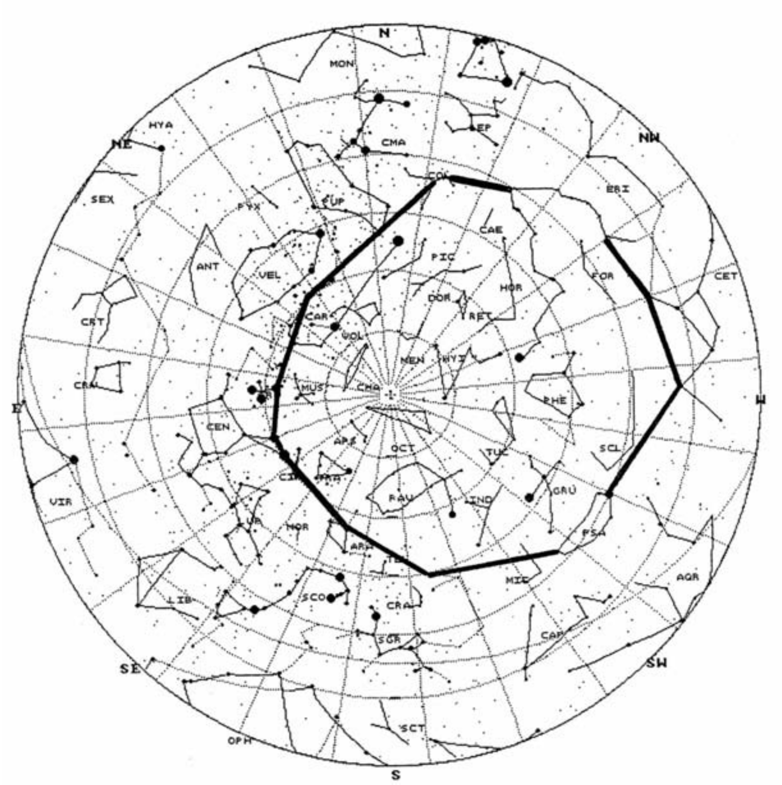

Fig. 3.2. Hipparchus's zone of invisibility. After Maunder 1922 [1908], 155. Reproduced in Ovenden 1966, 7.

All those who have concerned themselves with the question of the temporal and spatial axis of the zone of invisibility begin their analysis, as did Maunder, by discussing the earliest complete description of the forty-eight constellations of the classical world. This is the work of Aratus of Soli (c. 310–240 BC) called *Phaenomena*, a didactic poem that describes, although in a thoroughly poetic style, the astronomical contents of an earlier work of the same name written by Eudoxus of Cnidos (c. 406–355 BC).[22] The latter supposedly had in his possession a celestial globe that he then described in his writings. Both the globe and Eudoxus' work have been lost. Yet it would appear that in writing his own description of the sky, *Commentaries on the Phaenomena of Eudoxus and Aratus*, Hipparchus (c. 190–125 BC) had access to a work known as *The Sphere of Eudoxus* as well as the poetic description of Aratus.

It was Hipparchus who first noted discrepancies in the descriptions of the risings and settings of the constellations provided by Eudoxus and Aratus. In short, they had to be considered erroneous unless they referred to a much earlier epoch. And the latter fact led to the conclusion that many of the constellations were much older than classical Greece. Hence, their sources had to be sought in pre-Greek astral traditions. Stated differently, the Greeks inherited and passed on constellations that were already in existence far earlier. Based on descriptions found in Hipparchus's *Commentaries*, it is clear that his zone of invisibility, far from being circular, was rather elongated (see Fig. 3.2).

As we have noted, various techniques can be brought into play in order to determine the latitude and date when the non-zodiacal constellations were projected skyward. Yet it has been the strategy first offered by Maunder (1922[1908]) that has proved most successful. Maunder's procedure is to define the boundaries of the zone of invisibility, and then, by correcting for the precession of the equinoxes, to adjust the empty circle so that its centre coincides with the celestial south pole of the epoch in question. According to Maunder and later Ovenden, this process results in a radius for the circle that, in turn, corresponds to the latitude of observation of those who invented the constellations.

In Fig. 3.3 we reproduce a drawing from Ovenden's well-known article (1966). In the diagram *N* represents the south celestial pole as it is now, *H* the same pole at the time of Hipparchus, and *C* indicates its location at the time Ovenden believed the constellations were designed, namely, around 2800 BC. The two final points are in the centre of two circular figures reproducing the zone of invisibility, as it would have appeared in each period. Ovenden argued that the one surrounding *H* represents the zone of invisibility at 31° as it would have been seen by Hipparchus. However, it would be more correct to consider that latitude as one corresponding to 36°, since we know that

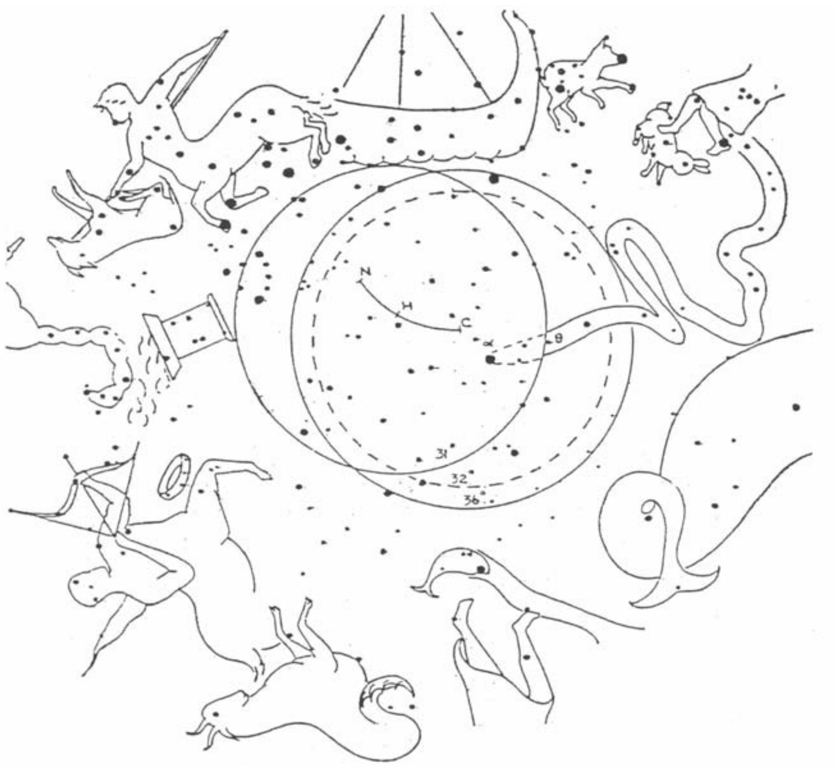

Fig. 3.3. Zone of invisibility. After Maunder 1922 [1908], 155. Reproduced in Ovenden 1966, 7.

Hipparchus did his observations from the island of Rhodes.[23] In any case, the major disagreements between our conclusions and those of Ovenden and Roy are related to *C* and the latitude assigned to its corresponding circumference.

First we should mention that the date of 2800 ± 300 BC obtained by Ovenden does not differ significantly from that of Maunder who, in 1908, had argued that it should be set at roughly 2700 BC. However, the very precision of these dates requires us to examine a major methodological issue: the question of the nature of the evidential base from which these dates have been extrapolated. In our opinion there are inherent upper limits to the precision of the results that can be obtained in the case of an experiment when the inputs themselves are poorly defined and/or intrinsically ambiguous. Additionally, before using the zone of invisibility to determine the spatial and temporal coordinates of our problem, we need to make explicit several assumptions underlying this approach to the data.

1. *Assumption of continuity of astral traditions*. Any reconstruction of the limits of the zone of invisibility depends on the assumption that the constellations abutting that zone which have been transmitted to us, are the same ones that the constellation-makers projected onto the sky and that they contain essentially the same stars as before. Certainly we have no access to star-charts or other relevant written materials from that remote epoch.

2. *Assumption of simultaneity of placement and uniformity of cosmovision*. The approach in question must assume that all the constellations abutting the zone of invisibility were projected onto the sky screen in a relatively short span of time (not much more than a thousand years) and by the same population. In this sense, the non-zodiacal constellations in question cannot be viewed as a hodge-podge collection of different astral traditions that only coincidentally merged into a whole.[24] This assumption implies that there probably was a text as well as a unified cosmovision standing behind the choice of placement. And, further, it implies that the population in question had a particular reason(s) for wanting to project their value system onto the sky screen for all to see.

3. *Assumption and recognition of the inherent ambiguity of the data*. There are several aspects to this, which we consider in more detail below.

Defining the zone of invisibility

As we have noted, it was Maunder (1922[1908]) who first suggested analyzing the zone of invisibility in order to determine the temporal and spatial coordinates of the constellation makers. Yet he begins his discussion by stating that it "is, of course, not possible to fix either time or latitude very closely, since the limits of the unmapped space are a little vague" (Maunder 1922[1908], 158). Gingerich and Welther (1984, 423) make the same observation: "In the first place, it is difficult to define unambiguously a circle of invisibility, partly because Ptolemy's star positions greatly deteriorate in quality near his southern horizon". Maunder goes on to state:

> First, no matter when the constellations were made, or how long they were in the making, or how often revised and "redacted", it is only with the final stage that we are concerned, and the men who gave the constellations that final form had their horizon coincident with a circle of declination: the space in the south invisible to them was circular, with the south pole of the time at its center. The other fact is that Ptolemy's unmapped space is not circular; its contour is circular throughout three quadrants, but in the remaining quadrant the circle is encroached upon... If we seek our clue from the fourth quadrant, it is evident that any horizon-circle fitted to it will be much smaller than the area left uncharted by Ptolemy.… I think there is a simple explanation forthcoming. Only two constellations break into the circle, Argo and Eridanus, and I would suggest that in both cases the original idea of the imagined picture required that it should extend to the horizon (Maunder 1913, 330–1).

With respect to this zone, in the *Phaenomena* we find the following relevant commentary by Aratus:

1. *Cetus*. Although she lies no small distance away, Andromeda is threatened by the approach of the great Sea-monster. For in her course she lies exposed to the blast of the north wind from Trace, while the southerly brings against her the hostile Monster, below the Ram and the two Fishes, and positioned a little above the starry River (Kidd 1997, 99).

2. *Eridanus*. For under the god's feet [those of Cetus] that too moves as a separate group, a remnant of Eridanus, river of much weeping. It extends below the left foot of Orion. The tail-chains by which the extremities of the Fishes are held, both come together as they descend from the tail-parts, and behind the Monster's back-fin move jointly as they converge and terminate in a single star that lies close to the top of the Monster's spine (Kidd 1997, 99).

3. *Anonymous Stars*. Other stars covering a small area, and inset with slight brilliance, circle between Argo's steering-oar and the Monster, lying below the flanks of the grey Hare, [and are] without a name. They are not cast in any resemblance to the body of a well-defined figure.... (Kidd 1997, 99–101).

Based on Aratus' commentary we find that Cetus is "positioned a little above the starry River [Eridanus]" and that Eridanus itself as well as Cetus and the Fishes appear to come together in the first vertebrae of the Sea Monster, in the star Mira. However, Aratus' statements do not give us any clues concerning the shape of the final section of Eridanus. On the other hand, one must keep in mind that we owe the name Eridanus precisely to Aratus for he is the first author to mention that constellation.

Of course Aratus does not speak of the constellation Columba (the Dove) that was defined by Bayer in his *Uranometria*, published in 1603. Rather he speaks of other stars, anonymous ones that circle near the rudder of Argo and Cetus. Hipparchus criticized this last passage saying that the anonymous stars in question do not reach Cetus, rather they are located between the rudder of Argo and Eridanus, the latter being a constellation that reached the star which today we call θ Eridani (Fig. 3.4). In the same figure we can also see that later Arab astronomers elongated Eridanus so that it would terminate in the star Achernar.[25]

In our opinion, the Arabic addition is not the only one that the constellation Eridanus acquired after first being designed on Eudoxus' globe. Indeed, we would allege that the entire segment of Eridanus, indicated in Fig. 3.4, should be understood to have been added either in a time frame that

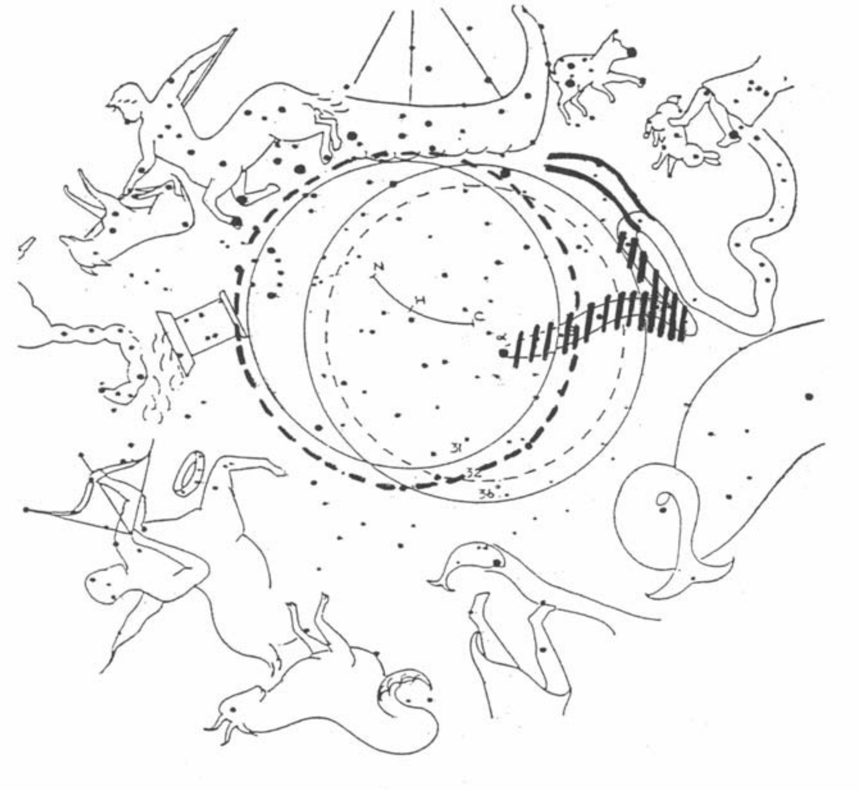

Fig. 3.4. Zone of invisibility (revised version).

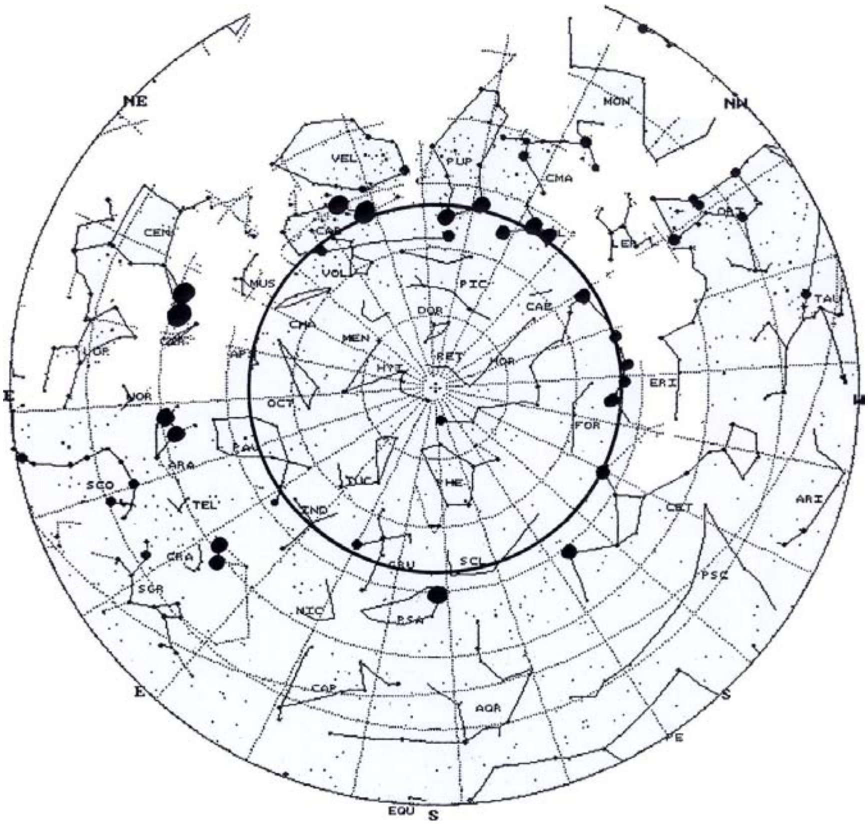

Fig. 3.5. Zone of invisibility 3500 BC.

coincided with the period in which Aratus was writing or at some point afterwards. This interpretation is based on the fact that while Aratus is the first to speak of the constellation using its name Eridanus, when he does so he does not explicitly mention the stars indicated in Fig. 3.3. Rather he speaks of a group of anonymous stars, stars without name, among which, according to our interpretation, would have been the ones that concern us. Therefore, we would assert that if one proposes a prolongation of Eridanus beyond Mira, it would have been one that stretched toward Puppis beneath Lepus and Canis Major. Thus, it would have occupied the space between Puppis and Cetus and in the process would have filled the area assigned to Columba, a constellation composed of rather faint stars of third-magnitude.

As can be observed in Fig. 3.5, following this line of argument the stars of Eridanus would coincide with a circumference indicating the south celestial pole and, consequently, the latitude of observation of those who designed the star figures on Eudoxus' globe. Concretely the latitude in question would be near 43°, significantly higher than Ovenden and Roy's result, namely, that of 36°. However, it differs little from the latitude of 40° proposed by Maunder as the upper limit of the data. In addition, in our simulation the south celestial pole corresponds to a date of approximately 3500 BC, again somewhat earlier than the dates proposed by the previous authors. For instance, the upper limit proposed by Ovenden for his model is 3100 BC.

As we have indicated previously, these are the results that would be obtained if the stars composing the constellation of Eridanus were portrayed as extending beyond the star Mira. We might also consider the possibility that Eridanus terminated in that star or somewhat below it, but without entering the region of stars beneath Lepus since those who designed Eudoxus' sphere simply could not see this area situated below "the flanks of the grey Hare". In the second scenario we would be able to talk of somewhat higher latitudes or of earlier dates for lower latitudes. Indeed, it must be recognized that any attempt to fine-tune the spatial boundary of the zone of invisibility further is complicated by the fact that the temporal and spatial coordinates are not independent variables. In other words, once the general limits of the circle of invisibility are reconstructed, albeit hypothetically, the celestial pole about which the circle is centred depends on the date chosen and, conversely, the date chosen determines the band of latitudinal position(s) available.[26]

In summary, although high precision results are not possible, the data do allow us to map the locations where the observations and other related activities would have been carried out. The spatial window of opportunity would correspond to a relatively narrow band, some seven degrees wide (from 36° to 43°N), stretching across Europe from west to east. Stated differently, the data provide us with important clues concerning the geographical and temporal coordinates of the zone in which the activities in question occurred.

Significance of risings and settings in Aratus

Maunder, Ovenden and Roy all assume that Aratus' text contains statements that "can be used as an independent test of the age of the constellations" (Roy 1984, 177). In saying this, they are referring to the fact that the text contains a number of "statements concerning the rising and setting of stars, which depend upon the location of the observer's horizon with respect to the stars, and therefore upon both the date and the observer's latitude" (Ovenden 1966, 11). While there is no question that much of the star-lore found in Eudoxus and Aratus dates from at least a thousand years earlier, it does not follow that the date(s) extrapolated from these poetic statements necessarily tell us anything about when the constellation figures themselves were originally projected onto the sky.[27]

Rather, as Rogers has observed, it shows us that "Greek authors before Hipparchus had apparently been repeating star-lore for one or two millennia without realizing that it was becoming so out-of-date as to be useless" (Rogers 1998b, 81). In other words, what these extrapolations of the temporal axis of the statements demonstrate is the following: that there must have been two separate traditions. In one, actual observations of the heavens continued to be carried out, for example, by actual navigators as well as pastoral (and agricultural) peoples. They would have used these rising and settings for a variety of practical and ritual purposes, including astrally coded interactive initiation rituals.[28] Yet there appears to have existed another tradition, a learned poetic one that lacked the observational component. Perhaps it functioned on a purely ceremonial level rather than combining ritual performance with the actual observation of the movement of celestial phenomena across the heavens. Whatever the reason, there were factors involved that allowed the pre-existing star-lore to become obsolete. The situation might be compared to the one found today in which, alongside astronomers, we find astrologers and their followers happily talking of the stars and planets without ever needing to step out of doors to confirm their beliefs. In conclusion, it would appear that the sources for Eudoxus and Aratus' work belong to a fossilized tradition that had slowly lost its moorings, so to speak, in the sky itself.

Nonetheless, Maunder goes on to state that the temporal axis can be determined with relatively high precision: "It is therefore a matter of very simple calculation to find the position of the south pole of the heavens at any given date, past or future, and we find that the centre of the unmapped space was the south pole of the heavens something like 4,600 years ago, that is to say about 2700 BC" (Maunder 1922[1908], 158). Maunder's reconstruction of the zone of invisibility brings him to the conclusion "that some time in the earlier half of the third millennium before our era, and somewhere between the 36th and the 40th parallels of north latitude, the constellations were designed, substantially as we have them now, the serpent forms [Draco, Hydra and Serpens] being intentionally placed in these positions of great astronomical importance" (*ibid*., 159).

Specifically, he argues that the three serpentine figures would occupy particularly strategic positions on a celestial globe set for 2700 BC and a north latitude of 40°N. For instance, Maunder notes the following:

1. the pole star would be in Draco;
2. the celestial equator would be marked by Hydra; and
3. the intersection of the equator with one of the principal meridians of the sky was marked by Serpens who is carried by Ophiuchus in a very peculiar manner. Namely, Maunder asserts that the scene was arranged so that Serpens was shown, "writhing itself for some distance along the equator, and then, struggling upwards, along the autumnal colure [sic], marking the zenith with its head" (Maunder 1922[1908], 158–9).[29]

Discussion

In these discussions we need to keep in mind that Maunder was elaborating an argument concerning the role of astronomy in the Bible. Because of this, he needed to prove that the ancient constellations, including those forming the zodiac itself, were already fixed in the sky and known to the nation of Israel "when the Old Testament was being written". He concludes, for example, that "[t]he most probable date—2700 BC—would take us to a point a little before the Flood, if we accept the Hebrew chronology, a few centuries after the Flood, if we accept the Septuagesimal chronology" (Maunder 1922[1908], 161). Somewhat later, the more cautious voice of the scientist reappears when he makes the following remark and in the process underlines the "rough" nature of his temporal boundary: "But it is clear that when the constellations were devised—that is to say, roughly speaking, about 2700 BC ..." (*ibid*., 168).

Similarly, in describing his own attempts to reconstruct the temporal and spatial axes of the data, Roy, too, is fully aware of the ambiguous nature of the data base that has been employed to do the calculations in the past. In contrast to Ovenden, Roy underlines the potential lack of precision in the results themselves. He does this by repeatedly using the adverb "roughly": "Roughly speaking the angular radius of the zone of avoidance is about 36° which means that the constellation-makers must have lived about 36°N. Very roughly speaking the centre of the zone of avoidance corresponds with the south celestial pole at a time about 2500 BC" (Roy 1984, 175).

The question then becomes the following: based on the data available, just how roughly should we be speaking? From our reconstruction of the problem, it would appear that there was a relatively wide window of opportunity in terms of the temporal frame. Indeed, the window in question appears to have covered a period lasting some 1500 years. Consequently, rather than attempting to set a rigid temporal boundary as if we were talking of a single isolated event, our window of opportunity would have its upper limit set at about 4000 BC with a lower limit of around 2500 BC. Similarly, as we have indicated, our model would introduce a spatial window of opportunity along a band stretching across Europe approximately seven degrees wide, i.e. from latitude 36° to 43° (Fig. 3.6).

Our model recognizes that during this period of time there might well have been repeated attempts to project the images skyward. Those attempts must have been accompanied by the invention of relatively sophisticated cognitive strategies for the storage and retrieval of astronomically coded data as well as related cultural artefacts. We need to recognize that the very fact that the images were kept, superimposed on the stars in the sky above, is proof of the efficacy

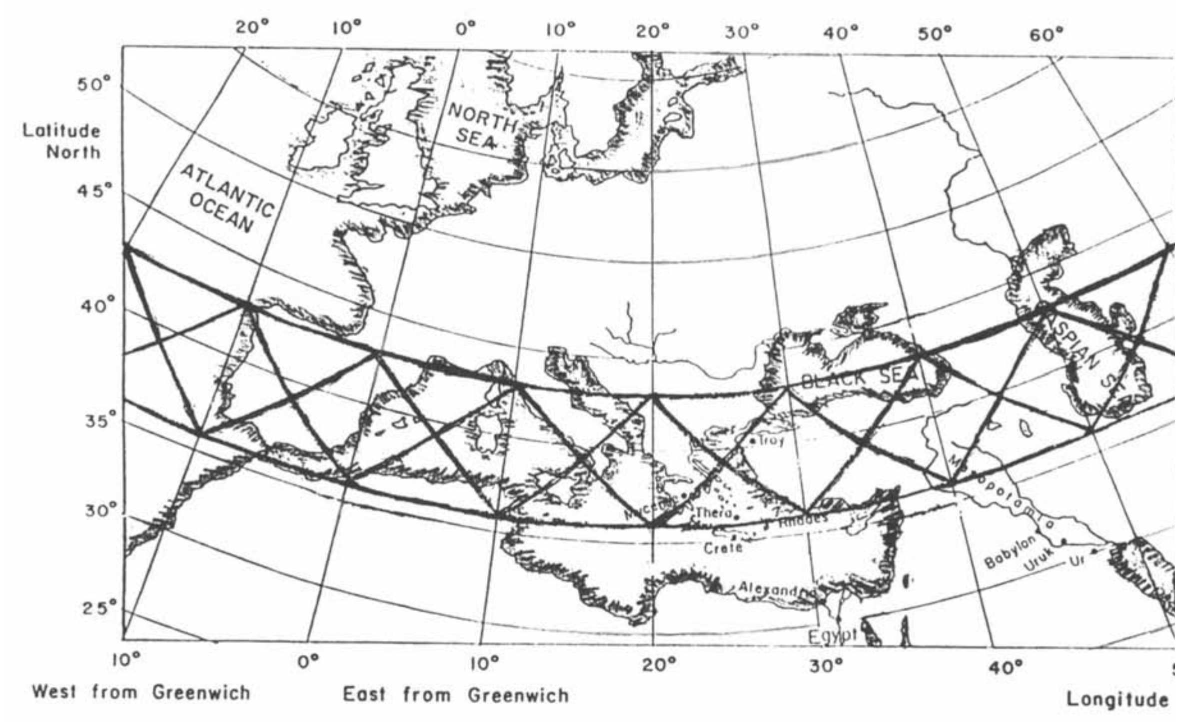

Fig. 3.6. "Window of opportunity" with an estimated band width of 7° (from latitude 36° to 43°N).

and astuteness of their choice of strategies and techniques. Whatever their nature, these were mechanisms that allowed for the storage and transmission of the cognitive artefacts in question from one generation to the next over many millennia. Again, it is noteworthy that such a temporal window of opportunity coincides with a period characterized by a marked increase in the construction of megalithic monuments in the Mediterranean as well as much further north across the Atlantic Façade.

The gradualist model: Rogers' new synthesis

Because of the remarkable clarity and originality of his two-part paper, Rogers should be credited with having moved the terms of the debate to a higher ground. Indeed, he has brought various aspects of it into much clearer focus. In his study, Rogers sets forth in a systematic fashion a more elaborate research model. In it he provides a detailed classification of what he considers to be the different component parts that were fused together to make up the star maps known to the classical world of Greek, Hellenistic and Roman cultures. Moreover, his model sets forth a sharply delineated time line for the integration and eventual synthesis of the various component parts. Overall, Rogers' approach and choice of categories coincide closely with those sketched out earlier by Gingerich (1984). Gingerich had argued against Maunder and Ovenden's Uniformist position: "The hypothesis that our present constellations are a long-evolved mixture including elements from very ancient cultures, stands in marked contrast to some earlier speculations" (*ibid.*, 220). Maunder's position is typified by the following statement: "When the idea had once arisen of identifying stars by giving them places in imaginary figures, the whole work of constellation making could easily have been carried out in the course of a single year. It is not a case where we have to invoke a long slow evolution …" (Maunder 1913, 332–3). Thus, Rogers' model follows Gingerich's lead, but then goes on to divide the ancient constellations into seven groups, six of which will be analyzed in this paper:

Group I. Widely recognized stars

Rogers' first group is composed of constellations that "were known to all cultures" and consists of star-groups that are "real clusters or associations … so distinct that they are named in every culture" (Rogers 1988b, 80, 83). These include the Great Bear, Arcturus, the Pleiades, the Hyades and Orion, along with Sirius in Canis Major and, of course, the Milky Way. These stars have been recognized and manipulated by many cultures, although with different connotations. It is noteworthy that Rogers does not fix the age nor geographical source of these constellations *vis-a-vis* the other members of the original set of forty-eight. However, by their placement as the first in the series, there is at least an implication of their temporal status, namely, that their recognition could be considered more ancient than the rest.

Group II. Bears, serpents, and giants: the ancient pole and equator

Next in order we find a second set of constellations which Rogers defines as being those "that were inherited from the putative Navigators" (Rogers 1998b, 83). This set is composed of "enormous serpents, bears and giants" (Ursa Major, Ursa Minor, Draco, Serpens, Hydra and Cetus, Hercules, Ophiuchus, Boötes and Auriga).[30] Following Rogers' line of argument, the outstanding characteristic of this set is that they were the ones that "best marked the celestial coordinates around 2800 BC". According to Rogers, the first do not stand out as obvious animal figures in the sky. Yet they clearly were designed symmetrically to mark the North Pole, the dragon that also marks the North Ecliptic Pole and the two bears back-to-back on either side of the Dragon which circle endlessly around each other.[31] Meanwhile, the serpent Hydra would have marked the celestial equator (*ibid*., 85). However, as Rogers himself admits, in the case of Draco a date of a thousand years on either side of 2800 BC would also fit the configuration. Thus, we certainly are not talking about a very tight fit. Indeed, the upper limit could reach back to c. 3800 BC. In reference to the longest constellation in the sky, Hydra, which is composed of a string of undistinguished stars, Rogers asserts, following the lead of Maunder, Ovenden and Roy, that its "only reason for existence seems to have been to mark the celestial equator around 2800 BC" (Rogers 1998b, 85). Yet the fit for Hydra is no tighter than that of Draco: it could refer to a simulation or modelling of the data with a much deeper time depth, as we indicated previously.

Rogers then goes on to note that "with one exception (Hydra) these [constellations] are not found in the Babylonian texts. So it is likely that they were invented by a Mediterranean people, for use in navigation at sea. We may call these people the Navigators. There is no documentary evidence as to who they were, but the most likely candidates are the Minoans; their seafaring civilisation was beginning around 2800 BC, and was destroyed following the great volcanic eruption of Thera in the 16th or 15th century.... The zodiacal stars would not have been specially significant to the Navigators" (Rogers 1998b, 80). At this juncture Rogers is paraphrasing the earlier speculations of Ovenden and Roy, particularly Roy's comments on the role of the volcanic eruption. It was the latter event that supposedly contributed to the cognitive rupture in the transmission of the Minoans' astronomical knowledge to the Egyptians and later the Greeks along with the consequent fossilization of the earlier astral tradition.

Furthermore, Roy himself chooses the Minoans of Crete because they "must have been familiar with the old Babylonian celestial sphere and the pantheon and mythology developed by that people.... They would refurbish the system, perfecting it as they did all other arts they embraced, superimposing their own pantheon and mythology over the old" (Roy 1966, 189). Hence, even in Roy's scenario we are talking about a synthesis of different astral traditions while the actual identity of the constellation-makers themselves, as opposed to the users of the system, i.e., the hypothesized Navigators, still remains shrouded in mystery. For, as Roy readily admits, the navigator people and the constellation-makers could have been two different peoples. In this scenario the navigator people who would have used the system, could have lived at a later era than the constellation-makers (Roy 1984, 181).

In contrast, in both Maunder and Ovenden's scenario the ancient constellations were woven of one cloth. Specifically, in their reconstruction of events the ancient star figures were all were placed in the sky at the same point in time, by the same people and with deliberate design. Their scenario draws on a model based on "elite dominance" in which a small group of people, in this case the counterparts of modern astronomers, set out to design a coordinate system that would be useful in celestial and terrestrial navigation. Their point of departure, particularly Maunder's, shows little appreciation for the complex nature of the cognitive mechanisms that must be brought into play by oral cultures for information storage, retrieval and dissemination. Rather, even if the validity of elite dominance model is accepted, at least momentarily, we find that both Maunder and Ovenden ignore the larger theoretical questions. These must be dealt with in order to explain the manner in which knowledge of the coordinate system would have been transmitted from one generation to the next and, furthermore, the mechanisms by which the system itself spread over a much larger geographical area under conditions of orality. Stated differently, if we accept the notion of a single-point origin for the constellations in question, in the resulting model we need to explain how the star figures making up the coordinate system were kept in the sky. Just how did their original inventors convince others to connect the dots in the same way that they had? That process implies not only a shared cosmovision, but also, in all likelihood, the presence of "information technologies" typical of oral cultures (cf. Couch 1988, 1989) that were held in common by the collective in question.[32]

Another difficulty in Rogers' classification system lies with the figure of Hydra. According to Rogers' own classification scheme, this constellation would belong to a totally different astral tradition than the rest of the constellations making up Group II, namely, to a Mesopotamian one. If we make this assumption, Hydra can no longer play a central role in a coordinate system supposedly set up—*tabula rasa*—by the putative Navigators. Stated differently, in order to come up with the date 2800 BC, Ovenden assumed that Hydra was utilized by the constellation-makers to mark one of the major coordinates of that system, the celestial equator, and, further, that that constellation in question was invented at that date by these Navigators.

For this reason Hydra's prominent position introduces a contradictory element into Rogers' classificatory paradigm: if Hydra originated in a Mesopotamian tradition, how did the Europeans come to know of it? There are several possible interpretations. For example, we could be talking about two snakes with separate genealogies, yet remarkably similar in their strategic placement in the sky. If, on the other hand, a single genealogy is proposed, we have to account for the cultural transmission of Hydra into Europe from Mesopotamia or for the existence of a much older layer of astral lore and related cosmovision that gave rise to the constellation Hydra in both geographical locations.

Group III. The zodiac

In Rogers' model the third set of constellations consists of the twelve signs of the zodiac along with four para-zodiacal animals, namely, Hydra, Corvus, Aquila and Piscis Autrinus, which he argues were associated earlier with the zodiacal constellations of Mesopotamia. According to Rogers (1998b, 81) this set of constellations, composed of the zodiacal ones plus the four para-zodiacal animals, developed slowly in Mesopotamia from 3200 to 500 BC and, once they became important to astrology, spread rapidly through the Egyptian and Mediterranean worlds soon after 500 BC. Again, following Rogers (1998b, 81), these constellations "were among the last to acquire Greek legends; Aratus did not give any for them".

Group IV. The southern sea

The fourth set of classical constellations, according to this model, "cannot be shown to belong to any of these [three] groups, and some of them these may represent Greek myths quite coherently, so they may have been invented by the Greeks themselves. The Greeks also synthesised the preceding traditions to give the classical list" (Rogers 1998b, 81). Curiously, at this juncture Rogers seems to introduce a slightly different criterion for his classification. It is a spatial one that turns on the southern sky and portrays the region more as a seascape, i.e. as the watery home of the Sea-Monster Cetus and the River, Eridanus.[33] As Rogers notes, neither the stars of Cetus nor those of

Eridanus appear at all in the Babylonian lists. Yet they are key players in determining the outline of the zone of invisibility and, hence, "may be associated with the ancient serpentine constellations—particularly as they were so large and Cetus looks like a dragon" (Rogers 1998b, 87). However, in terms of its validity as a separate category for classifying the star figures, Group IV is not as convincing as the others for it includes only one constellation, namely, Eridanus, not assigned to one of the other categories.

Group V. Two great southern myths: Centaur and Argo

The Greeks could not see the whole of these constellations, as precession had pushed their southern stars permanently below the horizon. Although from a pictorial point of view the two constellations portray separate and fully distinct scenes, Greek mythology contains references to both constellations that are somewhat intermingled. For example, centaurs appear and among them Chiron who supposedly educated several Greek heroes and invented the constellations. Furthermore, it is Chiron who was said to have made Sagittarius in his own likeness to guide the Argonauts. He eventually ended up being placed in the sky by Zeus after having been wounded accidentally by Hercules. He was in such pain that he begged to die and Zeus, in turn, complied, putting him in the sky as the constellation Centaurus. But that version does not explain in any way why the figure of this half-man, half-horse is killing a wolf.[34] In fact, none of these Greek tales offers a narrative thread that would provide a motive for portraying these two figures together.

Group VI. The Andromeda legend

Just as Gingerich did, Rogers argues for the prior existence of an astral narrative that wove several separate constellations together, namely, Andromeda, Perseus, Pegasus and the ferocious Sea-Monster, Cetus. In addition, among the cast of characters in the Greek version of the narrative were the constellations of Cepheus and Cassiopeia. Rogers has suggested that some members of the set were surely invented by the Greeks, "simply to illustrate the [pre-existing] myth". Indeed, the Andromeda-Perseus legend, as it has been transmitted to us through Greek astral traditions, may represent the reprocessing of pre-Greek materials (Rogers 1998b, 88) originally formed part of a single lineage (Gingerich 1984, 220). At this stage in our investigations it is too early to state whether the Andromeda-Perseus materials, viewed as pre-Greek astral myths, are connected in any way to the Hartzkume Bear Son saga.

Conclusions

Because of the discrepancies in Aratus' data, authors have suggested that Eudoxus must have deduced his list of *Phaenomena* from examining a pre-existing star-globe, not from actual observations of the night skies. As we have seen, authors such as Ovenden and Roy have attempted to recreate the set of circumstances that could have led to this result. In the process, again as we have pointed out, they ended up painting a picture in which the Minoans, a.k.a. the Navigators, along with the eruption of Thera, played a major role, the latter explosion being an element contributed to the model by Roy (1984). Yet, that theory itself is based more on wishful thinking than actual hard evidence. Indeed, Ridpath has made the following comments in reference to it. He states that the Babylonian constellations must have reached Egypt (and hence Eudoxus) via some other civilization, although "it must be admitted that there is no direct evidence, such as wall paintings or star lists like those of the Babylonians, to demonstrate any Minoan interest in astronomy. So, for now, the theory that the Minoans were middlemen to our constellation system remains nothing more than an appealing idea" (Ridpath 1990, 167).

In addition, at this juncture we can see that quite a separate research question needs to posed: where, when and under what circumstances did the synthesis of the different astral traditions take place? The question assumes that there was a specific location and point in time when the fusion of all these pre-existing astral traditions took place. For instance, according to Rogers (1998b, 81), the fusion almost certainly took place in Greece itself between about 540 and 370 BC.[35] However, this issue must be understood as a separate investigation, not directly related to the one we have been discussing in this study, that is, where, when and under what circumstances did our zon-zodiacal constellations came to be projected onto the sky screen?

For the record, the logic of Roy's argument needs to be examined more closely. In his simulation he proposes that Eudoxus received a globe, Minoan in origin, during his visit to Egypt, and that that globe's design revealed a pole and equator adjusted to 2000 BC. Subsequently, according to Rogers' more elaborate reconstruction of what happened next, we encounter Eudoxus making a copy of a Minoan globe. Initially the globe in question "showed only the Navigators' constellations, with the pole and equator adjusted to 2000 BC, perhaps with the stars accurately plotted," and in making his copy Eudoxus "mapped both the Babylonian zodiac and more recent Greek mythological constellations [onto it]" (Rogers 1998b, 81). In this way, Eudoxus would have produced "the first complete synthesis of the classical constellations. Then he used his globe to read off his 'phenomena', and never checked them against the actual sky" (Rogers 1998b, 81). Naturally, this reconstruction of events is based on the transmission of complex data by means of a physical object, not by oral tradition and/or ritual practice. Furthermore, while the story told is ingenious, it does not have a shred of solid evidence to back it up: it is pure speculation.

Several conceptual difficulties inherent in the Uniformist Model have been pointed out quite astutely by Rogers. Yet the following discussion of his reflects another unstated assumption encountered in the earlier models: "Previous authors have implicitly assumed that the classical constellations were created at a single place and time, but this leads to a historical paradox. The only plausible centres of civilisation at the right time and latitude were Mesopotamia and the Mediterranean" (Rogers 1998b, 79). In his remark Rogers assumes that only a high civilization or at least one that left a lasting mark in the archeological record, could have produced the system in question. Only that sort of a culture could have developed the relatively sophisticated celestial coordinate system needed in order connect the star dots to form an effective mechanism for time-keeping at night as well as a means of celestial navigation on land and at sea. That line of thinking is one that was utilized by both Ovenden and Roy to justify their choice of the Minoans as their Navigators, i.e., as those who "invented" the constellations and coordinate system in question.

Furthermore, there is an implicit assumption that the observational astronomy necessary for initially undertaking such a task could not have been carried out unless it was undertaken by members of a high civilization. As has been pointed out earlier, until recently the only viable candidates who had been proposed were the Minoans. At this stage, however, we have an alternative: those peoples inhabiting a relatively narrow band from 36°N to 43°N and living between c. 4000–2500 BC. Neither the dates nor the time frame are precise, but based on the data they are relatively secure. Therefore, the next problem seems to be whether Rogers' already excellent model can be adjusted so that the Hartzkume materials can be fitted into it. And that process will involve determining which non-zodiacal constellations should be identified as belonging to the Hartzkume group, i.e. which ones should be classified as illustrating scenes from the Bear Son's vision quest and his initiation rituals.

Notes

1 The origins of the constellations have also been treated by various other authors in the past (see Allen 1963 [1889]; Crommelin 1923; Gleadow 1968; Flammarion 1881; 1882; Hartner 1965; Lum 1951; Phillips and Steveanson 1923; Sesti 1991; Van der Waerden 1953; 1974; Wensinch 1921). However, most of these writers have been much more concerned with compiling information related to the astral myths of the great civilizations of Mesopotamia, Egypt and Greece. Although they often emphasize the hybrid or at least transcultural aspects of the materials, the works are not characterized by a research methodology aimed at deciphering the question of the ultimate cognitive origins of the star figures themselves.

2. In reviewing the literature on this topic it becomes readily apparent that errors, perhaps totally unintentional ones, have crept into it. For instance, it is commonly stated that the constellation makers lived at a latitude of about 36°N, yet apparently no one since Roy (1984) has bothered to explain in detail the difficulties inherent in reaching such a remarkably precise conclusion based on the nature of the data available. And popularizers, again with the best of intentions, have a tendency to simplify matters for their audience. In the process they use a very matter-of-fact style of writing. This practice further obscures the complexity of the original data. In this case it makes what are highly speculative conclusions in the original research report appear to be matters of fact and, hence, totally proven. The following comment is a good example of that tendency in the literature: "Therefore we can conclude that the constellations described by Aratus were invented around 2000 BC by people who lived close to latitude 36 degrees north" (Ridpath 1990, 166). In his 1990 and 1995 articles, Ridpath repeats the same type of arguments that he made in the introductory chapter of his book, *Star Tales* (Ridpath 1988, 1–12).

3. Maunder (1851–1928) was one of the founders of the British Astronomical Association and a renowned historian of astronomy. He joined the Royal Observatory at Greenwich in 1873 and retired in 1919, with a short break between 1913 and 1915. In his later years he was an "Assistant" which was a quite high grade; at Greenwich by 1919 there were the Astronomer Royal (the director), the Chief Assistant (second in command) and then the other senior staff who were the Assistants. Apart from *The Astronomy of the Bible* his many works include *The Royal Observatory*, *Greenwich: its History and Work* (1900) and *Astronomy without a Telescope* (1903).

4. Dr Rogers is the Jupiter Section Director of the British Astronomical Association and a professor of molecular neurobiology in the Department of Physiology at Cambridge University.

5. In fact, Roy's formulation of the Minoan hypothesis first set forth by Ovenden might itself be interpreted as somewhat Gradualist. He seems to favour the possibility of a synthesis derived from at least two different astral traditions, the well-known Babylonian one and another lesser known Mediterranean one.

6. From an ecocentric or biocentric perspective, *Homo sapiens* no longer lies at the centre of all things (anthropocentrism) or represents the culmination of evolution (speciesism). Rather the human species is viewed as being thermodynamically and biologically, and therefore inescapably, bound to natural processes. By situating the human species fully inside this web of nature, as occurs in the case of cosmovisions found in many traditional cultures, ecocentrism questions speciesism, the idea that humankind is somehow superior to and therefore entitled to impose its values on nature. Therefore the ecocentic perspective goes beyond strict preservationism which holds that nature has use-value only. As a result, ecocentric cosmovisions, such as those associated with Bear Ceremonialism, tend not to produce strictly anthropomorphic cosmogonies, i.e., stories concerning the origins and mythical ancestors of the given people. This is because an ecocentrist understands the human species as part of a natural community, not as standing apart and holding dominion over the rest. Consequently, as Rolston (1986, 121) has argued, the key idea underlying an ecocentric perspective is that of nature being a source of values, including our own. Nature becomes a generative process to which we want to relate ourselves and by this to find relationships to other creatures (cf. Drengston 1999; Eckersley 1992; Oelschlaeger, 1991, 218–319; Synder 1995).

7. The negation of "immortality" is another indication of the radically different nature of the underlying epistemology. It is an ecocentric cosmovision that speaks to us of an inversion of the notion of transcendence and, hence, undermines the transcendent dimension—the desire to escape from this world—so common to Indo-European mythology (cf. Frank and Susperregi, 2000, 2001).

8. The fact that none of the other Spirit Animal Guardians is domesticated suggests that in the prototypical version the canine in question was most probably a fox.

9. The episode of the "Grateful Eagle" is a particularly significant one. It provides a mechanism for determining that Hesiod's commentaries in his *Theogeny* concerning the Greek hero Prometheus are reworkings of pre-Greek astral traditions (Frank 1997). Furthermore, the anthropocentric and hierarchically ordered background found in the Greek version of the tale is underscored by the inversion of roles with respect to the female Eagle Shaman. In the Hartzkume materials, the Eagle's agency is evident nearly from the beginning when she appears among the four Spirit Guardian Animals. In addition, she reappears as an autonomous agent who saves Hartzkume himself, flying him to the Upper World. In the Greek version, her role is changed in major ways. First, it is inverted in the sense that she appears not as the Greek hero's friend and saviour, but as an enemy force; indeed, as his torturer. Rather than being autonomous, the bird's shamanic features have been stripped away, her agency reduced. When compared to her agency in the Hartzkume tales, the creature's role in the Greek story is relatively minor. Yet her agency is quite fitting for a society such the Greek one which was developing a non-shamanic world-view. There we can detect the emergence of a sharp, vertically conceptualized division between the higher and lower orders: a hierarchical dualism that set humans apart from the other animals and in the process proclaimed the "wilderness" to be enemy territory.

10. Among the scenes most commonly depicted in European performance art is one involving a character who dresses as a Grey Mare (in some versions of the performance it is understood to be a White Mare). It is this character who at one point in the performance attacks another character representing the Black Wolf. Often there are groups of Grey Mares who engage in this ritual battle with the astrally coded Black Wolf antagonists (cf. Frank 1995; n.d.c.).

11. There are additional narrative elements in the Hartzkume tales pointing to the strong possibility that some of the mythological materials relating to Hercules emanate from older pre-Greek sources, as is the case for those linked to the figure of Prometheus (Frank 1997; 2000). In addition, attempts to date to paint Hercules' adventures onto a solar-oriented, zodiacal backdrop have been unsuccessful (cf. Krupp 1991).

12. It is noteworthy that Taube (1984, 346), with no knowledge whatsoever of the Pyrenean versions of the tale, when speaking of the shamanic coding of the narrative, argued that the hero's comrades are "reflections of the shamanistic spirit-assistants", i.e., spirit animal helpers. In addition, the shamanic coding of the episode where the hero is saved by the female Eagle Shaman elicited the following commentary by Taube (*ibid*.): "…[the mythical bird] has its nest with the young ones, whom the hero guards from being killed by a snake, thus gaining the bird's assistance. The bird becomes the hero's helper, either at once or later, by handing him a feather with which the bird can be called [upon] in case of danger or need. This motif provokes the association of feathers, skins and so on with the shaman's costume which transmits the animal's strength and abilities to the shaman. There is a hint of shamanistic initiation rites in that the hero, after having safeguarded the bird's chicks, is temporarily swallowed by the mother-bird. According to ideas connected with shamanistic initiation rites, the future shaman lives through a mystical death, a dismembering of his body, in consequence of which all spirits, being fed with pieces of his body, will become his helping spirits. Thus, the power of a shaman also essentially depends on the number of his spirit-assistants, which points to the question, very often put to the tale's hero: 'How many magic means do you have?' The several comrades, with special abilities, who sometimes join the hero on his raid, are also reflections of the shamanistic spirit-assistants" (Taube 1984, 346).

13. This possibility is underlined by the odd nicknames of the hero's male helpers. In shamanic practice it is commonplace to avoid referring to the Spirit Animal Guardian directly by its name. Rather, it is often alluded to by means of a rather elaborate nickname or "kenning".

For example, in German a bear is called “the brown one” or *bruin*, while in Slavic languages the kenning for the animal is *medved* “honey-knower”.

14. Such changes in the cognitive frame must have resulted in part because of the fact that the tellers of the tale were losing track of the tenets of the older belief in Bear Ancestors. That cosmovision was slowly replaced by one increasingly based on the existence of high anthropomorphic sky gods (cf. Frank and Susperregi, 2000; 2001; Hartsuaga 1987) and, it would appear, one that perhaps resulted in greater concern for the path and role of the Sun, Moon, and planets. Outside Europe, a similar cognitive shift might be detected in Mesopotamia. It would have been indicated by the increased interest in the Sun’s path which becomes apparent in “the historical record of Babylon by the 6th century BC when the twelve constellations were defined with equal boundaries, after which the zodiac itself quickly spread to neighbouring cultures” (Rogers 1998b, 81). That shift away from an ecocentric cosmovision could also reflect cognitive readjustments motivated by a transition from transhumanic pastoralism to sedentary agriculture (cf. Williamson and Farrer 1992).

15. Most historians of science are more familiar with the use, in antiquity, of the parallel passing through Rhodes which was set at 36°N. That setting is a clear sign of the early cognitive dominance in literate mathematical traditions of the meridian of Alexandria which was thought to run due north through Rhodes. For example, in his elementary textbook on astronomy and mathematical geography, *Introduction to Phaenomena*, Geminus of Rhodes (fl. c. 70 BC) specified that all stellar globes, or at least those used for teaching, should be constructed for the local latitude of Rhodes, that is, 36°N, so that the polar axis made an angle of 36° with the plane of the horizon. Actually Rhodes is nearer to the latitude of 36·5°, specifically 36° 34′ (Aujac 1987, 161–71; García Franco 1957, 54–8).

16. For a detailed discussion of the coordinate system and the use of this latitudinal position as a benchmark for celestial navigation in the Mediterranean, see Frank (1999a, n.d.a.).

17. In some versions of the stories the Black Wolf is portrayed as a Black Dog with a White Star on its forehead. It is this star that must be pierced in order to cause its death (Frank n.d.b).

18. Roberts (1987–8, 151), for instance, mentions a detail “from the great rock shelter in the hills above the Dogon village of Songo. … This section of rock face is repainted during the boy’s initiation rituals. ... Some are abstract representations of masked dancers, lizards, or leather carrying bags; while others refer to celestial phenomena”. The circular forms shown in Roberts’ accompanying photo represent the Moon and Venus.

19. In Erdész (1961, 331), the story-teller places the Ice Mountains far to the east whereas the Crystal Mountains are to the west. What is totally unclear, of course, is whether such a ritual landscape ever corresponded to actual features of European topography. It should be noted, however, that there is other evidence that would place the female Black Wolf’s lair in the extreme eastern part of the European continent, namely, in what today would be the region of Galicia, Spain. Other evidence points to the existence of megalithic epoch pilgrimage routes that crossed through certain zones of Euskal Herria. These sacred pathways are associated today with the cult of St. James (cf. Frank n.d.b). The possibility of astral-terrestrial correlations, specifically, that these mountains were perceived as having not only celestial counterparts, but also terrestrial ones, i.e., that the tellers related them to topographical features in their own landscape, is not entirely out of the question. This is particularly true given the research that has been carried out on the way in which in China socio-political divisions have been mapped skywards and then utilized as justifications for the established order. For example, “the earliest principle underlying this astrological system was a cosmological parallelism between the Yellow River and its celestial analogue, the Milky Way. ... The evidence points to a 2nd millennium BCE date of inception for these astral-terrestrial correlations, consistent with contemporaneous evidence of observational astronomy” (Pankenier n.d.). For further discussion of other aspects of the topic of field allocation astrology, see Pankenier (n.d.).

20. With respect to this type of motivation, the following statements taken from a Navajo creation story are relevant where First Woman says: “I will use these (the stars) to write the laws that are to govern mankind for all time. These laws cannot be written on the water, as that is always changing its form, nor can they be written in the sand, as the wind would soon erase them, but if they are written in the stars they can be written and remembered forever” (Newcomb 1967, 83).

21. Roy also saw scientific merit in the efforts of these proto-astronomers. He, too, recognized that value must be attributed to their observations, calculations and mapping procedures and that these operations were inevitably required in order for them to be able to project their star figures skyward: “We have now come a long way from the naive view that the ancient constellations were the idle fancies of a primitive and pastoral people. It does no justice to the truth of the matter which is that a certain people at a specific epoch, for purposes yet unknown, created in a systematic manner a set of interconnected constellations, thus mapping out the night sky. They must have been totally familiar with the sky and its behaviour. In short, they were astronomers of long-standing” (Roy 1984, 179).

22. See the introduction to Kidd (1997) for an extended discussion of Aratus’ work, its style, translation difficulties and multiple extant manuscripts.

23. The mistake of erroneously assigning a latitudinal position of 31° to Rhodes first appeared in Ovenden (1966, 9) and was later repeated in Roy (1984, 175).

24. Here we must distinguish clearly between two time frames: (1) the period of gestation in which plans for projecting the stories onto the sky would have been elaborated along with detailed observations of the stars that would lead to the choice of some of them over others in the final design of the star figures; and (2) the period that it took them to actually finalize their project and develop mechanisms for maintaining its presence on the sky screen, strategies of cultural storage that would have had to have been highly effective reiterative vehicles of communication. And we should recall that we are speaking of social practices characterized by orality.

25. Maunder (1913, 331) was keenly aware of the role of Argo and Eridanus in fixing the boundaries of the zone of invisibility: “Thus of Argo Aratus writes: ‘Argo is driven stern foremost towards the tail of the Great Dog, for its mode of movement is not that of its usual course, but is like that given to a ship by the sailors, who, on entering a harbour, reverse the rudder so as to suddenly turn the vessel round and backing run it ashore. Thus from the stem is Jason’s Argo drawn.’ The figure represented by Argo is therefore that of a ship ‘grounded’ or ‘beached’ in the harbour. It required to be extended to the horizon, and as the constellation makers, or their successors, moved southward, a number of bright stars were revealed to them, just below the keel of the original Argo. Similarly, Eridanus had, like the Persian celestial stream Arêdvîsûr, to flow downward until it met the horizon, and so to become the source of terrestrial streams. It could not be represented as coming to an end in mid-heaven, and Theta and the numerous Upsilons, all brighter stars than the upper portion of the River can boast, were just in the right place for Ptolemy to use in its continuation. Eridanus has, indeed, been continued further south since his time.... Achernar was below Ptolemy’s horizon, and its position does not accord with the place he gives ‘for the last of the river.’”

26. In a future paper, we plan to discuss in further depth some of the problems inherent in modelling these data which in themselves are inherently vague in nature, and elaborate particularly on the astronomical factors that led to our decision to set 43° as the absolute upper latitudinal limit of the data being modelled. For example, there is the problem involved in developing a model capable of determining which stars were incorporated into the constellation Eridanus in the epoch being simulated by the model itself, i.e. 3500 BC. Moreover, as stated above, equally important in developing any simulation of the data is that the researcher must take into account the fact that the temporal and spatial coordinates are not independent variables.

27. For instance, Roy (1984, 177) states: "There can be little doubt that the sections in Aratus' *Phaenomena* dealing with the way in which the circles of the equator and Tropics of Cancer and Capricorn cut the constellations refer to a celestial sphere dated about 2000 BC with an uncertainty of 200 years each way". Roy's conclusion is based on the number of correct hits at different epochs produced by his interpretation of 34 statements in Aratus. These relate to the way in which the equator and the tropics of Cancer and Capricorn cut the constellations (Roy 1984, 177–8). The breakdown of his percentages is as follows: for 2000 AD, 4·0; 1000 AD, 4·5; 0, 13·0; 1000 BC, 21·5; 1500 BC, 30·5; 1800 BC, 32·5; 2000 BC, 33·0; 2200 BC, 30·5; 2500 BC, 13·0; 4000 BC, 3·0; 5000 BC, 3·5. As an example of the intrinsic ambiguity of these statements, as well as the problems of multiple translations of the same text, consider the following:

    - "That head [of Draco] wheels near where the limits of setting and and rising blend" (Mair 1921, cf. Ovenden 1966, 11; Roy 1984, 177–8); and
    - "The head of the Dragon passes through the point where the end of settings and the start of risings blend with each other" (Kidd 1997, 77).

    Clearly, it is a matter of judgement as to the proper interpretation of the word "near" in Mair's translation and on the words "end" and "start" in Kidd's.

28. Such interactive performances are certainly not rare among traditional peoples, e.g. Cajete 1994; Farrer 1992; Williamson and Farrer 1992.

29. See Maunder (1922[1908], 158–65) for further discussion of Serpens' strategic position and Ovenden (1966, 7–8) for another discussion of Maunder's views.

30. Ovenden (1966), who argued that we see a fossilized arrangement of the constellations dating back to 2800 BC (±300), noted that one ring of non-zodiacal figures, including Auriga, Perseus, Hercules, and Boötes, was symmetrical about the north celestial pole at that time. It is significant that among these four figures we find Perseus who appears to belong to a different astronomical tradition.

31. It is noteworthy that Rogers, in contrast to Gingerich, does not speculate on the possible antiquity of the bear constellations. For instance, Gingerich asks whether it is possible to push back the origins of any of the constellations still further than Hartner (1965) did with his hypothesis concerning the Leo-Taurus combat in Sumer that would have occurred some 5,000 to 6,000 years ago. Hartner argues that these two key constellations must have been recognized as early as 3500 BC. Speaking of Ursa Major, Gingerich makes the following comments: "Somewhat different is the case of the Big Dipper, which is seen as a Great Bear by many different Indian tribes of North America. It is difficult to be sure how old their oral traditions are. Could the Indians have gotten the European notion of Ursa Major from early explorers? I think this is unlikely. It seems more plausible that a very early tradition of a celestial bear crossed the Bering Straits with ancient migrants, especially so since the same identification is found across Siberia, as has been pointed out by Marshack. Such an early tradition could have diffused throughout the world from the ancient cave dwellers of Europe. ... In the widespread mythological connection of the dipper stars with a Great Bear (Ursa Major) we have a hint that a few of the constellations may date back as far as the Ice Ages" (Gingerich 1984, 220).

32. Although outside the scope of the present study, any model that attempts to examine and reconstruct these preliterate cognitive strategies and technologies must take into account the possibility that their remnants may be encountered in the traditional metrological practices and number systems of Europe. For example, there are residual elements from a vigesimal way of counting in English (e.g. "three score and ten"), French and Celtic languages. Since Proto-Indo-European had a decimal system, the appearance of vigesimality in languages classed as Indo-European would seem to be an anomaly. Thus, one solution is to allege that the linguistic practice hearkens back to a much earlier number system. In this respect, it

should be kept in mind that Euskera is a pre-Indo-European language and, linguistically speaking, counts by twenties rather than tens (cf. Frank 1997, 1999a; Vennemann 1998, 8-12). For a different approach to the data see Justus (1999).

33. If my reading of Rogers' comments is accurate, he classifies the Fish (Piscis Austrinus) as a member of the constellation figures inherited from Mesopotamia.

34. According to a rather ingenious interpretation offered by Sesti (1991), the figure holds a thyrus, an ivy-covered wand allegedly used in Dionysian rites. Moreover, he suggests that originally the Wolf and the Centaur may have been engaged in a Dionysian coupling. Yet this would be a relatively bizarre combination and one for which there is no extant evidence. Moreover, if in Greek tradition this odd coupling had been important enough for it to appear portrayed in the sky, one would assume that there would be other pictorial representations of it or additional mythological commentary on it.

35. In his recent work, Belmonte (1999,173–213) lays out this research question with great skill and then proceeds to formulate a convincing solution to it.

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4

Prehistoric Sites along the "Hellweg" Trade Route

Wolfhard Schlosser

This paper consists of two parts. The first deals with monuments along the Hellweg trade route which were not included in the previous paper on this topic (Schlosser 1996). The monuments discussed were either not known at the time of the Bochum SEAC conference, or the state of scientific discussion then had not reached sufficient maturity for publication.

Newly discovered monuments along the Hellweg

The Daseburg-Ringgraben ($\lambda = -9°{\cdot}22$, $\phi = +51°{\cdot}49$)

In 1994, workers digging trenches for a gas pipeline unearthed a circular ditch from the Rössen period, about 4500 BC (see Kröger 1998). It was excavated by the *Westfälisches Museum für Archäologie, Außenstelle Bielefeld*. The author noted its connection to the most beautiful mountain in that area, the *Desenburg*. As seen from the centre of the prehistoric site (Fig. 4.1), the sun will set on the longest day of the year behind this solitary mountain.

Fig. 4.1. While archaeologists are still unearthing the Daseburg-Ringgraben*, the sun is setting at summer solstice around 4500 BC behind the summit of the* Desenburg*. Based on a photograph © Westfälisches Museum für Archäologie.*

FIG. 4.2. *The isolated* Falkenstein *rock.*

While this manuscript is being written, a new enclosure is being excavated in the same area (Dedinghausen, see Fig. 4.10). It is hewn in rock. It has gates in the south and west, the latter being decorated with two tiny stone columns (Priv. comm. from H. Kröger, Westfälisches Museum für Archäologie).

The Falkenstein stone seats ($\lambda = -8°{\cdot}92$, $\phi = +51°{\cdot}87$)

Some 400m south of the point where the Hellweg cuts through the Egge-Mountain rocks, the isolated *Falkenstein* (falcon stone) dominates the *Knickenhagen* ridge (Fig. 4.2). This rock is difficult to climb. Earlier rumours of stone seats on top of this rock were confirmed in April 1998. With the support of the *Bundesanstalt Technisches Hilfswerk* (Federal Agency for Technical Support) and the *Deutscher Alpenverein* (German Mountaineering Association), the author and U. Niedhorn (a specialist in prehistoric stone masonry) were able to work

FIG. 4.3. *One of the few naturally formed* Opferkessel *that have been dressed using stone implements. It is oriented towards sunset at winter solstice. The black line in the lower part marks the edge.*

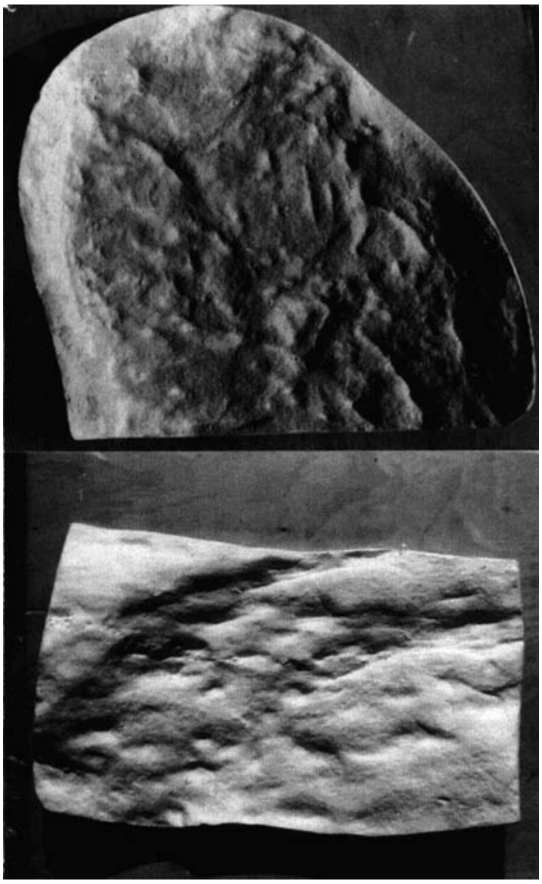

FIG. 4.4. *Plaster casts of two stone seats with traces of prehistoric stone masonry. Photograph © U. Niedhorn.*

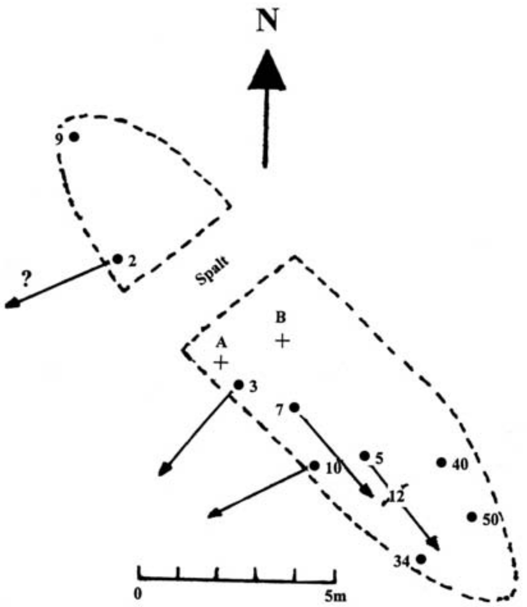

FIG. 4.5. The orientations of dressed weather pits (no. 2 is doubtful).

FIG. 4.6. A protruding rock dressed so that it resembles a ship's deck (centre of picture). Each of the three parts of the "deck" is planar (to a precision of a few centimetres), but some retouche *has been applied in order to remove shadows from the upper rocks.*

for one week on the top of this rock. Four of five of the many naturally occurring *Opferkessel* (weather pits) show signs of having been slightly dressed using stone implements (Figs 4.3 and 4.4). They are all roughly oriented towards sunrise and sunset at winter solstice (Fig. 4.5). It is remarkable that there are no traces of metal tools having been used, implying that the site was abandoned in Neolithic times. Furthermore, it should be noted that suitable weather pits marking the summer solstice were not dressed.

The "Ship" ($\lambda = -8°{\cdot}92$, $\phi = +51°{\cdot}87$)

Not far from the Falkenstein there is a small lake with a high rock at the north-east. Eight metres above the water level there is an inaccessible protrusion. Its upper part, extending for four metres, is dressed and resembles the deck of a ship (Fig. 4.6). This "deck" is lower towards the bow and the stern, but higher in the middle. This rock has been dressed using metal tools, but little more can be said at present owing to the inaccessibility of this site.

The "deck" of this "ship" is in a perfect position for viewing winter solstice sunset around the year 0. At this time, the sun sets exactly behind the summit of a mountain 1 km away. This mountain has the name "Rigi". This is absolutely untypical of the names of mountains in this part of Germany; there is a well-known Swiss Rigi overlooking the Vierwaldstätter See. Like its Swiss counterpart, the Hellweg-Rigi might well bear a Celtic name. The linguist Prof. Fergus Kelly (priv. comm. 1998) does not exclude this hypothesis, but more research has to be done on this topic. An appropriate translation of the Celtic word "Rigi" would be "royal mountain".

That Celts were present in this part of Germany does not come as a surprise. Certain forms of stone working in the Teutoburger Wald area are in the La Tène style, one example being a slender shaft hewn into solid rock close to the "Ship". A mere 0·10–0·12m in diameter, it reaches to a depth of 8·2m (a ratio of 1:80). Celtic Viereckschanzen (quadrangular enclosures) often contain vertical shafts, which are quite similar in shape. The well-known Viereckschanze at Holzhausen (Bavaria) has a shaft 3·6m in diameter and 35·6m deep, i.e. a ratio of 1:10. None of these Celtic shafts had any obvious practical function, but they may have served for ritual purposes.

A large sculpture oriented towards the summer solstice sunrise ($\lambda = -8°\cdot92, \phi = +51°\cdot87$)

Now officially recognised as one of North Rhine-Westphalia's major archaeological artefacts, this 14 m-high sculpture faces the rising sun on the longest day of the year. Wind, ice and water had modelled the sandstone into something like a human shape. Less than 10% of the rock's surface then had to be dressed in order to make it resemble a crucifixion (Fig. 4.7). There is even a hole reminiscent of a liver wound. The implements used were of the same kind as those used for the sun-hole at the nearby Externsteine, and are Neolithic (Niedhorn 1995; Schlosser and Cierny 1996). When, a decade ago, Niedhorn and Schlosser were able to conduct the first detailed examination of this sculpture thanks to the assistance of the Fire Brigade (Fig. 4.7), white pebbles were discovered in the liver wound—probably old offerings.

This sculpture is only a few metres south of the Hellweg. Fifty metres to the north is the largest open-air relief in Germany. It dates from about AD 815 and shows the *Deposition from the Cross* (Fig. 4.8). It is tempting to speculate that this relief is the Christian response to the midsummer sunrise-oriented "hanging man with liver wound" from prehistoric times.

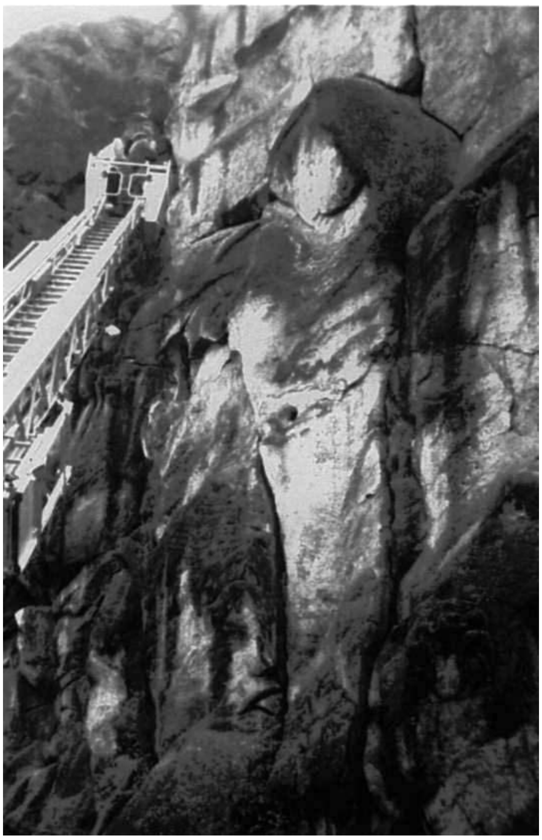

FIG. 4.7. A prehistoric sculpture reminiscent of a hanging man. Clearly visible in this picture are the head and one shoulder respectively to the right of, and below, the top of the ladder. The liver wound is close to the centre of the photograph.

FIG. 4.8. The Deposition from the Cross *(Carolingian epoch). This is one of the most famous early Christian works of art in Germany. Its proximity to the prehistoric "hanging man" may be intentional.*

A measure to quantify the probability of ancient monuments being solar observatories

The procedure described here is a refinement of the "solar-arc criterion". A monument has probability $p = 0$ of being an ancient solar observatory if its architectural alignments fall outside the azimuth ranges of sunrise or sunset over the year. Following Iwaniszewski (1996), and especially his diagram on p. 28, one may define non-zero probabilities as follows (Fig. 4.9):

$p = 1$	for cardinal and solstitial azimuths
$p = 0{\cdot}75$	for azimuths corresponding to solar declinations $\delta = \pm 0{\cdot}71\varepsilon$ (Beltaine, etc)
$p = 0{\cdot}5$	for solar azimuths not included in the above cases

A margin must be specified for a tolerable deviation. It was set to ±2°·5 in azimuth. There should not be too much debate about this value in the case of cardinal points and solstices. It might be too small for $p = 0{\cdot}75$. However, a sharper criterion is always the more trustworthy one.

Once such a set of criteria has been established, there exists a universal function $P(T, \phi, h)$ for random distributions of azimuths, where T is the time of erection of the monument (this enters the equation because of the variation in the obliquity of the ecliptic, ε), ϕ is its geographical latitude, and h is the altitude (angle above horizontal) of the horizon in the direction of alignment. The author uses one further parameter in his calculations: the elevation (height above sea level), in order to obtain an accurate estimate of the refraction correction.

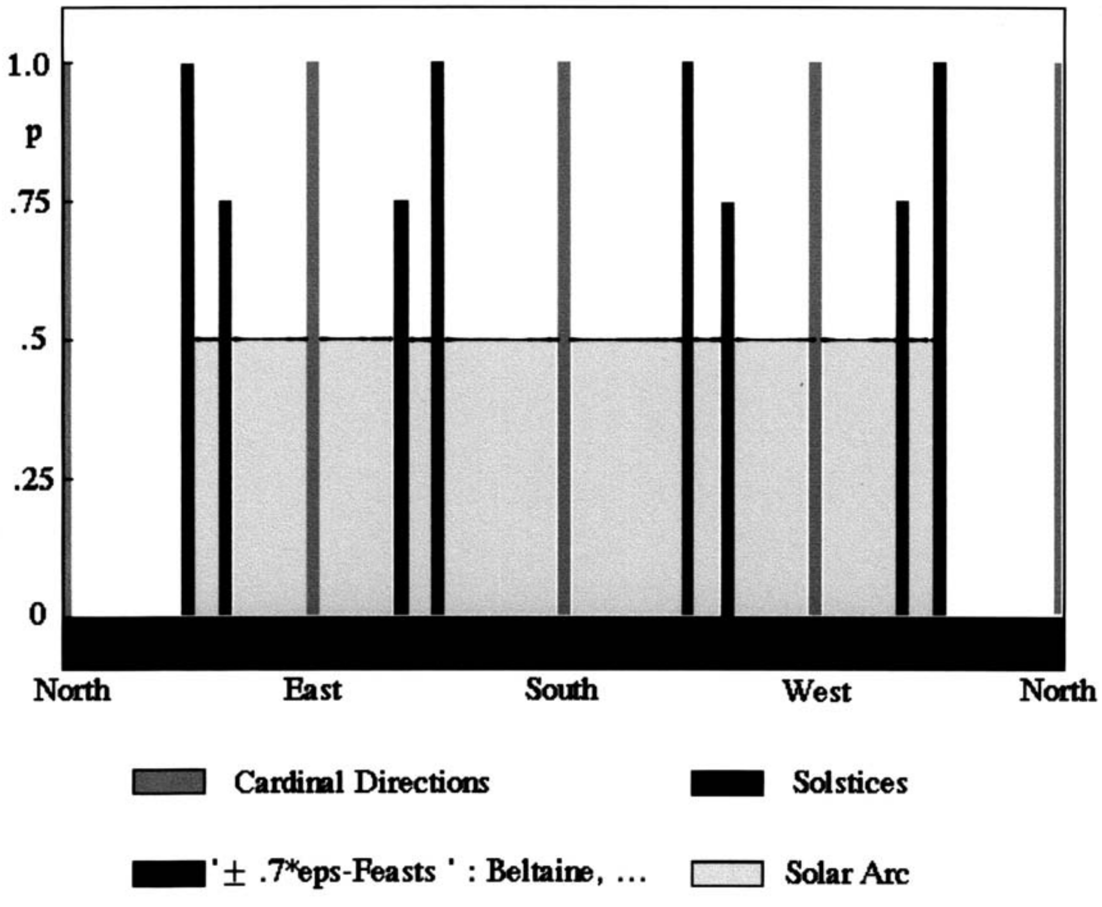

FIG. 4.9. Definition of probability p *for different solar azimuths.*

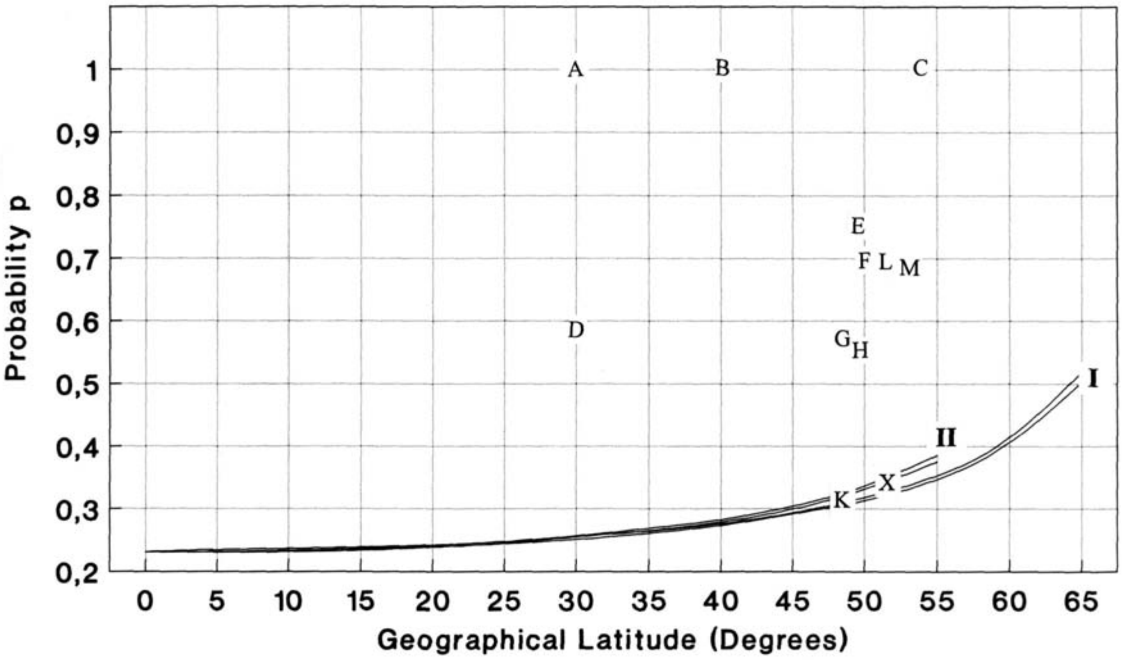

FIG. 4.10.

I. Probability function P *for horizon altitude 0° (upper curve 4000 BC, lower curve 0)*

II. Probability function P *for horizon altitude 10° (upper curve 4000 BC, lower curve 0)*

p-*values for individual monuments or monuments in an area: A: The three Great Pyramids; B: Imperial City of Beijing; C: Newgrange; D: Persepolis (Lentz and Schlosser 1969); E: enclosures in Bavaria; F; enclosures in Bohemia; G: enclosures in Austria; H: enclosures in Moravia; K: enclosures in Slovakia (E–K after Iwaniszewski 1996); L: Stonehenge (selection of the many lines); M: enclosures in North Rhine–Westphalia (Dedinghausen* p *= 0·67 according to the unpublished excavation record; Daseburg* p *= 0·67 after Kröger 1998; Bochum* p *= 0·71 after Schlosser and Cierny 1996; X: sample of modern buildings in Bochum.*

The statistic P may now be compared to a p derived for a sample of similar monuments. The larger the difference $p–P$, the more likely the monuments have something to do with astronomy. If one is aware of the pitfalls when using small numbers, $p–P$ may of course be derived for an individual monument. If one orientation is of special importance (of course *not* for the archaeoastronomer who may be indulging in wishful thinking, but judged from the architecture of the monument itself), it may receive double weight.

In Fig. 4.10, this function P is plotted for two epochs (0 and 4000 BC), and two horizon altitudes (0° and 10°). The p-values of some ancient and archaeological objects are given. Note the point marked *X*. It gives the mean p-value for a number of modern buildings in the city of Bochum (excluding churches, of course), among them a car factory, the main station and the author's house. With $p \approx P$, contemporary Bochumers obviously do not pay much attention to astronomy when erecting their buildings.

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5

Astronomy, cosmology, monuments and landscape in prehistoric Ireland

Clive Ruggles

Introduction: perceptions of archaeoastronomy in Ireland and elsewhere

Archaeoastronomy may be flourishing but activities in this area are only of value if they are helping to address relevant wider archaeological questions (Aveni 1989; Ruggles 1993; Iwaniszewski in this volume). It is true to say that the field still suffers from "image problems" within archaeology as a whole. In his introductory address at the SEAC98 conference, George Eogan spoke of perceptions of archaeoastronomy amongst Irish archaeologists, and similar words would be spoken by many other archaeologists in Britain and elsewhere. Their continuing unease relates in part to what we might call "popular archaeoastronomy", and this is certainly booming in Ireland. The December solstice 1997 issue of the *Irish Times*, for example, contains not only what has become almost an obligatory piece about Newgrange, but also a description of the solstitially-aligned short stone row at Gleninagh in Connemara, which is now being visited by increasing numbers of modern pilgrims, spurred on perhaps by a wonderfully evocative description published in 1996 by Tim Robinson (Robinson 1996, 199–208). This is a phenomenon all too familiar to colleagues in certain other countries, from the thousands who converged each June on Stonehenge for solstice festivals in the 1960s and 1970s (Chippindale 1994, 250–63) to the huge numbers who now visit the pyramid of Kukulcan at Chichen Itza for the equinox "hierophany" (Carlson 1999). The problem is that the popular view of archaeoastronomy is strongly coloured by the best-selling books on ancient astronomy that appear from time to time—recent examples being *The Orion Mystery* (Bauval and Gilbert 1994) and *Heaven's Mirror* (Hancock and Faiia 1999)—and what creates "best sellers" tends to be speculation and sensationalism rather than detailed academic arguments (see also Ruggles 2000, S66).

Even within academia, there has long been an uneasy relationship between archaeoastronomy and archaeology. In Britain and Ireland, the early "archaeoastronomers" were not archaeologists: Norman Lockyer was a physicist; Boyle Somerville, a naval rear-admiral; Gerald Hawkins, an astronomer; and Alexander Thom, an engineer. This background created its own nomenclature which was out of touch with the archaeological norms: terms that seemed second nature to archaeoastronomers grated in the ears of archaeologists. The very term "astronomy" was seen by many to imply twentieth-century scientific astronomy, and hence an ethnocentric approach (e.g. Thorpe 1983); and this was compounded by the use of the term "megalithic astronomy" to describe Thom's ideas, with its inherent implication of a coherent "megalithic culture" rather than the use of stone (among many other, less durable materials) in a variety of largely unrelated social contexts (Ritchie 1982; Ruggles 1999a, 80). The idea of "observatories", although acceptable to some archaeologists (e.g. Renfrew 1976, 16), was for most part taken to mean that standing stones should be seen as "observing instruments" of some sort, another unpalatable idea (cf. Ruggles 1997a, 203).

Nomenclature aside, archaeologists have for a long time had problems with the idea that astronomy was the main purpose or meaning of monuments. Astronomical alignments *per se* presented no problems to the likes of Gordon Childe (1940, 100–1) and Stuart Piggott (1949, 119). Even Jacquetta Hawkes, one of the first to oppose Gerald Hawkins' portrayal of Stonehenge as a computing device and eclipse predictor in 1967 (Hawkes 1967), had spoken only a few years earlier of Stonehenge as an astronomical temple (Hawkes 1962, 168). The problem is when astronomy is focussed upon to the apparent exclusion of all else, or at least when astronomical potential is the exclusive focus of interest. Rightly or wrongly, archaeologists generally perceive archaeoastronomers to be making the assumption, for example when studying orientations, that their potential significance is exclusively astronomical. The very term "archaeoastronomy" does little to help (cf. Hoskin 1997, 19).

Archaeologists have also had problems with archaeoastronomers' apparent fixation on "sites", and particularly on conspicuous orthostatic monuments. This is not to deny that archaeologists themselves were very site-focussed back before the last thirty years; but more recently there has been a significant shift of emphasis towards broader analyses of the landscape as a whole. This has brought not only the birth of "landscape archaeology" with its increased stress on field-walking, geophysical survey, topographic survey and so on, but also many works exploring prehistoric landscapes on a theoretical level (e.g. Tilley 1994; Ashmore and Knapp 1999). Interpretative archaeologies of the 1980s and 1990s have drawn attention to the issue of how prehistoric people perceived of themselves and their environment, and its importance for our understanding of the spatial patterning of human activity in the landscape (e.g. Carmichael *et al.* 1994). Terms such as "symbolic landscapes" and "sacred geographies" have come to encapsulate the idea that to prehistoric people the landscape and places within it were imbued with meaning (Ruggles 1999a, 120–1 and references therein). One way of keeping people's activities in tune with nature was to build monuments in accordance with perceived principles of cosmology or world-view (Ruggles 2000). And one of the consequences of this is that archaeologists now take very seriously the idea that monuments may have made reference in their architecture to features in the surrounding landscape and the sky (e.g. Bradley 1993; 1998). An irony is evident, then; for archaeoastronomy, by drawing attention to alignments upon celestial risings and settings in relation to horizon features, was one the first fields of interest within archaeology to examine seriously some of the relationships between monuments and the broader landscape.

Why, though, should today's prehistorian see archaeoastronomy as important? The main reason is that once we become interested in questions of perception and cognition, then we need to become concerned with how principles of cosmology might have been reflected in patterns that we could discern in the archaeological record. The sky is ubiquitous, and perceived relationships involving celestial objects and events form an essential part of almost every non-Western world view (Ruggles 2001b). It is a particularly important part for us because we can deduce, from modern astronomy, the appearance of the sky at any place and time in the past (Ruggles and Saunders 1993; Ruggles 2000). In other words, we have a much more direct knowledge of this part of the prehistoric environment than almost any other. Architectural alignments upon horizon astronomical phenomena, for example, may now be seen as relevant to our attempts to understand something of prehistoric people's perceptions of themselves in relation to their environment.

It is perhaps because of the level of interest now shown in questions of cognition and cosmology that the numbers of archaeologists coming to archaeoastronomy meetings are slowly increasing, providing a necessary counterweight to balance the more technical bias we have often had in the past. The "astronomy, cosmology and landscape" theme of the present conference reflects this.

What can we say of the relationship between archaeoastronomy and prehistoric archaeology in Ireland in particular? For better or worse, there has not been a lot of Irish archaeoastronomy, particularly as compared with the huge levels of interest and activity in Britain, especially between the 1960s and the 1980s. One of the pioneering figures was Boyle Somerville, whose papers report surveys of a variety of Irish monuments in the 1920s including stone circles, short stone rows, and dolmens (e.g. Somerville 1923; 1930). But these almost pale into insignificance compared to the hundreds of British, and particularly Scottish, sites surveyed during subsequent decades by Alexander Thom (1955; 1967; 1971). Thom himself ignored Ireland—with the single exception that he helped reduce and interpret site data from the complex of stone circles and rows at Beaghmore, Co. Tyrone, obtained by his son Archie (Thom 1980; see Thom 1988, 29; Burl 2000, 141–2). The first systematic archaeoastronomical surveys of local groups of Irish monuments took place in the 1970s. These were John Barber's study of 30 Cork-Kerry axial stone circles (Barber 1973) and Ann Lynch's study of 37 short stone rows in the same region (Lynch 1982). The 1990s saw the Cork-Kerry stone circles reinvestigated by Ruggles and Prendergast (1996; see also Ruggles 1999a, 99–101) and the rows by Ruggles (1994; 1996; see also Ruggles 1999a, 103–7). Recently, Prendergast has extended this line of investigation to the short stone rows of Counties Galway and Mayo (Prendergast 2000).

In many ways, the fact that the strong influence of Thom's ideas by-passed Ireland can be seen as an advantage: archaeoastronomers can approach Irish monuments with less interpretative baggage than in, say, Scotland, where it can be hard to shake off the legacy of certain monuments having been widely acclaimed as high-precision observatories. There is also some more general baggage, such as the "archaeoastronomical toolkit" which assigns implicit, unquestioned importance to the solstices, equinoxes, and lunar extremes without examining the theoretical basis for believing that these events might have been meaningful to prehistoric communities (Ruggles 1997a, 206–9). In fact, with regard to the equinoxes at least, archaeologists have fallen into the same trap (Ruggles 1997b). The idea of a calendar in which the year is divided into eight or even, perhaps, sixteen equal parts, demarcated by the solstices, equinoxes, mid-quarter days, and (in the case of the sixteen-month version) the days halfway between those, dates back to the work of Lockyer and Somerville. The idea that such a calendar was widespread during Neolithic times was espoused by Thom and by some archaeologists who took Thom's conclusions seriously, notably Aubrey Burl (e.g. Burl 1988) and Euan MacKie (1977; 1997). This has led to mid-quarter-day alignments, along with solstices and equinoxes, being regarded as implicitly significant "targets" by both archaeoastronomers (e.g. Krupp 1997, 23) and archaeologists from the broader mainstream (e.g. Parker Pearson 1993, 65). Yet the whole idea rests upon foundations that are shaky in two fundamental respects: a range of evidence points to significant regional diversity throughout the Neolithic in Britain and Ireland (Cooney 1999; Barclay 2000); and the "universal calendar" that is being proposed rests implicitly upon Western preconceptions of abstract space and time (Ruggles and Barclay 2000).

When I am speaking to archaeologists I often characterize archaeoastronomy as having two ends and a middle. At one end is a sensible core of work that is "theoretically aware"—aware of wider developments in ideas within archaeology—and hence is in touch with, and addressing questions of direct relevance within, the wider archaeological agenda. The other end is rife with speculation, all too often unabated by academic principles of weighing up the evidence in a fair way, and is all too often subject to sensationalism. In the middle is a surprisingly large grey area, populated mainly by academics working outside their own subject specialisms, who often become amazingly un-self-critical when doing so. Archaeoastronomers are generally aware of this, and this perhaps gives archaeoastronomy some of the vitality that attracts us; but it also carries dangers. If we are to maintain credibility with our peers then we have to be particularly self-critical.

Frameworks of theory and method are vitally important to us. The question of theoretical underpinnings is beginning to be seriously addressed (Iwaniszewski 1989 and in this volume; Ruggles and Saunders 1993; Ruggles 1999a). So too are key issues of methodology that archaeoastronomers face directly but which are increasingly relevant within the wider realms of the interpretation of "cultural landscapes". One of the most fundamental is the conflict between what we might call "general" (statistically rigorous, "scientific") and "specific" (interpretative, contextual, "historical") approaches (Ruggles 2001a). This is brought into sharp focus, at least in the traditional "alignment studies" part of the discipline, by the simple fact that an astronomical alignment, while empirically real, might have been unintended by those who constructed it and of no significance to anyone in the meantime prior to its "discovery" by the modern archaeoastronomer. Repeated trends might for many of us provide the most acceptable basic evidence of intentionality, but only contextual arguments are able to address questions of meaning (*ibid*.).

The example of the solstitially-aligned axial stone circle at Drombeg, Co. Cork epitomizes the problem. Although much-heralded, the solar alignment is not repeated at a single other example of this type of monument (Ruggles 1999a, 100; 2001a). While not belittling the importance of the "one-off", repeated trends constitute important evidence that strengthen or weaken existing ideas. We ignore them at our peril. On the other hand, we should expect significant regional diversity, as already mentioned; and even where dominant world-views led to commonalities of ritual practice

Fig. 5.1. Beaghmore, Co. Tyrone.
(a) Plan, after Pilcher (1969, fig. 11).
(b) The four rows radiating ENE-wards from the cairn between circles A and B, viewed from immediately to the west of the cairn.

that were quite widespread in space and time, we should still expect significant variation in what comes down to us in the material record.

The challenge, then, is to cope with variation—the limited extent of most repeated patterns and the complexity of patterns of continuity and change—without abandoning all attempts to assess alignment data fairly and quantitatively. In much of my own work in Ireland to date I have been interested specifically in correlations between the form and orientation of monuments and the surrounding landscape (including astronomical alignments) that may have expressed perceived cosmological relationships. The results have been fully published (Ruggles 1994; 1996; Ruggles and Prendergast 1996; Ruggles 1999a, 99–107) and there is no need to repeat them here. However, it worth emphasizing that the contrast that such studies reveal between the superficially similar axial stone circles of Cork and Kerry and the recumbent stone circles of Aberdeenshire in Scotland (Ruggles 1999a, 91–101) demonstrates that analyses of architectural alignments upon features in the natural landscape, such as prominent hilltops, and celestial objects and events, such as the rising and setting of the sun and moon, offer important insights that form and orientation alone do not.

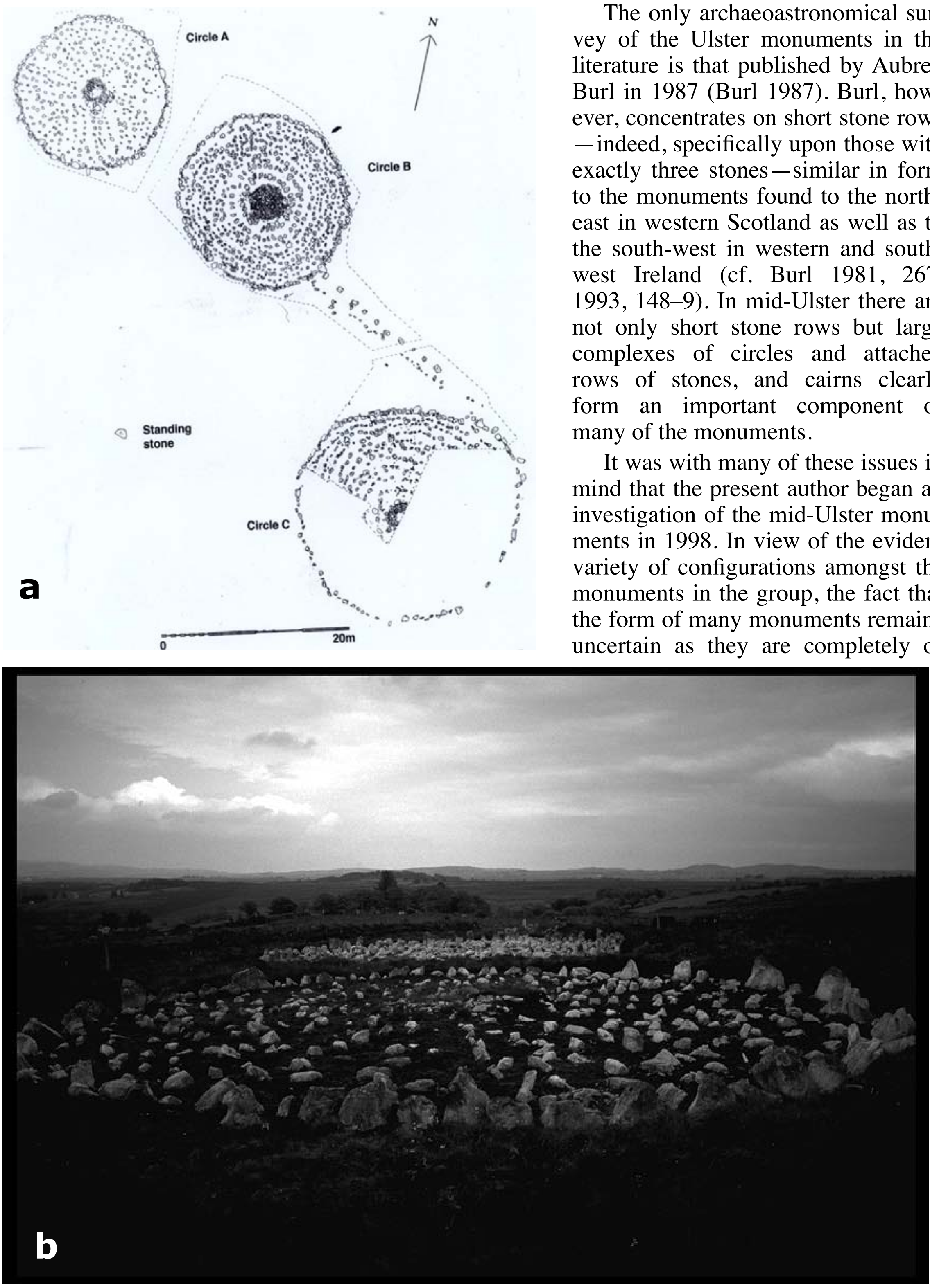
Circles and rows, land and sky in Bronze Age Ulster

Motivation for the project

Regional groupings containing as many as several dozen monuments of similar, but distinctive, design that are well enough preserved to permit systematic archaeoastronomical investigation are few. The best known examples are the recumbent stone circles of eastern Scotland, the axial stone circles of south-west Ireland, and the short stone rows of the same area (Ruggles 1999a, 91–107 and references therein). Short stone rows are also found in significant numbers in western Scotland (Ruggles 1985) and western Ireland (Prendergast 2000). More scattered and sometimes unique examples of Bronze Age monuments are found elsewhere (Burl 1993; 2000) but few are more spectacular and intriguing than some of the complex monuments containing several stone circles and rows, as well as small cairns, found in the north of Ireland, within a fairly compact geographical area centred upon Counties Tyrone, Fermanagh, Derry and Donegal, of which the best known is Beaghmore, Co. Tyrone (Burl 2000, 139–41) (Fig. 5.1).

Compared with the aforementioned concentrations of recumbent and axial stone circles and short stone rows, the cluster of Bronze Age orthostatic monuments in mid-Ulster is more problematic as the object of an archaeoastronomical study. There are only a few dozen known monuments in the group, they vary considerably in form and there are no clear patterns of orientation to form the starting point. Yet they are important for two reasons. First, they have the potential to provide an important case study in addressing the methodological challenge mentioned above. Second, they fill a significant gap in trying to build a wider interpretative picture of patterns of continuity and change amongst the regional cosmologies in Bronze Age Britain and Ireland, since they are geographically situated between the groupings of short stone rows and related monuments in western Scotland and those of central-western and south-western Ireland.

The mid-Ulster monuments have been understudied archaeologically, let alone archaeoastronomically. Accurate plans do not even exist for many of the monuments. A corpus of stone circles in northern Ireland was published by Oliver Davies in 1939 (Davies 1939), and the most recent systematic study is an unpublished Masters thesis by Rosemary McConkey (1987). There have been few excavations: the stone circle, row and cairn at Drumskinny, Co. Fermanagh was excavated in 1962 (Waterman 1964) and peat clearance at Beaghmore in the late 1940s was followed by excavations in 1953 (May 1953) and further clearance in 1965 (Pilcher 1969). An extraordinary site at Copney, Co. Tyrone, consists of several stone circles including three with internal settings of (in two cases) concentric circles and (in the other) radial lines of small stones, the internal settings only being discovered following peat clearance in 1994 (Foley and Macdonagh 1998) (Fig. 5.2). However, while excavations are planned in order to determine the full extent of the site, activities at the three circles themselves are likely to focus exclusively on preservation (Claire Foley, priv. comm., 1999). The excavation at Drumskinny uncovered almost nothing in the way of artefacts, but dates from Beaghmore (Pilcher 1969) suggest that the circles and rows here were constructed in the early to middle Bronze Age between about 1900 and 900 BC (see also Burl 2000, 141). This is in line with Ann Lynch's dates for Cashelkeelty axial stone circle in Cork-Kerry (Lynch 1981, 66) and Martlew and Ruggles's for Ardnacross double-stone row in North Mull (Martlew and Ruggles 1996).



The only archaeoastronomical survey of the Ulster monuments in the literature is that published by Aubrey Burl in 1987 (Burl 1987). Burl, however, concentrates on short stone rows —indeed, specifically upon those with exactly three stones—similar in form to the monuments found to the north-east in western Scotland as well as to the south-west in western and south-west Ireland (cf. Burl 1981, 267; 1993, 148–9). In mid-Ulster there are not only short stone rows but large complexes of circles and attached rows of stones, and cairns clearly form an important component of many of the monuments.

It was with many of these issues in mind that the present author began an investigation of the mid-Ulster monuments in 1998. In view of the evident variety of configurations amongst the monuments in the group, the fact that the form of many monuments remains uncertain as they are completely or

FIG. 5.2. Copney, Co. Tyrone.

(a) Plan of the three uncovered circles, as published in Foley and Macdonagh (1998, 25). © Environment and Heritage Service, Department for the Environment for Northern Ireland. Reproduced by permission.

(b) View of circle A from the west, with circle B visible in the background.

partially covered by peat, and the fact that their form may well have changed over time, it was clearly unrealistic to hope to formulate a clear field strategy—and in particular clear data selection criteria—in advance. Instead, the project took a more exploratory approach in searching for patterns of correlation between the form and orientation of the monuments and features of the surrounding landscape and sky that are evident from the surface remains. To some extent, reconnaissance trips in March and April 1998 were used to formulate working hypotheses that could then be "tested" during theodolite surveys undertaken during the subsequent months, One overall objective was to suggest questions that could be tackled more systematically by an intensive landscape project along the lines of the North Mull project (Ruggles 1999a, 112–24).

Source list of monuments

A source list of Bronze Age orthostatic monuments in mid-Ulster (Counties Tyrone, Fermanagh and Derry) was generated from the Sites and Monuments Record database held by the Department for the Environment for Northern Ireland by searching for entries whose summary description (site type) contained the words "stone alignment" or "stone row". Not all entries described as "standing stones" have been checked, although some short rows may be categorised thus. Adjacent counties in the Irish Republic were also examined. In the case of Counties Donegal and Cavan, the main sources were the county inventories, published in 1983 (Lacy *et al.* 1983) and 1995 (O'Donovan 1995) respectively. The County Monaghan inventory (Brindley 1986) lists no stone rows, only one pair of stones "which may be part of a megalithic tomb" (*ibid.*, p.9, no. 60) and eight single standing stones (*ibid.*, p.9, nos. 61–8). Paul Walsh of the Archaeological Branch of Ordnance Survey Ireland in Dublin confirmed (priv. comm.) in June 1998 that no rows had been recently reported in Counties Cavan, Donegal or Monaghan.

This list was then cross-checked against Burl's corpus of three-stone rows in Ulster (Burl 1987), Rosemary McConkey's gazetteer of stone circles in Ulster (McConkey 1987, 35–67) and Oliver Davies' corpus of stone circles in northern Ireland (Davies 1939) as well as the more general listings of stone circles and rows in Burl 2000 and Burl 1993 respectively. The list will be published in full elsewhere, with cross-references.

Brief details of the sites considered in 1998, including the dates of visits and the types of survey carried out, are given in Table 5.1.

TABLE 5.1. Brief details of the sites considered in 1998.

Column headings:

1 County (DL = Donegal; LDY = Derry; TYR = Tyrone; FER = Fermanagh; CN = Cavan)

2 Site no. in Lacy *et al.* 1983 for Donegal sites; DoE(NI) Sites and Monuments Record (SMR) no. for Derry, Tyrone and Fermanagh sites; Site no. in O'Donovan 1995 for Cavan sites.

3 Townland

4 National Grid reference

5 Summary description

6 Site no. in Davies 1939 (Derry, Tyrone and Fermanagh sites)

7 Page ref. of entry in stone circle gazetteer in McConkey 1987

8 Page ref. of entry in corpus of three-stone rows in Burl 1987

9 Plan: D = fig. no. in Davies 1939; L = fig. no. in Lacy 1983; M = fig. no. in McConkey 1987

10 Date of survey (YYMMDD) or NV (not visited)

11 Category of survey (A = theodolite survey; B = theodolite survey with lower-accuracy azimuth calibration; C = compass/clinometer survey; NS = not surveyed)

12 Reason why not visited or not surveyed

TABLE 5.1.

1	2	3	4	5	6	7	8	9	10	11	12
DL	439	Knocknafaugher	C 0397 3440	Row of at least five stones		—			980621	A	
DL	326	Cashelenny	H 1710 7489	Possible complex of stone circles and rows		41			980624	A	
DL	328	Lettermore	G 8509 8458	Circle and tangential row; second row		42		L27; M43	980625	A	
DL	358	Barnes Lower	C 122 263	Three-stone row		—	17		980621	A	
DL	190	Creeveoughter	C 257 328	At least 3 rows of low stones		41		M27	980621	A	
DL	441	Labbadish	C 2386 0934	Three-stone row		—	17		980621	NS	Overgrown and not in line; no profiles visible (trees)
DL	471	Rashenny	C 4180 4822	Row of at least five stones, including two standing parallel		—		L34	980620	B	
DL	472	Rashenny	C 4216 4754	Possible three-stone row		—	17		NV		Megalithic tomb; not a stone row
DL	477	Roosky	C 3757 4549	Row of 10 stones		—			980620	NS	Unconvincing row
LDY	23:3	Ballyholly	C 5771 1178	Double row tangential to circle; single row tangential to circle	26	50			NV		In forest; not located
LDY	23:23	Ballyholly	C 5797 1148	Possible row(s) and circle(s)	26	51			980520	C	
LDY	26:73	Tamnyrankin	C 8350 1027	Possible four-stone row	—	—			980604	C	
LDY	30:21	Aughlish	C 6619 0431	Complex of at least 6 circles, 2 double and 2 single rows, standing stones and possible cairns	9	52		M28	980604	A	
LDY	34a:2	Altaghoney	C 5172 0118	Double row tangential to circle on “small stones” side	56	53		M45	980520	A	
LDY	40:10	Corick	H 7798 8957	Complex of at least 6 stone rows and 1 circle	28	53		M18	980629	A	
LDY	45:19	Ballybriest	H 756 889	Two stone rows	—	54			980629	A	
TYR	6:22	Doorat	H 4926 9689	Two stone circles, one apparently with a double tangential row.	48	56			980627	A	

TABLE 5.1 (continued)

1	2	3	4	5	6	7	8	9	10	11	12
TYR	6:30	Doorat	H 4953 9655	Sinuous row of at least 54m (32 stones) long running NE-SW. Associated with (but not actually joined to) two circles and a single standing stone.	—	56			980628	B	
TYR	11:15	Aghalane	H 4947 9260	Stone circle and possible stone row	52	57			980627	NS	Features too difficult to interpret
TYR	11:16	Castledamph	H 5217 9236	Stone circle, cairns and double row	6	57		M13	980627	A	
TYR	12:22	Oughtboy	H 586 938	Two stone rows	47	58			980628	B	
TYR	13:1	Goles	H 6698 9475	Row of 8 stones, partially reconstructed	—	—			980603	A	
TYR	18:8	Culvacullion	H 4950 8892	Large circle (with interior chamber or smaller circle) and tangential row. Two smaller circles in the vicinity.	1	58			980627	A	
TYR	20:4	Beaghmore	H 6847 8423	Complex of 7 circles and associated rows and at least 12 cairns	11	59-60	18	M8	980521	A	
TYR	20:19	Broughderg	H 660 871	Stone circle and double row	—	60			980629	A	
TYR	20:20	Broughderg	H 6498 8612	Two circles, one double (concentric), and two single rows	—	61			980626	B	
TYR	20:23	Beaghmore	H 686 843	Cairn and stone row	—	—			980627	A	
TYR	20:48	Broughderg	H 679 869	Cist and stone row	—	—			980626	C	
TYR	23:42	Seegronan	H 1946 7873	Possible row of 4 or 5 stones	—	—			980624	C	
TYR	25:13	Glasmullagh	H 3869 8040	Four circles close together in square formation; single row running eastwards from between the NE and SE circles	34	61			980521	A	
TYR	25:27	Glasmullagh	H 3859 8050	Possible stone row and standing stone	—	61			980521	A	
TYR	26:5	Golan	H 4399 8193	Stone circle and possible stone row	35	62			980628	A	
TYR	27:33	Copney	H 599 780	Complex of at least 9 stone circles, cairns, double row and standing stone	—	62-63		M6; M7	980617	A	
TYR	27:41	Copney	H 5956 7830	Two stone rows	—	—			980617	C	

TABLE 5.1 (continued)

1	2	3	4	5	6	7	8	9	10	11	12
TYR	28:11	Beleevnabeg	H 6935 8277	Three-stone row	9	60	18		980629	A	
TYR	37:8	Moymore	H 7106 7451	Nine circles, between some of which run two single rows meeting at right angles	13	64		M9	980519	A	
TYR	37:13	Cregganconroe	H 6503 7519	Stone row	14	64			980622	A	
TYR	37:20	Tremoge	H 6538 7330	Double row tangential to circle on “large stones” side; further circle adjacent to NE	15	65	18	M46	980519	A	
TYR	37:21	Tremoge	H 6570 7359	Double row tangential to circle on “small stones” side. Further possible circle, or two circles, c.30m to east.	15	65	18	D4; M47; M48	980519	A	
FER	134:7	Formil	H 1588 6758	Four-stone row, circle with double row, and three further possible circles	53	45	18		NV		In forest; not located
FER	135:3	Drumskinny	H 2009 7072	Stone circle, cairn and stone row	41	45		M14	980601	A	
FER	135:4	Montiaghroe	H 1932 6944	Three-stone row	45	—	18		980601	A	
FER	135:5	Montiaghroe	H 1936 6932	Stone circle and two stone rows	45	45	18		980601; 980624	A	
FER	193:14	Brougher	H 3579 5285	Stone row and standing stone	43	46			980625	A	
FER	212:10	Ratoran	H 3259 4655	Four-stone row	62	—			980625	A	
FER	212:86	Cavancarragh	H 2990 4495	Three stone rows, and possible cairns	61	47		M12	980619	A	
FER	212:111	Mountdrum	H 3080 4310	Triple-concentric circle and stone row	—	—			980619	A	
FER	212:112	Mountdrum	H 3079 4315	Stone circle and two stone rows	—	—			980619	A	
FER	212:117	Mountdrum	H 3073 4310	Possible stone circle and stone row	—	—			980423	NS	Features too difficult to interpret
CN	69	Lissanover	H 2363 1626	Three-stone row		—			980618	NS	Bad weather conditions; trees obscure most of horizon
CN	70	Shantemon	H 4650 0782	Five-stone row		—			980618	C	

FIG. 5.3. Aughlish, Co. Derry.

(a) The complex viewed from the south.

(b) One of the circles, here viewed from the north-west, is bisected by a townland boundary wall. The half of the circle on the far side has been destroyed.

Form and orientation

While there are certainly some short rows of large standing stones in the north of Ireland that resemble those in western Scotland or south-west Ireland—examples being Barnes Lower, Montiaghroe (135:4) and Shantemon—the mid-Ulster group of monuments is characterized particularly by distinctive combinations of circles, rows and cairns. A problem that besets the investigation of these monuments is that many are comprised of tiny stones no more than a few tens of centimetres in any dimension, some of which may be just visible through the peat while others are completely

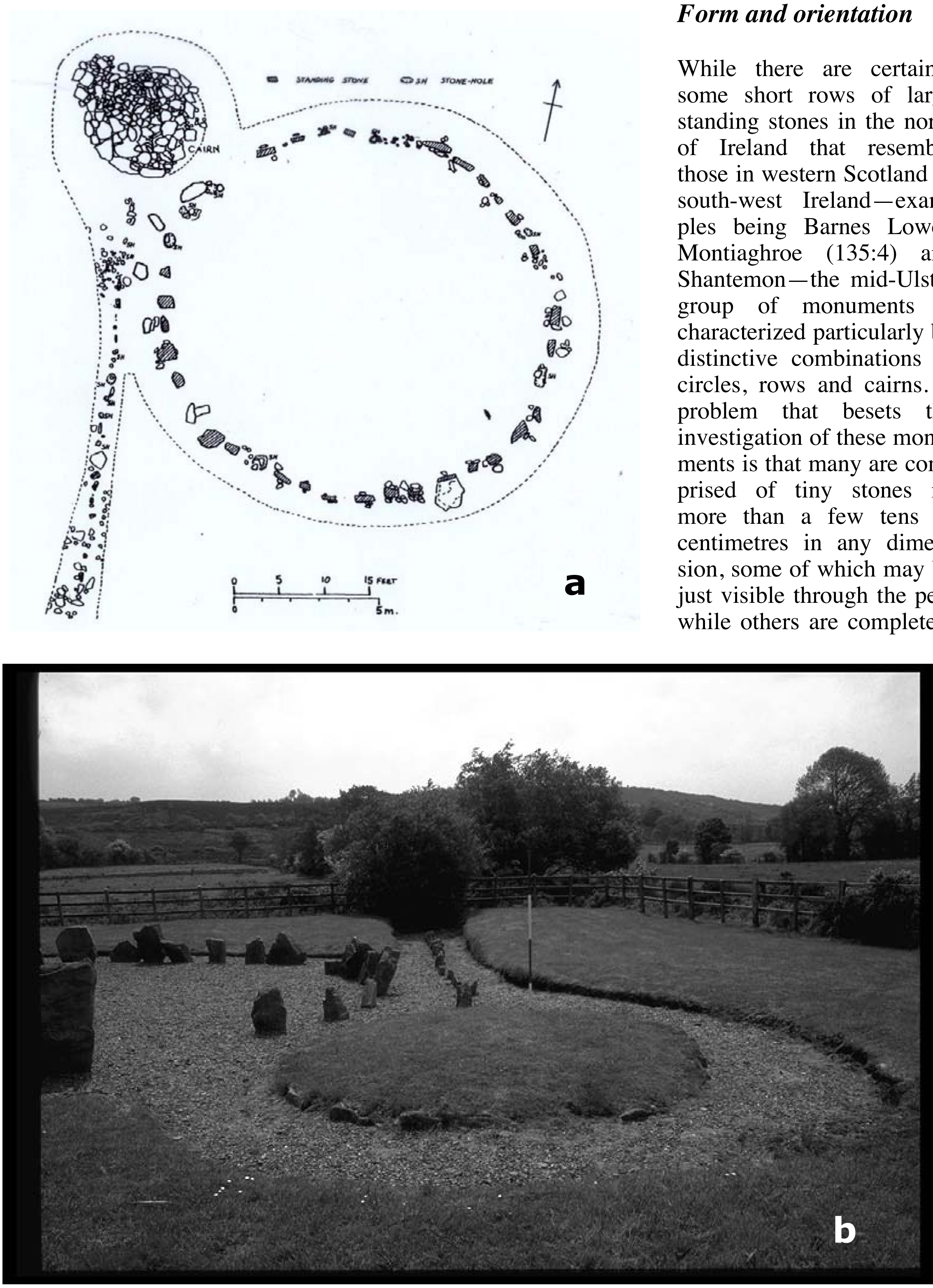


Fig. 5.4. Drumskinny, Co. Fermanagh.
(a) Plan, after Waterman (1964).
(b) View from the north, showing the cairn, the stone row extending away to the south, and part of the stone circle to the east.

buried. On the plus side, this means that there may well be extensive complexes in a good state of preservation still waiting to be discovered under blanket peat. The disadvantage, however, is that stones are easily moved or removed. Many sites have been extensively damaged or completely destroyed, and the fieldwork in 1998 depressingly demonstrated that the despoilment of these monuments has proceeded apace in recent years, quite often in the course of land improvement schemes. Nowhere does one gain a more direct impression of what has been lost than at Aughlish, where part of a major complex of several rows and circles is well preserved on one side of a townland boundary, but is completely destroyed on the other (Fig. 5.3).

The tiny stones characteristic of many mid-Ulster sites are reminiscent of those found, for example, in Caithness, and are quite distinct from the large stones—commonly between one and two, and in some cases three or more, metres high—that typically constitute the short stone rows and stone circles found in Scotland and elsewhere in Ireland. Yet there are also larger stones here. At Copney, for example, a single large monolith 1·8m high stands adjacent to the several circles of tiny stones. A ubiquitous form in mid-Ulster is the double row, quite frequently comprising one row of tiny stones together with a parallel row of taller ones. There are several examples at Beaghmore, one at Copney, and one at Castledamph, to name but a few.

There is no simple or obvious typological classification for these monuments. While there are some rows apparently without circles, as at Ballybriest, nearly all the sites comprise at least one circle together with at least one single or double row. Many also contain one or more cairns. But any attempt to impose order upon the interrelationships between these different elements soon flounders. It is true that rows are generally attached to circles or cairns, but there is no consistency in how this is done. One of the simplest combinations of the three different elements is to be found at the excavated site at Drumskinny, which comprises a single cairn, stone circle and stone row (Fig. 5.4). As is evident from the picture, the row runs radially away from the cairn, with the circle placed on one side. A more complex form of the same idea seems to hold sway at Beaghmore, where, for example, two double rows run away ENE-wards from the easternmost cairn, with circles being placed immediately adjacent to the cairn to the north and south (Fig. 5.1). In some cases,

Fig. 5.5. Moymore, Co. Tyrone. View from the south. A stone row runs to the right (ESE-wards) from the stone marked by the upright ranging pole, then turns and runs NNE-wards, away from the camera. Beyond and to its left are four circles in a two-by-two arrangement. In the foreground and to the right of the row are a further five circles.

rows run tangentially to circles, as at Culvacullion (McConkey 1987, 58); in other cases they run radially, as at Castledamph (*ibid*., fig. 13).

Even to characterise the form of the monuments as, for example, "rows attached to circles", may be misleading and may tend to dictate, rather than to inform, questions of interpretation. For example, it is not implausible that the cairns formed the focal points of these monuments while the rows provided some sort of demarcation or division, with the circles being placed with respect to them. The latter idea suggests itself particularly at sites such as Moymore, where no fewer than nine stone circles are found adjacent to one another with a stone row running between them and, at one point, turning through a right angle (Fig. 5.5).

Even though surveying the extant remains provides no direct evidence on the matter, it may be unwise to ignore the possibility that many of these sites were not designed and constructed as a whole but developed more slowly over time. Were cairns or circles added to existing complexes, or were rows extended as time went on? There are certainly instances of something similar in modern times, both in Melanesia (Layard 1942) and Madagascar, where the Zafimaniry sometimes erect a standing stone to commemorate a person's father (or three small stones, capped, for a mother) and these accumulate into family groupings (Bloch 1995, 71–3). It is especially tempting to wonder whether, at Copney, the highest circle, with its radial spokes surrounding a cairn close to the summit of a ridge, was the earliest construction, with further cairns together with associated circles and rows being added later, thereby extending the complex down the hill.

Unlike the concentrations of circles and rows in eastern and western Scotland and the south-west of Ireland, there are no obvious overall trends in orientation amongst the Ulster monuments. The most obvious first question is whether the stone rows manifest any overall consistency in orientation, and the answer is a clear no. A diagram showing the orientations of a broad sample of stone rows associated with stone circles, produced by McConkey (1987, fig. 15) and reproduced here as Fig. 5.6, shows them scattered all round the compass. One can discern some localised trends—for example, Fermanagh rows tend to run southwards away from their associated circles, as at Drumskinny—but none seems to involve more than a small handful of monuments.

This raises the question of referents to the wider landscape. Are there any evident trends in orientation that seem to relate consistently to the surrounding topography? One that suggested itself to the present author after visiting a number of the Ulster row-circles was how the row often seems to mark the division of the world into "open" and "closed" parts: the closed part being where the ground rises and the horizon is close (and would have been so even in the absence of vegetation cover); the open part being where the ground falls away and there is a distant view. Nowhere is this dichotomy, and the row's correlation with it, more evident than at Glasmullagh (25:13), where there is wide vista to the south but the ground rises steeply northwards towards the summit of Bessy Bell. The sceptic will quickly point out that the orientation of this row might be more easily explained by the fact that it contours along the side of the hill. However, cases such as Creevoughter, Tremoge (37:20) and Copney itself serve as counterexamples. An extension of this idea is to ask whether there is any correlation between the "sidedness" of double rows and the surrounding topography, for example, with the side of the row comprising the larger stones always facing the more open (or, conversely the more closed) landscape. The idea is not inherently absurd: in Siberian paganism, for example, an "upper world/lower world" dichotomy is indeed reflected in orientation (Kosarev 1999, 452–3). On-site data were collected in order to permit analyses of "orientation of visibility" (see Ruggles 1999a, 94) and whether these speculations are supported by quantitative data remains to be seen. However, the example of Beaghmore, where there exist one and possibly two instances of adjacent double-rows with opposite sidedness, makes this seem unlikely.

In a few cases it is easy to imagine the form of a monument reflecting the wider landscape. At Culvacullion, for example, the stone row runs parallel to the flow of water along a stream at the bottom of the valley. But in the preliminary analyses of the mid-Ulster data there is little to suggest that any such relationships hold with any consistency from one monument to another.

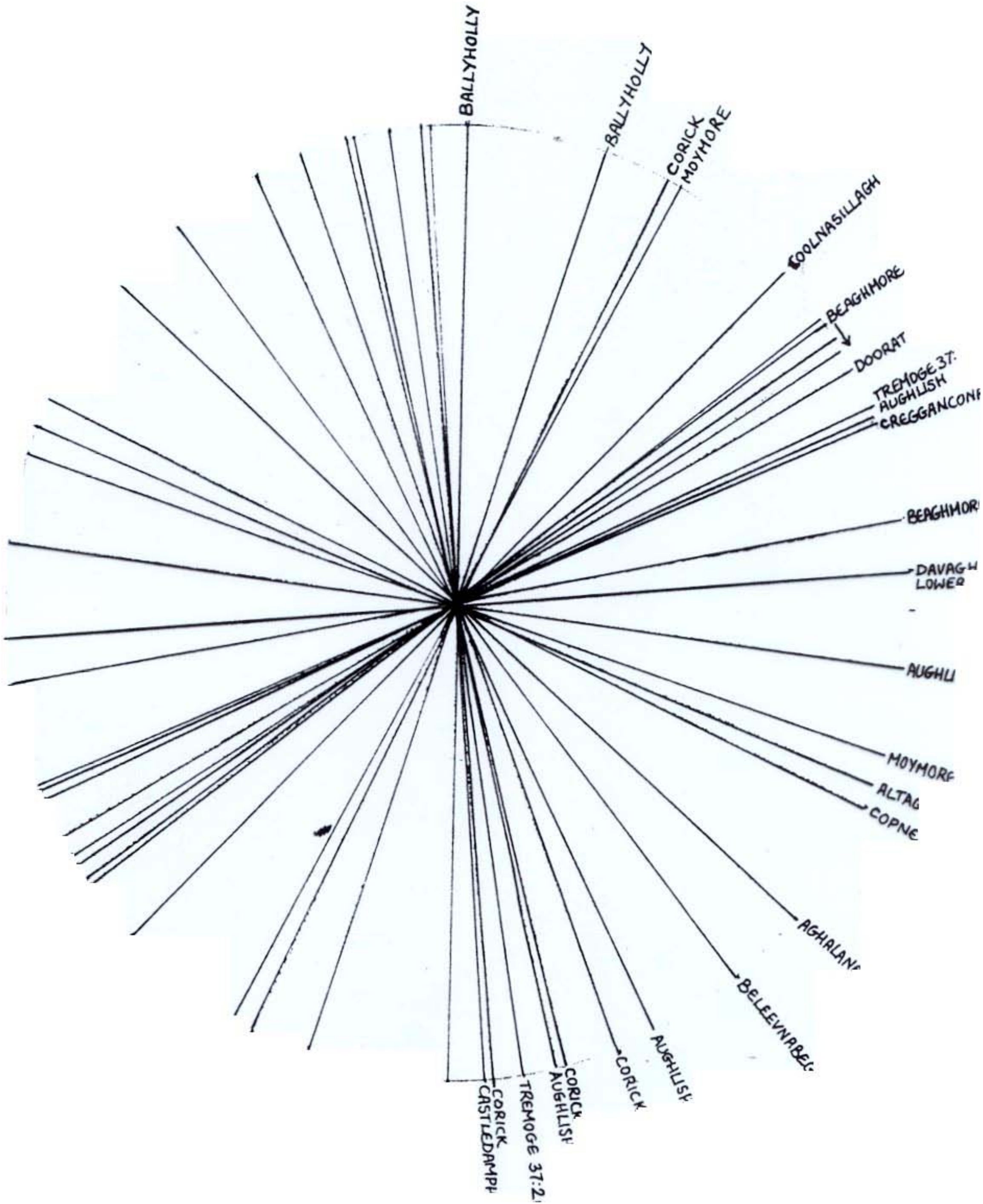


FIG. 5.6. Orientations of some stone rows associated with stone circles in mid-Ulster (McConkey 1987, fig. 15). Reproduced with the author's permission.

Alignments and astronomy

Something that soon strikes the visitor to several short stone rows in the south-west of Ireland is that many of them are oriented directly upon prominent hills. This is by no means universally true; but systematic surveys do back up the casual observation, showing that the correlation holds in approximately 50% of known cases, a highly significant proportion (Ruggles 1994). Nothing like this is as clear for the mid-Ulster sites, and indeed it could not be true given what we have already said about the rows often appearing to demarcate the boundary between distant and closer horizons. Nonetheless, there are some instances of alignments upon prominent hills, a good example being the orientation of the longer row at Lettermore northwards upon Binbane. (With an azimuth of 332°·6 and an altitude of 7°·9, yielding a declination of +38°·2, this has no obvious astronomical significance.)

At the time of writing there has been no systematic reduction of the astronomical data, but some preliminary impressions may be reported. There are one or two alignments that might be interpreted as solstitial, but early results are more suggestive, if anything, of the moon. Thus the high southerly horizon indicated by the row at Goles (A = 161°, h = 7°) yields a declination around –27°; the alignment of the row running NE from the cairn between circles C and D at Beaghmore (A = 36°, h = 0°·5°) yields +28°; an alignment of one of the rows at Aughlish upon a particularly prominent horizon cleft (Fig. 5.7) (A = 203°, h = 2°) yields –30°; the alignment of the most convincing row at Cashelenny (A = 150°, h = 0°) yields –30°; and the rows at Creevoughter (A = 145°, h = 0°) yield –28°. On the other hand, a good many rows are oriented roughly east-west or north-south.

The few sites that resemble the short stone rows from other parts of Ireland and Scotland seem generally to follow the pattern, clear in Cork and Kerry although somewhat mutated in the west (Prendergast 2000, fig. 3), of north-east/south-westerly orientation. Knocknafaugher is oriented in the SW upon the peak of Muckish Mountain (A = 211°·0, h = 5°·2, δ = –24°·5); the midwinter sun would have set halfway down the right-hand slope of the mountain. Barnes Lower is again oriented NE-SW and yields declinations of around +26° and –25° respectively. Rashenny (DL 471), on the other hand, is oriented more or less north-south and Ratoran more or less east-west. It is tempting to conclude that the distinctive mid-Ulster monuments are superimposed geographically upon a wider tradition of short stone rows and are perhaps chronologically distinct from it. The short stone rows in the area would then be seen as following broader patterns of orientation and astronomical alignment evinced down across Ireland and across the North Channel into western Scotland. However, we must be careful to avoid circular argument, by being tempted to see a site as a classic short row if it fits the familiar pattern with regard to orientation and astronomy, but a remnant of something more complex if it does not.

Brief discussion

A systematic presentation of the site data, and a full report including interpretation, will be published in due course. Even at this preliminary stage it seems clear, however, that there will be no clear trends in orientation, no strong consistency of relationship to the features in the surrounding topography, and no strongly consistent patterns of astronomical alignment. The methodological challenge lies in how we develop contextual arguments to balance these shortcomings, and to use the existing data to assess competing hypotheses, without reverting to a situation where we are selecting evidence an uncontrolled and opportunistic manner (e.g. Ruggles 2001a).

Some of the early conclusions and observations are, however, worthy of note. At Beaghmore, Copney, and a number of other sites in the group, a single or double stone row is constructed radially to a cairn. One gets the impression that the cairn is the central place, with the row marking a direction of significance leading away from it, and circles being placed on one or other side of the "space" thus divided. This pattern of relationship between cairns and stone circles (and rows) at the Ulster monuments seems to counter the suggestion made by Bradley (1998, 139), in the context of Cumbria and the Peak District, that burial cairns found in association with stone circles and related monuments may be a secondary development.

There is certainly superficial evidence to support the idea that some of the mid-Ulster rows might have reflected the division of the perceived world into different parts, radiating out from a central place such as a stone circle or cairn, or forming a divide, with the correct positioning of circles or cairns in relation to those rows being perhaps a matter of great, even cosmic, importance.

Fig. 5.7. Aughlish, Co. Derry. View to the south along one of the rows at Aughlish upon a particularly prominent horizon cleft, aligned upon moonset at the major standstill limit.

But how do such ideas relate to the more traditional notion that structures such as rows might have been oriented upon a prominent landscape feature such as a hill, or a horizon astronomical event? There are almost endless ways in which the form of a monument might have related symbolically to the surrounding landscape and sky, and there are limits to how systematic we can be given the small size and evident diversity of the mid-Ulster monument group. Perhaps the way forward will become clearer when the archaeoastronomical data, orientation of visibility data, and data on other relationships between the monuments and their landscape have been fully reduced.

In conclusion, let us return once more to Irish archaeology. I have been critical of the idea that an eight-month calendar existed in Neolithic times, and that it perpetrated down to become the "Celtic" calendar of later eras. However, recent data from Altar wedge tomb in County Cork has provided clear evidence of ritual activity stretching from c. 2000 BC up to the first or second century AD (O'Brien 1993). Furthermore, the orientation of this tomb is upon sunset close to a mid-quarter day (Ruggles 1999b). I do, therefore, have to admit that some form of continuity in the significance of this date is at least possible in this locality. The reason that the Irish data pose this distinct challenge is due to the distinctive nature of the Bronze Age–Iron Age transition, and particularly to the continuity from Iron Age into Medieval times owing to the lack of a Roman invasion. These help to create some distinctive and attractive features of Irish archaeology, and ones where archaeoastronomy may have a significant interpretative role to play in helping to identify patterns of ideological continuity and change.

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6

Differences in Minoan and Mycenaean orientations in Crete

Mary Blomberg and Göran Henriksson

Summary

This closer look at the orientation traditions of the Minoans and Mycenaeans was occasioned by the eye-catching deviations in orientation of two small shrines built at the time when the Mycenaeans were establishing their hegemony in Crete. They indicate that one of the most significant achievements of Greek culture and an important architectural influence in our own culture, the Greek temple, was the result of the new composite culture which emerged from that struggle. It is proposed that both Minoan and Mycenaean orientation traditions influenced the new culture in Crete and thus lived on to influence the Greeks. The very different pattern of Mycenaean orientations invites further study, to increase our understanding of their cosmology and thus shed more light on the great Bronze Age cultures of Greece and their later influence.

Introduction

One of the most important problems of the Late Bronze Age in the Aegean is the nature of the relationship between the Minoan and Mycenaean cultures and the influence of these on the later Greeks. We present here some results of our study of the orientations of the cult rooms and graves of the two cultures which we think shed some light on the subject. The Mycenaeans of course were themselves Greek, but it is convenient to reserve the term for the culture that developed in the Aegean after the Late Bronze Age.

The Minoans had settled in Crete at the beginning of the Early Neolithic Period, no later than the seventh millennium BC (Evans 1994), and had there developed a splendid culture. This culture was at its height in the first phase of the Late Bronze Age (Late Minoan I) which began in about 1600 BC. The Mycenaeans had migrated to the Greek mainland towards the end of the Middle Bronze Age, about 2100 BC (Drews 1988), and their rude culture soon became heavily influenced by the Minoan. This has been called the Versailles effect (Wiener 1984) and can be compared to the influence of French culture on, for example, that of the Swedes and the Russians of two centuries ago. Mycenaean figured pottery, for example, is entirely the result of the contact with Crete. Earlier mainland pottery was plain or had geometric designs.

By about 1450 BC (beginning of Late Minoan II), the relationship between the two cultures had changed radically. Following a period of island-wide destruction, the Mycenaeans emerged as rulers in Crete (Driessen and Macdonald 1997). Large numbers of primarily economic documents written in the Mycenaean Linear B script have been found in the Minoan palaces at Knossos and Chania. Linear B is the adaptation of the Minoan Linear A syllabic script to the Mycenaean Greek language and its use for accounting in the Minoan palaces reasonably presupposes that the Mycenaeans were in command of those palaces. Another illustration of the altered relationship between the two cultures is that the Mycenaean figured pottery style, which had developed under Minoan influence, came to prevail in Crete itself and also throughout the Aegean.

According to the most widely accepted explanation for these changes, the Mycenaeans took advantage of a series of natural disasters in Crete to install themselves as rulers in the island. The

Fig. 6.1. The shrine at Ayia Triada, (a) from the north-west and (b) from the south-east. Orientation of axis of symmetry = 295·5° ± 0·5°.

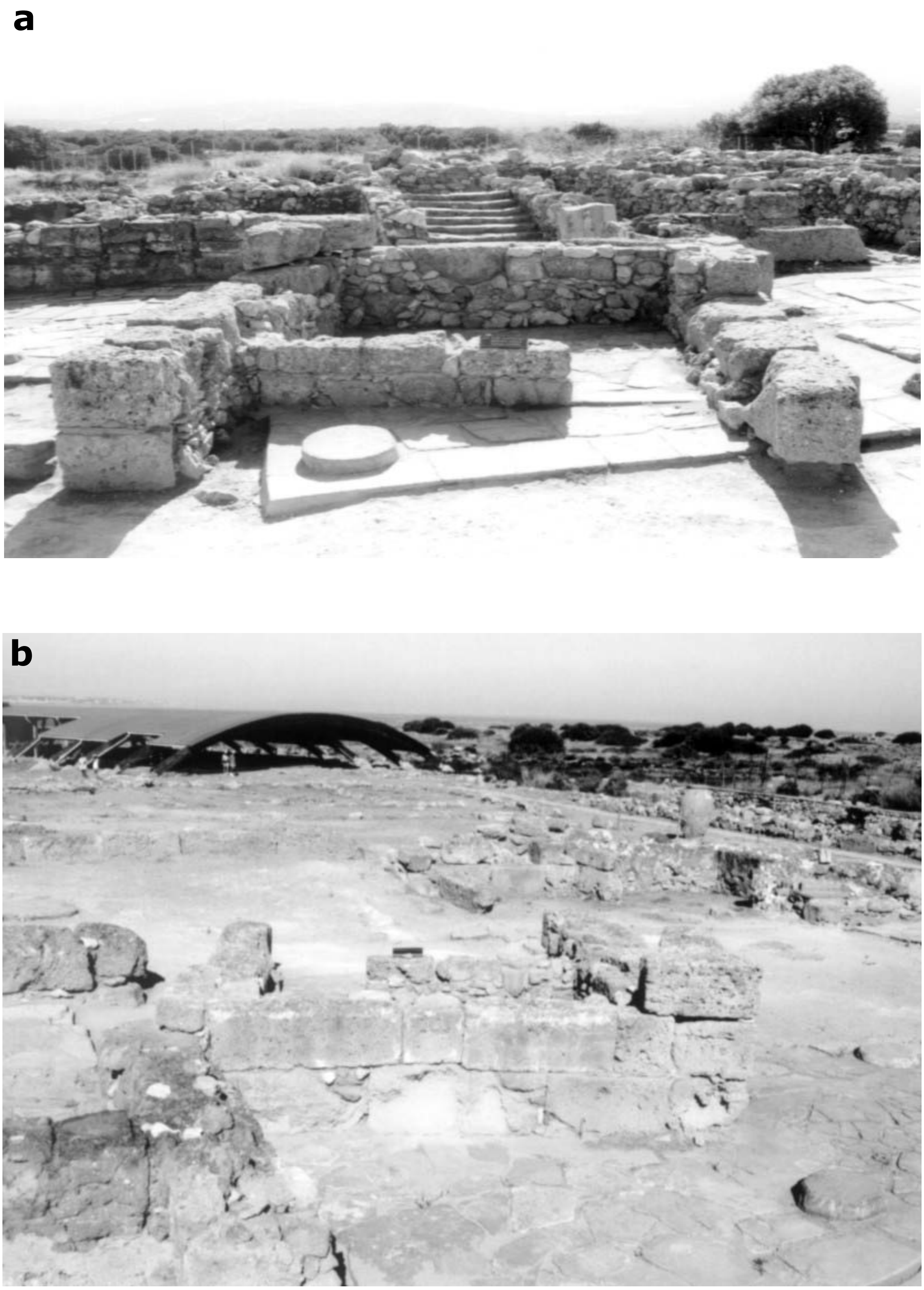

FIG. 6.2. The shrine at Mallia, (a) from the north-west and (b) from the south-east. Orientation of southern wall = 300·9°.

methods used and the length of the process are the subjects of a large number of books and articles and many questions are still unanswered. For example: What was the earlier relationship *in Crete* between the Mycenaeans and the Minoans? The adaptation of the Linear A script to write Mycenaean Greek implies a considerable period of peaceful co-operation, as the languages were not closely related. Was there only a replacement of the ruling elite, with the population still largely Minoan? To what extent and in what ways did the Mycenaean culture influence the Minoan? We have noted the wide prevalence of the Mycenaean pottery style. Even more noteworthy is the great difficulty in distinguishing in general between material aspects of the two cultures after the Mycenaean political and economic domination in Crete. Did elements of Minoan culture survive to influence Greek culture?

The shrines at Ayia Triada and Mallia

Two remarkable small buildings, both generally considered to be shrines, were constructed in Crete not long after the Mycenaean take-over of the island, one in the ruins of the villa at Ayia Triada and the other in those of the palace at Mallia (La Rosa 1985; Pelon 1997). Their orientations are unique in Crete and may illuminate the nature of the development in the island following the take-over. They indicate that the outcome of the Mycenaean hegemony was a new, composite culture with important consequences for Greek culture. For example, it may reasonably be argued that the origins of the Classical Greek temple lie in these two small structures.

As they were built not long after the take-over, they were most likely constructed by Minoan craftsmen in the service of Mycenaeans. This is especially clear in the case of the shrine at Ayia Triada. It is built largely according to Minoan techniques with well-dressed stone masonry on the exterior and smaller stones on the interior which were covered with plaster (Figs 6.1a–b). The type of threshold, the bench built against the rear wall and the presence of two doors even in such a narrow room are also Minoan features. The stone thresholds are characteristic of the uniquely Minoan pier-and-door partition system according to which there were as many doors as the width of the room allowed. The system seems to have been designed to permit maximal adjustment to weather conditions and it is one of the most typical features of Minoan architecture (Graham 1987, 86–7, figs 4 and 13). There was a fine fresco floor with a single large design consisting of dolphins, fish and an octopus (Hirsch 1977, 10–11; 1980, 459–60). The only other known floor of the same type—that is, with a single large design—was in a room of the Knossos palace (Hawke-Smith 1976, 73–4). It too was a marine scene and was laid at about the same time, which means that it was made for Mycenaeans. All other fresco floors—both Minoan and Mycenaean—had small repetitive, symmetrical designs. The floor, then, is the only element in the building which may show Mycenaean influence at Ayia Triada. The orientation, although unusual in that it is to sunset, is still Minoan in spirit in that it established a relationship between the shrine and the cosmos.

The Mallia shrine is different both from the Ayia Triada building and also from anything Mycenaean, whether in Crete or in the Mainland. It is said to have been built entirely of well-dressed masonry (Pelon 1997, 342). We do not get this impression from photographs, in which the walls resemble those of the shrine at Ayia Triada (Figs 6.2a–b), but this may be due to conservation effects. The single door is far to one side and although there is a porch with side walls there were no columns. The column base on the floor of the porch belonged to the earlier, Minoan, palace (Pelon 1980, 79). Similarities to Minoan architecture are also hard to find other than the orientation to sunset which, as in the case at Ayia Triada, may be said to be Minoan in spirit.

Orientations of Minoan and Mycenaean cult rooms and graves

Our attention was attracted to the two beautifully proportioned small buildings because of the striking deviation of their orientations from those of their surroundings (Figs 6.3a–b), a feature which has given the building at Mallia the name by which it is known in the literature, *le bâtiment oblique*. Both were oriented close to sunset at the summer solstice. At Ayia Triada the sun was observed to set 2° north of the mountain peak which is in line with the axis of the building

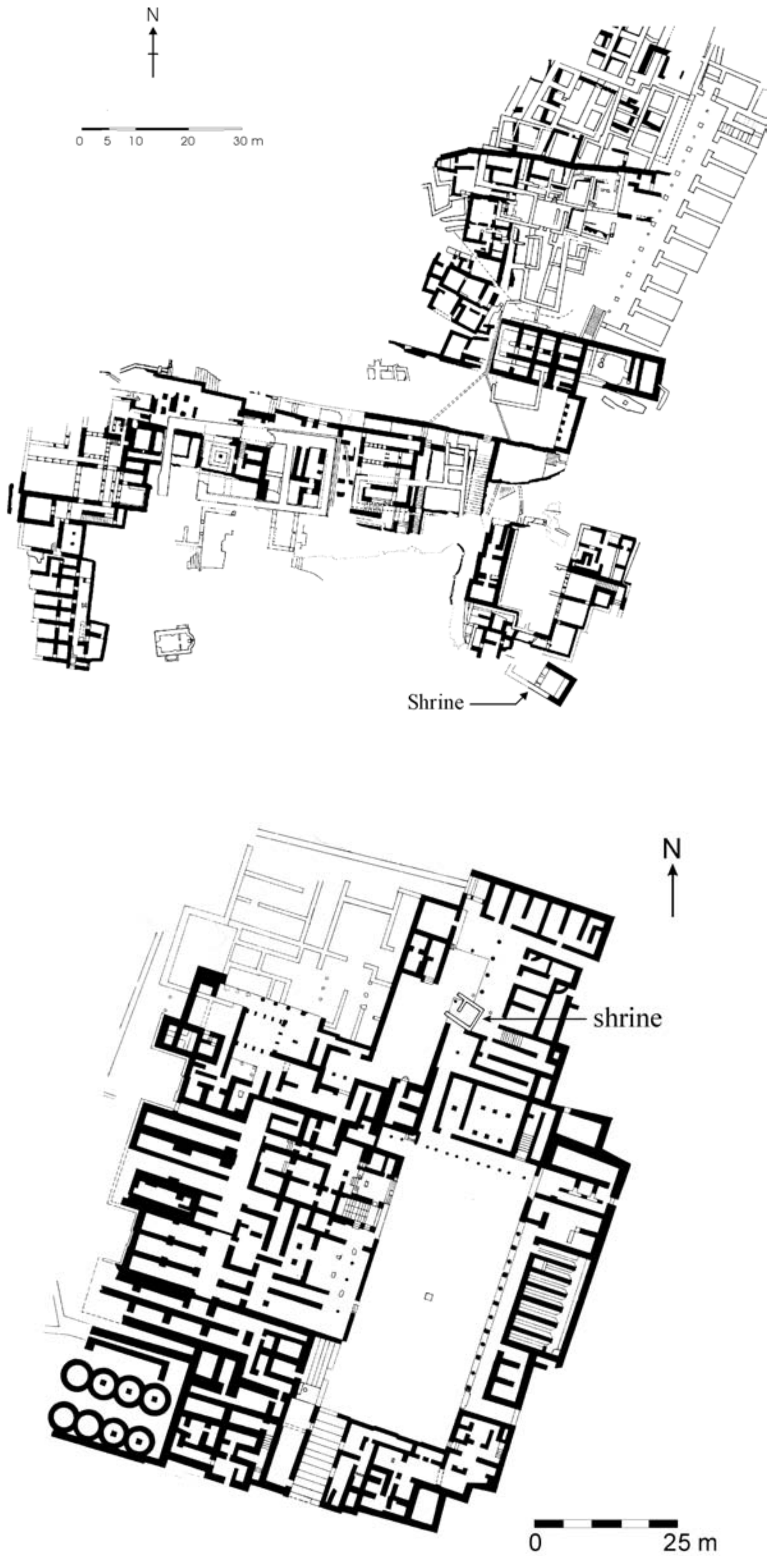

Fig. 6.3. Plans of the shrines at (a) Ayia Triada and (b) Mallia. By permission of the editors of The Aerial Atlas of Ancient Crete.

(= 295·5° ± 0·5°, Fig. 6.4a). At Mallia the southern wall of the shrine is oriented 0°·5 north of sunset (=300·9°, Fig. 6.4b).[1] Because of the asymmetrical position of the door, this wall would have been completely illuminated at the summer solstice. The orientation at Mallia was maintained until recently to be towards moonrise (Pelon 1997, 349), despite the fact that the only door opens to the west. This opinion was based on the fact that the foothills of the mountain Selena lie to the east of the site (van Effenterre 1980, 355).

These two buildings not only differ in orientation with respect to their immediate surroundings but they also differ with respect to the orientations of all earlier cult rooms *in settlements* both in Crete and in Mainland Greece. The generally acknowledged cult rooms in the Minoan palaces lie in the west wings with their doors opening to the east (Shaw 1977). This seems to have been true also for the assumed cult rooms in the large villas; however the acceptance of these rooms as primarily religious is problematic. At Knossos and Phaistos the rooms of the west wings are oriented to sunrise at the equinoxes. The more southerly orientation at Knossos is due to the mountain ridge in the east (Blomberg and Henriksson, in press). The orientation of

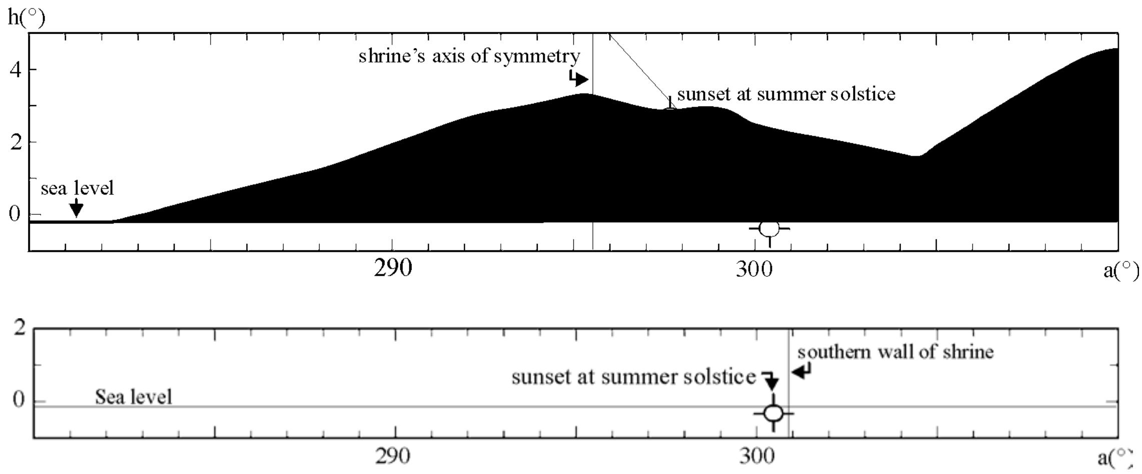

Fig. 6.4. Sunset at the summer solstice as seen from the shrines at (a) Ayia Triada and (b) Mallia. Calculated for 1350 BC when sunset would have been observed at 18:54·00 from Ayia Triada and at 19:13·40 from Mallia, local solar mean time and assuming that t = *+20°. The details provide the possibility of checking the correctness of our program.*

the rooms of the west wing at Zakros is to the southernmost point of moonrise (southern major standstill), and at Mallia it is to sunrise one month before the spring equinox and after the autumn equinox (Fig. 6.5a). If we compare the Mycenaean palatial cult rooms, the *megara* (Fig. 6.5b), there seems to be no interest in orientations to the rising or setting points of the sun or moon. This also holds true for other Mycenaean cult rooms. There may, of course, have been other reasons for Mycenaean orientations, for example significant features in the landscape, and this should be investigated.

To fill out the picture we tabulated the orientations of a representative number of graves in Crete and in the mainland. We chose to compare Late Bronze Age tombs with passages, or *dromoi*, as these were the most usual graves in both areas at the time. Also the type is argued to have originated in Crete and been taken over by the Mycenaeans (Hood 1960). The

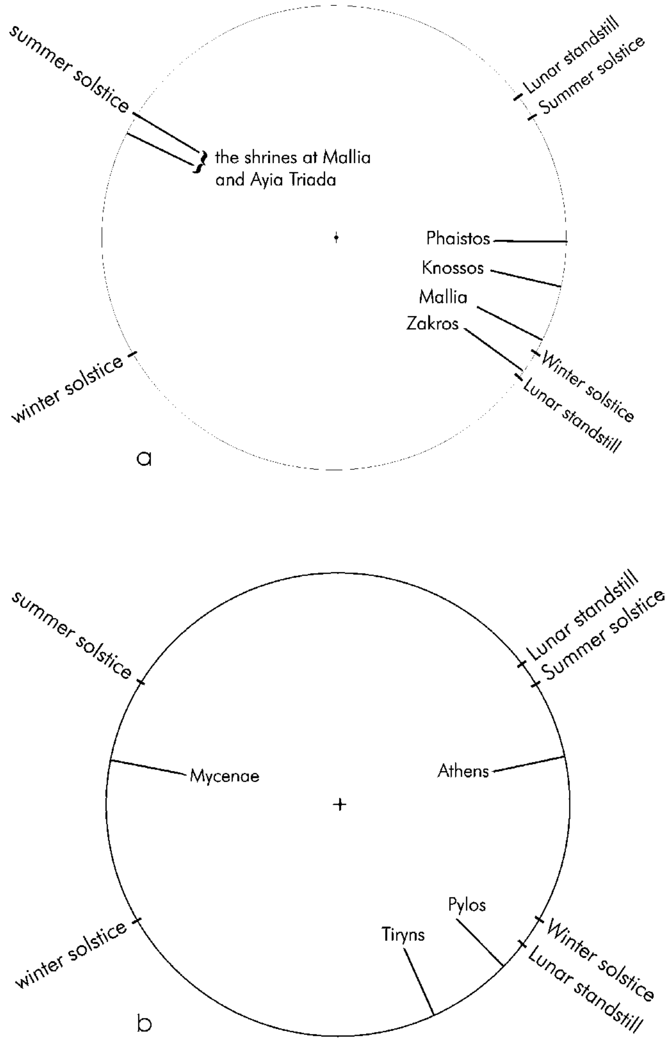

Fig. 6.5. Orientations of palatial cult rooms, (a) in Crete and (b) in the Greek mainland.

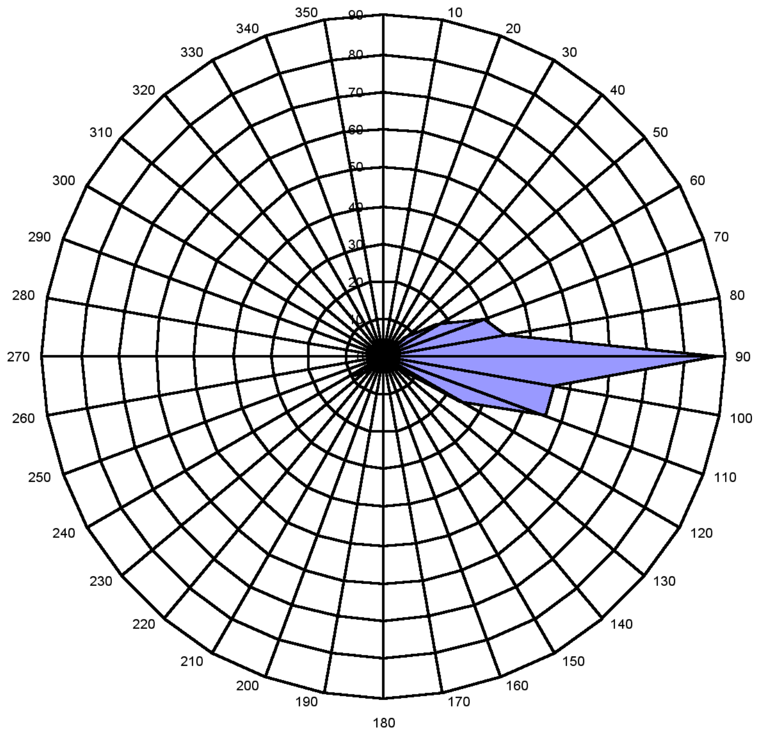

Fig. 6.6. Frequency distribution of the orientations of 323 chamber tombs with passages from 15 sites in Crete.

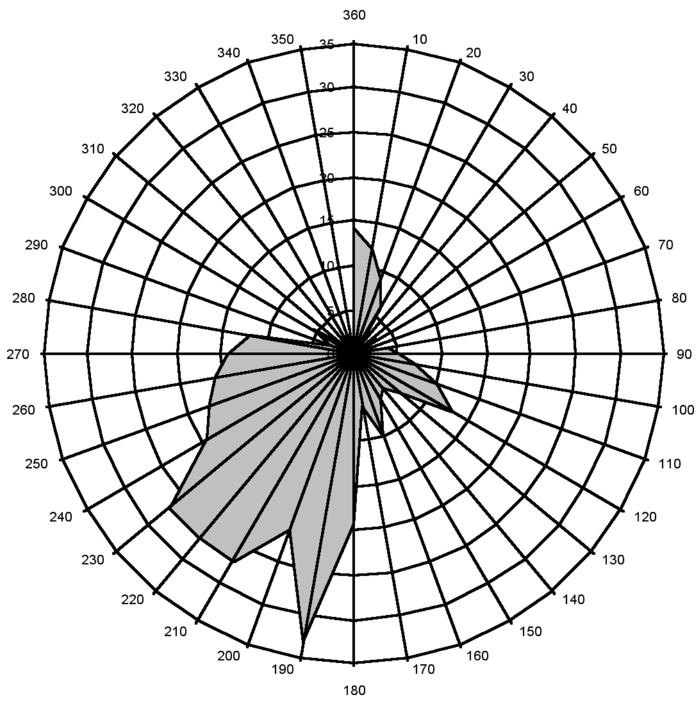

Fig. 6.7. Frequency distribution of the orientations of 372 chamber tombs with passages from 25 sites in mainland Greece.

orientations of the graves at Prosymna in the mainland and at Armenoi in Crete have been published (Blegen 1937; Papathanassiou, Hoskin and Papadopoulou 1992; 1993; Papathanassiou and Hoskin 1996), while the remainder were determined by us by measuring published plans (Blegen 1973; Bosanquet 1901–2; Bulle 1906-9; Demakopoulou 1990; Evans 1904; 1905; Forsdyke 1926–7; Frödin and Persson 1938; Heartley and Skeat 1930–1; Hood and De Jong 1952; Hood, Huxley and Sandars 1958–9; Hope Simpson 1958–9; Hutchinson 1956; Iakovidis 1980; Immerwahr 1971; Kontorli-Papadopoulou 1987; Papadopoulos 1976; Papazoglou-Manioudaki 1994; Persson 1931; 1942; Pini 1968; Popham 1974; 1980; Protonotariou-Deilaki 1990; Wace 1932; Wells 1990).

The clear preference for orientations to the east in Crete is also evident in the graves and from as early as about 2500 BC (Goodwin 1998). Eighty-seven per cent are oriented within the limits of moonrise which encompass only 20% of the circle. Especially notable is the fact that 40% of the orientations are within 10° of due east (Table 6.1; Fig. 6.6). The margin of error for 69% of these graves—those published by Papathanassiou, Hoskin and Papadopoulou (1992; 1993), and Papathanassiou and Hoskin (1996)—is less than ±1°. The margin of error for those determined by us from published plans is estimated to be less than ± 5°.

The orientations of Mycenaean graves give an entirely different pattern. We observe no consistent relationship to

TABLE 6.1. Grave orientations in Crete

No.	Site & grave designation	°	No.	Site & grave designation	°	No.	Site & grave designation	°
1	Armenoi, zone A, 1	82	47	Armenoi, zone A, 86	112	93	Armenoi, zone A, 206	65
2	Armenoi, zone A, 2	98	48	Armenoi, zone A, 87	88	94	Armenoi, zone A, 207	89
3	Armenoi, zone A, 3	56	49	Armenoi, zone A, 88	100	95	Armenoi, zone A, 208	82
4	Armenoi, zone A, 4	103	50	Armenoi, zone A, 89	92	96	Armenoi, zone A, 209	84
5	Armenoi, zone A, 25	65	51	Armenoi, zone A, 90	83	97	Armenoi, zone A, 210	89
6	Armenoi, zone A, 26	76	52	Armenoi, zone A, 91	94	98	Armenoi, zone A, 211	112
7	Armenoi, zone A, 27	81	53	Armenoi, zone A, 92	126	99	Armenoi, zone A, 212	120
8	Armenoi, zone A, 28	93	54	Armenoi, zone A, 93	123	100	Armenoi, zone A, 213	128
9	Armenoi, zone A, 29	83	55	Armenoi, zone A, 94	110	101	Armenoi, zone A, LIII	86
10	Armenoi, zone A, 30	76	56	Armenoi, zone A, 95	75	102	Armenoi, zone A, LIV	92
11	Armenoi, zone A, 31	78	57	Armenoi, zone A, 96	83	103	Armenoi, zone A, ?	95
12	Armenoi, zone A, 32	74	58	Armenoi, zone A, 98	82	104	Armenoi, zone A, ?	94
13	Armenoi, zone A, 33	72	59	Armenoi, zone A, 160	72	105	Armenoi, zone A, ?	81
14	Armenoi, zone A, 34	98	60	Armenoi, zone A, 161	72	106	Armenoi, zone A, ?	92
15	Armenoi, zone A, 35	94	61	Armenoi, zone A, 162	78	107	Armenoi, zone B, 6	101
16	Armenoi, zone A, 36	74	62	Armenoi, zone A, 163	75	108	Armenoi, zone B, 7	99
17	Armenoi, zone A, 37	68	63	Armenoi, zone A, 167	92	109	Armenoi, zone B, 8	133
18	Armenoi, zone A, 38	54	64	Armenoi, zone A, 168	70	110	Armenoi, zone B, 9	119
19	Armenoi, zone A, 39	52	65	Armenoi, zone A, 171	81	111	Armenoi, zone B, 10	115
20	Armenoi, zone A, 40	78	66	Armenoi, zone A, 172	72	112	Armenoi, zone B, 11	109
21	Armenoi, zone A, 41	84	67	Armenoi, zone A, 173	76	113	Armenoi, zone B, 12	112
22	Armenoi, zone A, 42	62	68	Armenoi, zone A, 174	77	114	Armenoi, zone B, 13	104
23	Armenoi, zone A, 43	56	69	Armenoi, zone A, 175	60	115	Armenoi, zone B, 14	98
24	Armenoi, zone A, 44	64	70	Armenoi, zone A, 176	78	116	Armenoi, zone B, 15	122
25	Armenoi, zone A, 45	64	71	Armenoi, zone A, 177	68	117	Armenoi, zone B, 16	88
26	Armenoi, zone A, 46	64	72	Armenoi, zone A, 179	69	118	Armenoi, zone B, 17	97
27	Armenoi, zone A, 47	72	73	Armenoi, zone A, 180	70	119	Armenoi, zone B, 18	99
28	Armenoi, zone A, 48	75	74	Armenoi, zone A, 181	70	120	Armenoi, zone B, 19	98
29	Armenoi, zone A, 65	81	75	Armenoi, zone A, 182	68	121	Armenoi, zone B, 20	96
30	Armenoi, zone A, 66	68	76	Armenoi, zone A, 183	83	122	Armenoi, zone B, 21	96
31	Armenoi, zone A, 67	88	77	Armenoi, zone A, 185	78	123	Armenoi, zone B, 22	96
32	Armenoi, zone A, 68	90	78	Armenoi, zone A, 186	95	124	Armenoi, zone B, 24	92
33	Armenoi, zone A, 69	90	79	Armenoi, zone A, 187	93	125	Armenoi, zone B, 49	100
34	Armenoi, zone A, 70	92	80	Armenoi, zone A, 189	109	126	Armenoi, zone B, 51	105
35	Armenoi, zone A, 71	82	81	Armenoi, zone A, 190	58	127	Armenoi, zone B, 52	102
36	Armenoi, zone A, 72	86	82	Armenoi, zone A, 191	58	128	Armenoi, zone B, 53	110
37	Armenoi, zone A, 73	100	83	Armenoi, zone A, 192	84	129	Armenoi, zone B, 55	122
38	Armenoi, zone A, 74	92	84	Armenoi, zone A, 196	84	130	Armenoi, zone B, 57	106
39	Armenoi, zone A, 75	101	85	Armenoi, zone A, 198	68	131	Armenoi, zone B, 63	113
40	Armenoi, zone A, 76	72	86	Armenoi, zone A, 199	66	132	Armenoi, zone B, 64	122
41	Armenoi, zone A, 77	72	87	Armenoi, zone A, 200	106	133	Armenoi, zone B, 81	92
42	Armenoi, zone A, 78	76	88	Armenoi, zone A, 201	102	134	Armenoi, zone B, 82	95
43	Armenoi, zone A, 79	74	89	Armenoi, zone A, 202	92	135	Armenoi, zone B, 83	92
44	Armenoi, zone A, 80	58	90	Armenoi, zone A, 203	93	136	Armenoi, zone B, 131	99
45	Armenoi, zone A, 84	89	91	Armenoi, zone A, 204	85	137	Armenoi, zone B, 132	118
46	Armenoi, zone A, 85	96	92	Armenoi, zone A, 205	88	138	Armenoi, zone B, 139	98

TABLE 6.1. Grave orientations in Crete [continued]

No.	Site & grave designation	°	No.	Site & grave designation	°	No.	Site & grave designation	°
139	Armenoi, zone B, 140	92	185	Armenoi, zone C, 120	120	231	Zafer Papoura 14	120
140	Armenoi, zone B, 141	108	186	Armenoi, zone C, 121	114	232	Zafer Papoura 15	102
141	Armenoi, zone B, 142	102	187	Armenoi, zone C, 122	104	233	Zafer Papoura 16	96
142	Armenoi, zone B, 143	114	188	Armenoi, zone C, 123	112	234	Zafer Papoura 17	95
143	Armenoi, zone B, 157	122	189	Armenoi, zone C, 124	113	235	Zafer Papoura 18	95
144	Armenoi, zone B, 158	116	190	Armenoi, zone C, 125	122	236	Zafer Papoura 19	96
145	Armenoi, zone B, 159	112	191	Armenoi, zone C, 126	99	237	Zafer Papoura 20	95
146	Armenoi, zone B, 164	112	192	Armenoi, zone C, 127	114	238	Zafer Papoura 21	96
147	Armenoi, zone B, 165	102	193	Armenoi, zone C, 128	101	239	Zafer Papoura 22	95
148	Armenoi, zone B, 169	96	194	Armenoi, zone C, 129	122	240	Zafer Papoura 29	94
149	Armenoi, zone B, 170	89	195	Armenoi, zone C, 130	100	241	Zafer Papoura 32	98
150	Armenoi, zone B, 193	106	196	Armenoi, zone C, 133	114	242	Zafer Papoura 35	113
151	Armenoi, zone B, 194	119	197	Armenoi, zone C, 134	100	243	Zafer Papoura 39	93
152	Armenoi, zone B, 197	117	198	Armenoi, zone C, 135	92	244	Zafer Papoura 40	95
153	Armenoi, zone B, ?	102	199	Armenoi, zone C, 136	92	245	Zafer Papoura 49	100
154	Armenoi, zone B, ?	124	200	Armenoi, zone C, 137	124	246	Zafer Papoura 50	97
155	Armenoi, zone B, ?	107	201	Armenoi, zone C, 138	122	247	Zafer Papoura 52	100
156	Armenoi, zone C, 23	108	202	Armenoi, zone C, 144	130	248	Zafer Papoura 53	99
157	Armenoi, zone C, 50	98	203	Armenoi, zone C, 145	128	249	Zafer Papoura 54	99
158	Armenoi, zone C, 54	107	204	Armenoi, zone C, 146	102	250	Zafer Papoura 56	96
159	Armenoi, zone C, 56	118	205	Armenoi, zone C, 147	118	251	Zafer Papoura 69	115
160	Armenoi, zone C, 58	120	206	Armenoi, zone C, 148	98	252	Zafer Papoura 80	95
161	Armenoi, zone C, 59	128	207	Armenoi, zone C, 149	92	253	Zafer Papoura 81	96
162	Armenoi, zone C, 60	101	208	Armenoi, zone C, 150	103	254	Zafer Papoura 82	92
163	Armenoi, zone C, 61	112	209	Armenoi, zone C, 151	102	255	Zafer Papoura 84	105
164	Armenoi, zone C, 62	118	210	Armenoi, zone C, 152	97	256	Zafer Papoura 85	95
165	Armenoi, zone C, 100	118	211	Armenoi, zone C, 153	97	257	Zafer Papoura 86	94
166	Armenoi, zone C, 101	124	212	Armenoi, zone C, 154	83	258	Zafer Papoura 89	95
167	Armenoi, zone C, 102	108	213	Armenoi, zone C, 155	115	259	Zafer Papoura 90	94
168	Armenoi, zone C, 103	112	214	Armenoi, zone C, 156	113	260	Zafer Papoura 93	98
169	Armenoi, zone C, 104	113	215	Armenoi, zone C, 214	106	261	Zafer Papoura 94	97
170	Armenoi, zone C, 105	93	216	Armenoi, zone C, 215	118	262	Zafer Papoura 95	92
171	Armenoi, zone C, 106	110	217	Armenoi, zone C, 216	126	263	Zafer Papoura 96	98
172	Armenoi, zone C, 107	82	218	Armenoi, zone C, 217	129	264	Zafer Papoura 97	118
173	Armenoi, zone C, 108	96	219	Armenoi, zone C, 218	132	265	Zafer Papoura 98	94
174	Armenoi, zone C, 109	117	220	Armenoi, zone C, 219	135	266	Zafer Papoura 99	96
175	Armenoi, zone C, 110	112	221	Armenoi, zone C, 220	118	267	Zafer Papoura 100	139
176	Armenoi, zone C, 111	116	222	Armenoi, zone C, I	110	268	Knossos, Temple Tomb	84
177	Armenoi, zone C, 112	112	223	Armenoi, zone C, LI	106	269	Mavro Spelio 1	241
178	Armenoi, zone C, 113	115	224	Armenoi, zone C, ?	94	270	Mavro Spelio 3	239
179	Armenoi, zone C, 114	118	225	Zafer Papoura 8	110	271	Mavro Spelio 4	244
180	Armenoi, zone C, 115	114	226	Zafer Papoura 9	99	272	Mavro Spelio 6	238
181	Armenoi, zone C, 116	109	227	Zafer Papoura 10	72	273	Mavro Spelio 7	242
182	Armenoi, zone C, 117	113	228	Zafer Papoura 11	97	274	Mavro Spelio 9	208
183	Armenoi, zone C, 118	126	229	Zafer Papoura 12	106	275	Mavro Spelio 12	248
184	Armenoi, zone C, 119	101	230	Zafer Papoura 13	96	276	Mavro Spelio 13	232

TABLE 6.1. Grave orientations in Crete [continued]

No.	Site & grave designation	°	No.	Site & grave designation	°	No.	Site & grave designation	°
277	Mavro Spelio 14	271	293	Gypsades 15	25	309	Knossos, Isopata 5	104
278	Mavro Spelio 15	236	294	Lower Gypsades	257	310	Knossos, Isopata 6	91
279	Mavro Spelio 16	231	295	Knossos, hospital site, 1	125	311	Phaistos 4	92
280	Mavro Spelio 18	262	296	Knossos, hospital site, 3	114	312	Phaistos 5	106
281	Mavro Spelio 19	248	297	Knossos, hospital site, 5	89	313	Phaistos 6	106
282	Mavro Spelio 21	224	298	Knossos, Sellopoulo, 3	243	314	Phaistos 7	90
283	Mavro Spelio 22	243	299	Knossos, Sellopoulo, 4	243	315	Phaistos 9	95
284	Gypsades 1	91	300	Knossos, Ay. Ioannis	249	316	Phaistos 10	92
285	Gypsades 3	68	301	Knossos, Kephala	239	317	Phaistos 11	92
286	Gypsades 4	87	302	Knossos, W. of Temple Tomb	331	318	Phaistos 12	100
287	Gypsades 5	92	303	Knossos, Isopata ?	67	319	Phaistos 13	107
288	Gypsades 6	49	304	Knossos, Isopata ?	10	320	Phaistos ?	96
289	Gypsades 7	29	305	Knossos, Isopata ?	101	321	Chrysolakkos	82
290	Gypsades 8	359	306	Knossos, Isopata 2	357	322	Palaikastro	190
291	Gypsades 9	91	307	Knossos, Isopata 3	6	323	Archanes tholos A	78
292	Gypsades 10	53	308	Knossos, Isopata 4	1			

TABLE 6.2. Grave orientations in Mainland Greece

No.	Site & grave designation	°	No.	Site & grave designation	°	No.	Site & grave designation	°
1	Mycenae «Clytemnestra» grave	168	24	Mycenae 517, Kalkani	358	47	Dendra 5	240
2	Mycenae Grave circle A	259	25	Mycenae 518, Kalkani	10	48	Dendra 6	249
3	Mycenae C-T grave	115	26	Mycenae 519, Kalkani	7	49	Dendra 7	248
4	*Atreus* grave	101	27	Mycenae 520, Kalkani	282	50	Dendra 8	251
5	Mycenae 1	285	28	Mycenae 521, Kalkani	248	51	Dendra 9	226
6	Mycenae 2	195	29	Mycenae 522, Kalkani	217	52	Dendra 10	247
7	Mycenae 3	200	30	Mycenae 523, Kalkani	199	53	Dendra 11	238
8	Mycenae 4	259	31	Mycenae 524, Kalkani	217	54	Dendra12, *Cuirass tomb*	255
9	Mycenae 5	276	32	Mycenae 525, Kalkani	17	55	Dendra 13	240
10	Mycenae 6	338	33	Mycenae 526, Kalkani	13	56	Dendra 14	231
11	Mycenae 7	307	34	Mycenae 527, Kalkani	2	57	Dendra 15	262
12	Mycenae 8	77	35	Mycenae 528, Kalkani	7	58	Dendra 16	256
13	Mycenae 9	174	36	Mycenae 529, Kalkani	14	59	Dendra Tholos	256
14	Mycenae *Fig tree tomb*	104	37	Mycenae 530, Kalkani	2	60	Pylos tholos III	233
15	Mycenae ?	114	38	Mycenae 531, Kalkani	224	61	Pylos tholos IV	227
16	Mycenae 102	102	39	Mycenae 532, Kalkani	15	62	Pylos E-4	178
17	Mycenae 502	116	40	Mycenae 533, Kalkani	4	63	Pylos E-6	170
18	Mycenae 504	97	41	Mycenae ? Kalkani	217	64	Pylos E-8	182
19	Mycenae 505	90	42	Mycenae ?, Kalkani	221	65	Pylos E-9	178
20	Mycenae 513, Kalkani	341	43	Dendra 1	258	66	Pylos E-10	181
21	Mycenae 514, Kalkani	16	44	Dendra 2	263	67	Pylos K-1	193
22	Mycenae 515, Kalkani	5	45	Dendra 3	260	68	Pylos K-2	269
23	Mycenae 516, Kalkani	1	46	Dendra 4	259	69	Asine 1, north-east	13

TABLE 6.2. Grave orientations in Mainland Greece [continued]

No.	Site & grave designation	°	No.	Site & grave designation	°	No.	Site & grave designation	°
70	Asine 1, east	54	116	Prosymna XL	65	162	Athens, Agora 21	35
71	Asine 2	35	117	Prosymna XLI	266	163	Athens, Agora 23	304
72	Asine 3	47	118	Prosymna XLII	246	164	Athens, Agora 24	10
73	Asine 5	61	119	Prosymna XLIII	126	165	Athens, Agora 40	246
74	Asine 6	40	120	Prosymna XLIV	237	166	Perati 1	274
75	Asine 7	53	121	Prosymna XLV	262	167	Perati 2	252
76	Asine II:1	9	122	Prosymna XLVI	276	168	Perati 3	250
77	Prosymna I	240	123	Prosymna XLVII	220	169	Perati 4	265
78	Prosymna II	124	124	Prosymna XLVIII	263	170	Perati 5	237
79	Prosymna III	129	125	Prosymna XLIX	266	171	Perati 10	238
80	Prosymna IV	136	126	Prosymna L	204	172	Perati 12	193
81	Prosymna V	288	127	Prosymna LI	196	173	Perati 13	198
82	Prosymna VI	304	128	Prosymna LII	188	174	Perati 14	248
83	Prosymna VII	326	129	Prosymna WI	228	175	Perati 15	244
84	Prosymna VIII	304	130	Prosymna WII	267	176	Perati 16	241
85	Prosymna IX	284	131	Kokla I	113	177	Perati 17	263
86	Prosymna X	213	132	Kokla VIII	98	178	Perati 18	182
87	Prosymna XI	247	133	Kokla IX	110	179	Perati 19	247
88	Prosymna XII	260	134	Kokla VII	137	180	Perati 20	250
89	Prosymna XIII	128	135	Kokla VI	129	181	Perati 21	241
90	Prosymna XIV	316	136	Kokla V	117	182	Perati 23	227
91	Prosymna XV	315	137	Kokla IV	103	183	Perati 25	230
92	Prosymna XVI	231	138	Kokla II	112	184	Perati 26	198
93	Prosymna XVII	253	139	Aigion A	12	185	Perati 27	197
94	Prosymna XVIII	279	140	Aigion 1	22	186	Perati 31	204
95	Prosymna XIX	286	141	Aigion 2	31	187	Perati 33	212
96	Prosymna XX	282	142	Aigion 3	22	188	Perati 36	219
97	Prosymna XXI	285	143	Aigion 4	13	189	Perati 39	217
98	Prosymna XXII	270	144	Aigion 5	32	190	Perati 42	280
99	Prosymna XXIII	229	145	Aigion 5a	347	191	Perati 43	359
100	Prosymna XXIV	242	146	Aigion 5b	23	192	Perati 46	226
101	Prosymna XXV	231	147	Aigion 6	30	193	Perati 47	217
102	Prosymna XXVI	225	148	Aigion 7	19	194	Perati 48	276
103	Prosymna XXVII	239	149	Aigion 8	22	195	Perati 49	273
104	Prosymna XXVIII	214	150	Athens, Agora 1	20	196	Perati 50	274
105	Prosymna XXIX	155	151	Athens, Agora 3	25	197	Perati 51	227
106	Prosymna XXX	240	152	Athens, Agora 4	16	198	Perati 52	200
107	Prosymna XXXI	225	153	Athens, Agora 5	118	199	Perati 53	195
108	Prosymna XXXII	223	154	Athens, Agora 7	283	200	Perati 55	224
109	Prosymna XXXIII	219	155	Athens, Agora 8	88	201	Perati 57	308
110	Prosymna XXXIV	222	156	Athens, Agora 12	7	202	Perati 64	130
111	Prosymna XXXV	194	157	Athens, Agora 13	14	203	Perati 65	128
112	Prosymna XXXVI	196	158	Athens, Agora 14	1	204	Perati 66	195
113	Prosymna XXXVII	103	159	Athens, Agora 15	28	205	Perati 67	185
114	Prosymna XXXVIII	96	160	Athens, Agora 18	59	206	Perati 68	164
115	Prosymna XXXIX	86	161	Athens, Agora 20	1	207	Perati 74	104

TABLE 6.2. Grave orientations in Mainland Greece [continued]

No.	Site & grave designation	°	No.	Site & grave designation	°	No.	Site & grave designation	°
208	Perati 75	93	254	Perati 132	227	301	Perati Σ 25	198
209	Perati 76	97	255	Perati 133	223	302	Perati Σ 26	209
210	Perati 77	125	256	Perati 134	203	303	Perati Σ 27	163
211	Perati 78	209	257	Perati 135	212	304	Perati Σ 28	181
212	Perati 87	273	258	Perati 136	209	305	Perati Σ 29	147
213	Perati 88	283	259	Perati 137	210	306	Perati Σ 30	174
214	Perati 89	275	260	Perati 139	220	307	Perati Σ 31	129
215	Perati 90	146	261	Perati 140	207	308	Perati Σ 32	114
216	Perati 91	127	262	Perati 141	191	309	Perati Σ 33	199
217	Perati 92	134	263	Perati 142	205	310	Perati Σ 34	180
218	Perati 93	188	264	Perati 143	221	311	Perati Σ 35	115
219	Perati 96	155	265	Perati 144	208	312	Perati Σ 36	132
220	Perati 97	158	266	Perati 145	198	313	Perati Σ 37	122
221	Perati 99	82	267	Perati 146	203	314	Perati Σ 38	193
222	Perati 100	134	268	Perati 147	240	315	Perati Σ 39	198
223	Perati 102	238	269	Perati 148	198	316	Perati Σ 40	186
224	Perati 103	246	270	Perati 149	220	317	Perati Σ 41	193
225	Perati 104	244	271	Perati 150	196	318	Perati Σ 43	251
226	Perati 105	217	272	Perati 151	191	319	Perati Σ 44	137
227	Perati 106	226	273	Perati 152	205	320	Perati Σ 46	200
228	Perati 107	208	274	Perati 153	203	321	Perati Σ 47	223
229	Perati 108	211	275	Perati 154	199	322	Perati Σ 48	189
230	Perati 109	185	276	Perati 155	216	323	Perati Σ 49	187
231	Perati 110	212	277	Perati 156	194	334	Perati Σ 50	258
232	Perati 111	193	278	Perati 157	192	325	Perati Σ 51	269
233	Perati 112	191	279	Perati Σ 1	221	326	Perati Σ 52	237
234	Perati 113	170	280	Perati Σ 2	257	327	Perati Σ 53	236
235	Perati 114	215	281	Perati Σ 3	239	328	Perati Σ 55	212
236	Perati 115	280	282	Perati Σ 4	263	329	Perati Σ 55	238
237	Perati 116	277	283	Perati Σ 5	239	330	Perati Σ 56	235
238	Perati 117	297	284	Perati Σ 6	118	331	Perati Σ 57	238
239	Perati 118	257	285	Perati Σ 7	141	332	Perati Σ 58	183
240	Perati 119	271	286	Perati Σ 8	213	333	Perati Σ 59	238
241	Perati 120	284	287	Perati Σ 9	190	334	Perati Σ 60	271
242	Perati 121	264	289	Perati Σ 10	164	335	Various, Attika, Vrana 10C	200
243	Perati 122	234	290	Perati Σ 11	210	336	Sparta, Arkines A	128
244	Perati 123	236	291	Perati Σ 12	209	337	Sparta, Arkines B	35
245	Perati 124	236	292	Perati Σ 13	154	338	Nichoria 3	241
246	Perati 125	229	293	Perati Σ 14	195	339	Nichoria 4	206
247	Perati 126	217	294	Perati Σ 15	166	340	Messenia, Routsi, tholos 1	331
248	Perati 127	226	295	Perati Σ 15	169	341	Messenia, Routsi, tholos 2	320
249	Perati 128	221	296	Perati Σ 16	190	342	Messenia, Tourliditsa	157
250	Perati 129	246	297	Perati Σ 18	191	343	Triphylia, tholos 1	207
251	Perati 130	239	298	Perati Σ 22	184	344	Triphylia, tholos 2	179
252	Perati 131a	226	299	Perati Σ 23	190	345	Triphylia, Kopanaki tholos	203
253	Perati 131b	218	300	Perati Σ 24	206	346	Triphylia, Malthi, tholos 1	291

TABLE 6.2. Grave orientations in Mainland Greece [continued]

No.	Site & grave designation	°	No.	Site & grave designation	°	No.	Site & grave designation	°
347	Triphylia, Malthi, tholos 2	282	356	Marmariane 4	161	365	Nemesis	133
348	Triphylia, Vassiliko	121	357	Marmariane 6	223	366	Thorikos B	185
349	Triphylia, Kakovatos A	164	358	Orchomenos tholos	158	367	Phocis, Medeon A1	266
350	Triphylia, Kakovatos B	211	359	Volimidhia A8	181	368	Phocis, Medeon T239	227
351	Triphylia, Kakovatos C	215	360	Keph. Kontogenadas A	215	369	Dimini B	296
352	Krini (Patras) 3	290	361	Kallithea 0	262	370	Thessaly, Pteleon A	145
353	Marmariane 1	208	362	Epidauros-Limera A	1	371	Thessaly, Pteleon C	142
354	Marmariane 2	190	363	Keph. Metaxata Ad	29	372	Thessaly, Pteleon E	255
355	Marmariane 3	214	364	Keph. Metaxata Ad	21			

the positions of the sun or moon. The orientations of only 11% lie within the limits for moonrise, and 42% within the limits for both moonrise and moonset. If there is any preference, it seems to be for the south-west quadrant where 56% of the orientations lie (Table 6.2; Fig. 6.7). The margin of error for 15% of the graves—those published by Blegen (1937)—is less than ±1°. As in the case of the graves in Crete, the margin of error for those determined by us from published plans is estimated to be less than ±5°.

Most of the chamber tombs in Crete are, in fact, from the period of the Mycenaean domination. Only a few of them, however, have been identified as belonging to Mycenaeans and this has been done on the basis of the relatively large amounts of weaponry and armour. These are the so-called *Warrior Graves* near Knossos and their orientations all lie within the limits of sunrise (Hood and De Jong 1952). As for the other graves in the Knossos area, it has not been possible to distinguish them as belonging either to Mycenaeans or to Minoans since the two cultures had become materially almost indistinguishable. There remained differences in religious values however, as indicated by the orientations. The Minoan pattern of relationships between the cosmos and their cult rooms and tombs remained unchanged. The Mycenaeans had no discernible influence on orientations in Crete. They seem instead to have adopted those of the Minoans for their own graves. On the mainland, on the other hand, they did not alter the pattern of orientations for their graves.

Origins of the Greek temple

The Mallia shrine has been related to the Greek temple in its early form, the so-called temple *in antis*, which is said to derive from the Mycenaean megaron (Pelon 1997, 343; Dinsmoor 1950, 20–1). The alleged similarity to Mycenaean architecture was based on two arguments: the shrine was built after the Mycenaeans were politically dominant in Crete and it was said to be similar to the Mycenaean megaron, when in fact it shows little similarity. The resemblance to the early Greek temple is also superficial, consisting merely of a room preceded by a porch. The shrine at Ayia Triada, with its axial symmetry, vestibule and symmetrically placed doors, shows a greater similarity to the megaron form, but since it was long considered to have been built in Late Minoan I, before the Mycenaean hegemony, the similarity was never noted (Banti 1941–3, 40–2).

The megaron is regarded as having been the political and religious centre of the Mycenaean palace and having derived from earlier mainland houses of the Middle Bronze Age (Taylour 1983, 83), but the similarities cited are general. There is also an unaccountable lapse of time as all surviving examples are late—after about 1300 BC—and all are very much alike. They show strict axial symmetry: there is a large room, the megaron proper, with one or more entrance doors and a central hearth surrounded by four columns, an anteroom or vestibule, a porch with roof supported by side walls, and columns symmetrically placed with respect to the door or doors (Taylour 1983, figs 75 and 80). There is better reason to consider the megaron to be another example of the Versailles effect, as in the case of the graves with passages; the axial symmetry and the porch with columns and side walls before the main room is found in Minoan houses as early as 1600 BC (Graham 1987, fig. 31,2).

We propose that, rather than being derived from the Mycenaean megaron, the form of the small shrines at Mallia and Ayia Triada was an independent development from the Minoan pattern for ceremonial rooms and that this occurred at about the same time that the pattern was also being developed in the mainland into the megaron system of the Mycenaean palaces. We also propose that these shrines were independently the prototypes of the later Archaic Greek temple which developed into the canonical peripteral temple of the Classical Period. The typical Archaic Greek temple consisted of the main room with a door on the axis, a porch with side walls, and symmetrical columns. Some examples had a row of piers or columns down the centre of the room to support the roof. The orientation is usually to the east, within the limits of sunrise. The hearth surrounded by columns, one of the most characteristic features of the Mycenaean megaron, is extremely rare in temples.

The most significant new feature of the two small shrines is that they are the first completely detached buildings *in settlements* devoted to religion and thus are in fact the earliest true temples both in Crete and in the mainland. All earlier Mycenaean and Minoan cult rooms, aside from the remote mountain sanctuaries in Crete, were parts of other buildings. Because of their fine proportions and the high quality of their construction, the two shrines succeed in imparting a sense of monumentality despite their small size. They are clearly important innovations in Bronze Age architecture. It should also be noted that they were not erected on the sites of earlier sacred areas or buildings.

The unique shrines are best explained as representing the earliest attempts to satisfy new religious needs emerging from the new social, economic and political situation in Crete following the Mycenaean take-over. The acceptance on the part of the Mycenaeans of Minoan architectural techniques and cosmological ideas is similar to their adoption of Minoan grave types and orientations. This suggests that the two peoples were not destructively hostile to each other, that each was prepared to accommodate the other and that, in the pro-

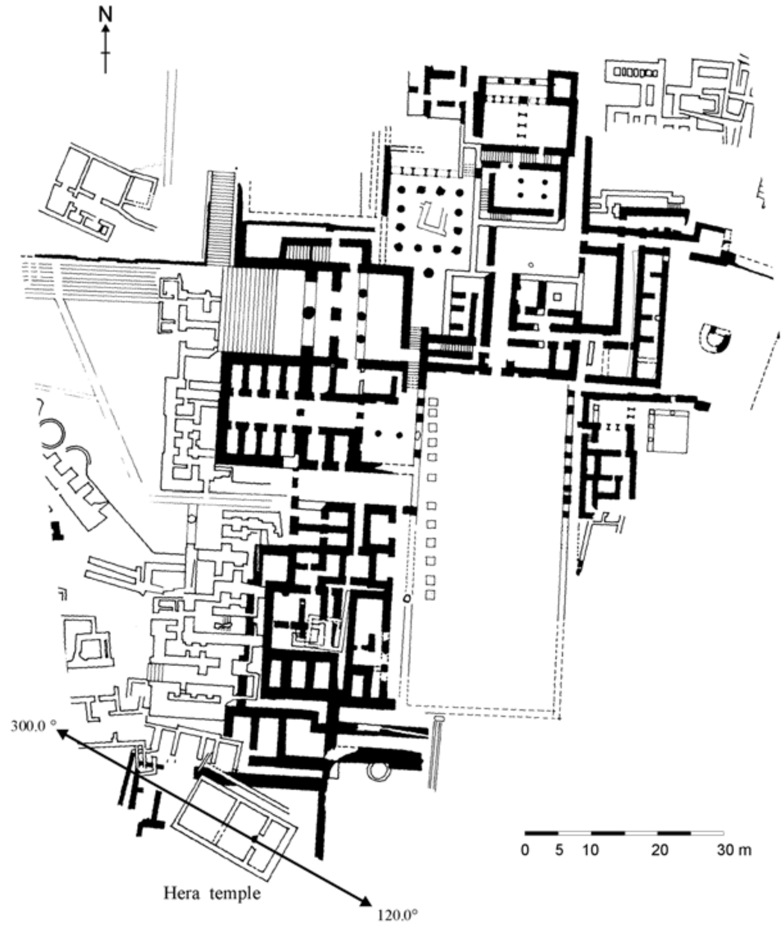

Fig. 6.8. Plan of the temple to Hera at Phaistos. Eastern orientation of the axis of symmetry = 120·0°. By permission of the editors of The Aerial Atlas of Ancient Crete.

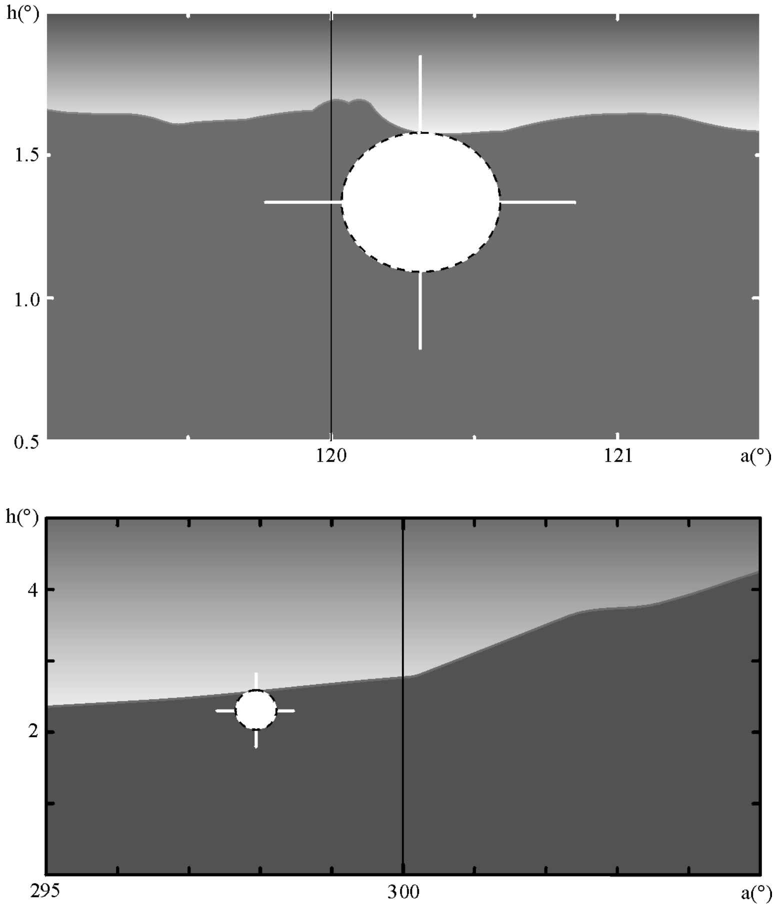

Fig. 6.9. (a) Sunrise as observed from the temple of Hera at the winter solstice, 20 Dec 900 BC at 07:23.15 local solar mean time: azimuth of the sun = 120·31°, altitude = 1·58°. (b) Sunset at the summer solstice, 22 Jun 900 BC at 18:56.45 local solar mean time: azimuth of the sun = 297·9°, altitude = 2·56°. The vertical lines correspond to the respective orientations of the axis of symmetry of the temple (120·0°/300·0°).

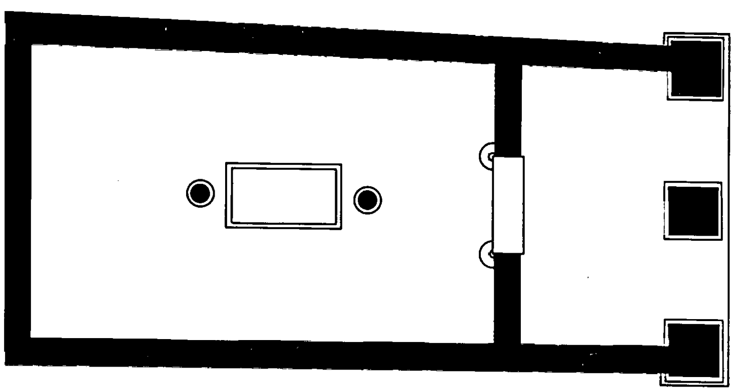

Fig. 6.10. Plan of the Archaic temple at Prinias in Crete.

cess, a new, composite culture emerged. Could the unusual orientation to the west have been a compromise acceptable to the Mycenaeans since it is the general direction of their homeland or because sunset at the summer solstice was an important date in the Mycenaean calendar?

The further development towards the Greek temple can be followed via the example at the south-west corner of the palace at Phaistos, which is just 3 km from Ayia Triada (Fig. 6.8). This is the so-called temple to Magna Mater or Hera, one of the divinities mentioned in the Linear B tablets along with a few other gods worshipped also by the Greeks. The dates of its construction are unclear; it may be no later than 900 BC (Myers, Myers and Cadogan 1992). Although the location of the entrance could not be determined, the intended orientation must have been to sunrise at the winter solstice (120·0°) where we have a distant double peak as foresight (Fig. 6.9a). Sunset at the summer solstice occurred south of the orientation of the temple due to the high close ridge in that direction (Fig. 6.9b).

A further step in the temple's development can be seen in the early Archaic example from Prinias in Crete, built about 700 BC (Fig. 6.10). Here the typical features have been established: axial symmetry, one door on the axis, a porch with side walls extended to the edge, and orientation to the east. A difference is the use of the pier instead of columns to support the roof of the porch. On the inside, two columns flank an altar used for burnt offerings. This has some similarity to the hearth and columns of the megaron but, as noted above, the inside hearth is very rare in Greek temples. Burnt offerings were usually made on an altar just outside. Small temples of this type continued to be made down into Roman times, contemporaneous with the elaborated version with surrounding colonnade which appeared towards the end of the Archaic period. Both types were usually oriented to the east, as were most Minoan religious monuments, but exceptions are more numerous, perhaps as the result of Mycenaean influence.

Our proposal of the development by the Greeks of a temple form which had it origins in the composite culture of Late Bronze Age Crete makes a lot of sense. The form arose as a solution to the new religious needs of a society struggling to accommodate two cultures. It may even have been used in the Bronze Age for gods common to both Mycenaeans and Greeks. Zeus, Hera, Ares, Artemis, and Dionysos are mentioned in the Linear B texts. Greek culture itself had been formed in a period of great change following the rapid decline of Mycenaean culture and the immigration of new Greek-speaking tribes. We know from contemporary documents that the Greeks were proud of the greatness of their Bronze Age past. The surviving legends of the warlike, heroic Mycenaeans and the wise, just Minoans were beacons in their Dark Age and they had great influence on the developing Greek culture. Greek lawgivers, for example, were inspired by the legendary Minoan kings who were believed to have received laws directly from Zeus (Plato 1942 [4th cen. BC], 624 A–B). We do not know to what extent the Greeks distinguished the Minoan culture from that of the Mycenaean. Their constellations were grounded in the mythology of both (Aratos 1989 [3rd cen. BC], 24–73). We can follow the calendar back through the Mycenaeans to the Minoans, but we do not know to what extent the Greeks were clear about its origins (Blomberg and Henriksson 1996).

Orientations of Greek temples

It is interesting to compare the orientations of Archaic and Classical Greek temples in Fig. 6.11 (based on Dinsmoor 1939, fig. 3) with Figs 6.5–6.7. Although 73% of the temples were oriented to the east within the limits of sunrise, other orientations do occur. Dinsmoor showed that the Parthenon was aligned to the point of sunrise behind Mt Hymettos on the festival day for Athena—to whom the temple was dedicated—in the year the temple was built. He argued that the Hephaisteion in Athens was oriented to sunrise on the festival day of the god Hephaistos. It was extremely important in Greek religion that the festivals of the deities be celebrated on the proper days. It is thus not surprising that a temple should have been oriented to sunrise on the festival day of its deity in the year when the temple was built. Festival days occurred in connection with specific phases of the moon. This explains the need and continued use of the Minoan luni-solar calendar by the Greeks.

We wonder to what is owed the Greek preference for eastern orientations. We have seen that there is no detectable Mycenaean interest in placing monuments in greater cosmic relationships through orientation. Any earlier need to influence Minoan practice in this respect, when the two cultures were in a sensitive period of accommodation, as may have been the case with the two small shrines, must have diminished with time. The Minoan practice of eastern orientations, on the other hand, was one expression of Minoan cosmology. The continued use of the Minoan luni-solar calendar could have been the vehicle for the survival of some of their beliefs. If it were the Greek custom to orient temples to sunrise on specific days, as Dinsmoor has shown in the case of the Parthenon, it may well have been derived from a Minoan practice. The eastern distribution of Minoan orientations is similar to that of Greek temples, except that there are fewer exceptions. It was mentioned in the study of the c. 220 orientations of the graves at Armenoi in Crete that they may have been oriented to sunrise or moonrise on a significant day (Papathanassiou, Hoskin and Papadopoulou 1992). Thus the idea could have remained in memory or even as a still-living tradition. It is possible that Mycenaean reasons for their orientations also survived and that these account for the larger percentage of Greek orientations outside the limits of sunrise.

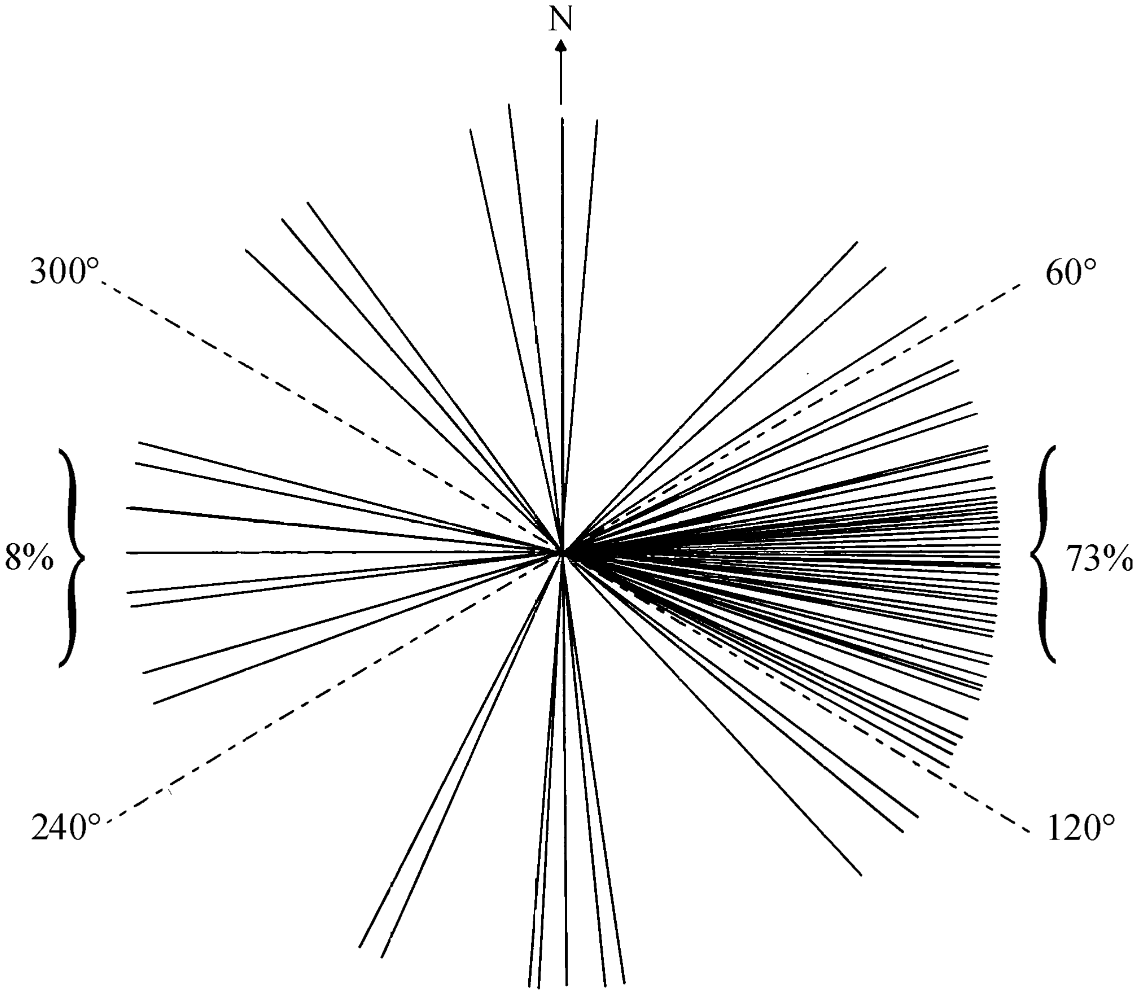

Fig. 6.11. Orientations of 110 Greek temples, after Dinsmoor (1939, fig. 3).

Note

1. The measurements of the walls of the shrines were taken with a SOKKIA SET 4C Total Station on two separate occasions, and the orientation of the co-ordinate system was obtained from timed observations of the sun, which are considered accurate to better than 0·01°. The contours of the landscape were calculated from theodolite measurements and corrections were made for parallax. With such precise measurements we can be confident that errors from this source are reduced to a minimum.

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7

Astronomy, writing and symbolism: the case of the pre-Hispanic Canary Islands

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Introduction

During the last few years, it has been demonstrated (Jiménez 1990; Esteban *et al*. 1994, 188; 1996; 1997; Perera Betancort *et al*. 1996, Barrios 1997) that astronomy played an important role in the religious and social world of the indigenous Canarian people, before the Spanish conquest and colonisation of the islands during the fifteenth century. The same can be said of their continental cousins, the proto-Berbers (see, e.g., Camps 1987, Jiménez *et al*. 1998). In an earlier paper (Belmonte *et al*. 1994), we suggested that important astronomical (or cosmological) information might be hidden in numerous short, yet still undeciphered, inscriptions produced by the ancient Canarians. According to (Marín de Cubas 1694[1986]) these

> ...contaban su año llamado Acano por las lunaciones de 29 soles desde el día que aparecía nueva, empesaban por el estío, quando el Sol entra en Cancro a 21 de Junio en adelante, la primera conjunción, y por 9 días continuos hazian grandes vailes y convites, y casamientos haviendo cojido sus sementeras, *hazian raías en tablas, pared o piedras; llamaban tara, y tarja, aquella memoria de lo que significaba...*

The fact that this single paragraph makes a connection between astronomy and what seems to be a reference to writing, seemed suggestive and appealing.

From the third or second centuries BC onwards, the ancient Canarians used a writing system (Springer Bunk 1996) which was related to the Libyan-Berber alphabets of continental north-west Africa. These closely related alphabets have formed the autochthonous method of writing of the people in north-west Africa and the Sahara, the so-called Berbers (Camps 1987), from late antiquity up to the present day (see Aghali Zakara and Drouin 1997 for a good recent review of the state of the art in this matter). However, over this long period of time, we can distinguish three very different stages and situations, reflected in three main alphabetical variants:

a) The Libyan alphabet (Ghaki 1995) in use in ancient Numidia and Mauretania from the third or second century BC to the end of the Roman era. The earliest dated inscriptions are found on a pot found, at the village of Tiddis (Algeria), inside a tomb dated to 250 ± 100 BC (Camps 1997) and in the bilingual (Libyan-Punic) monumental inscriptions at Dougga (Tunisia) dating from the second century BC. The vast majority are funereal stelae of the Roman era, including several that are bilingual Libyan-Latin (Chabot 1941; Alvarez Delgado 1964), found in the Tell region of Tunisia (Rössler 1979) through to the Atlantic Ocean (Galand 1989).

b) *The Saharan alphabet, used throughout the Sahara from the Atlantic to the Fezzan and from the Atlas Mountains to the Niger River*. Inscriptions written using the Saharan alphabet are difficult to date with precision or even to attribute to any specific human groups (de Foucauld 1920; Marcy 1937; Malhomme 1959–60). Even though some of them have been traced back to the seventh or sixth century BC (e.g. the "man" of Azib n'Ikkis—Malhomme and Galand 1960), there are no strong grounds for believing that any Saharan inscription is earlier than the Dougga bilingual ones.

c) *The "Tifinag" alphabet of central Sahara of the last two centuries*. This is still in use (de Foucauld 1952; Aghali Zakara 1993; Drouin 1995 and references therein) and is supposed to descend directly from the earlier Saharan alphabet.

To complicate the situation further, we must include in the above panorama the rock inscriptions of Kabilia (Poyto and Musso 1969), difficult in principle to attribute to any of the above groups, and the much discussed and highly controversial Libyan-Berber inscriptions of the Canary Islands (Alvarez Delgado 1964; Tejera Gaspar 1993; Springer Bunk 1994; 1996).

During its more than twenty centuries of existence, the Libyan-Berber alphabetical system has existed side by side with other alphabets such as the Punic, very likely its parental alphabet (since its creation at some time during the Roman domination), Latin (since the Roman colonisation of Africa but, perhaps, only since much later in the Canaries) and Arabic (from the seventh century onwards and today among the Tuareg).

In a recent paper (Belmonte *et al*. 1998) we have shown that Canarian inscriptions (see Fig. 7.1) were most likely related to the ancient Libyan alphabet of what was the ancient Kingdom of Numidia (Chabot 1941), than to other (mainly Saharan) Libyan-Berber alphabets of greater geographical

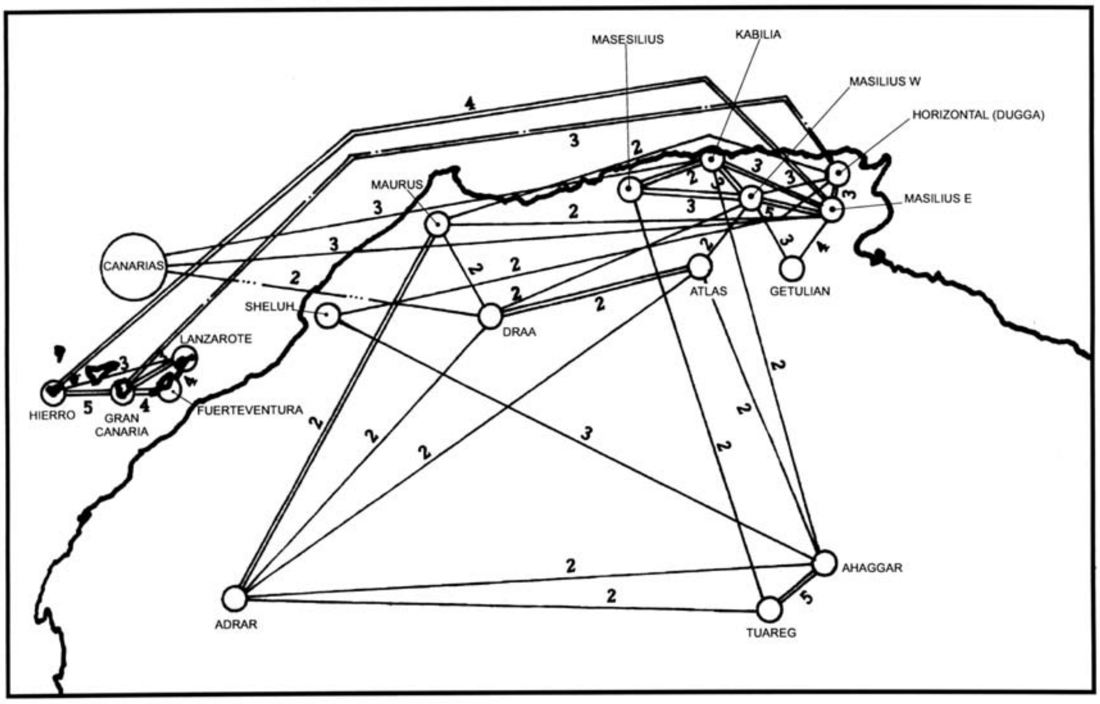

Fig. 7.1. The "degree of affinity" between Libyan-Berber inscriptions from different regions in north-west Africa. It ranges from 0 (equality in 50% of the signs) to 5 (almost total equality). A double line indicates that the relationship is stronger (Belmonte et al. *1998). The dotted line is used where the Bentaiga (Gran Canaria) inscription (with the sign]]) is involved. The triple-dotted line is used where the single ••• sign, existing at Zonzamas (Lanzarote), is considered. Note the close relationship between the different "Numidian", "Saharan" and "Canarian" groups of inscriptions. Apparently, western, "Canarian" inscriptions are more closely related to eastern, "Numidian" than to "Saharan" ones, as was previously believed. It is clear from the diagram that most close relationships result from geographical proximity, the Maurus and Canarian scripts being an important exception. The relationship between Sheluh and Tuareg New-Tifinag writings and "Libyan" is due to the recent artificial incorporation into these alphabets of signs that had already been lost in classical Tifinag (Ahaggar, Adrar). The small degree of affinity (2) between most of the "Saharan" inscriptions suggests that they were near cousins, with a common ancestor (possibly "Numidian", Maurus, or both), rather than a single "alphabet" with local variants. In our opinion, this supports the idea that the Libyan-Berber writing system was developed in Numidia, under Punic inspiration, at some time near the creation of the kingdom, rather than in other areas (Sahara, Atlas, etc.) as had been suggested previously.*

Latin	As in ...	**Western**	**Eastern**	Masilius	Pichler (1996)
A,U,I	**O**h! (glotal stop)	•	•	•	?
B	**b**oat	⊙	⊙	⊙	B (also ⊕)
Z	pri**z**e	I	I	–	S4
D	**d**ate	⊃ ⊂	⊃ ⊂	⊃ ⊂	D
F	**f**og	(∝ ⊄) [2]	(∝)	(∝ ⊄)	F
G	**g**ame	⌈ ∧ ∩	∧	⌈ ∧	G/K2
H or ‘	**A**h! (laringal vowel)	III	III •••[3]	III	â
K	ca**k**e	(≥ ⊇)	(≥)	(≥) ⇑	G/K1
L	**l**ake	=	=	=	L
J	**J**ohn	H (H)	H (H)	H (H) (⧺)	S1
M	**m**ad	∪	∪	∪	M G/K2*
N	**n**o	–	–	I	N
R	**r**ose	**O**	**O**	**O**	R
S	**s**ing	8 ∞ θ	8 ∞	8 ∞ θ	S3
Š	**sh**ip	w	w	w	S5
S’	**s**un	⊥ (⊥)	⊥ (⊥)	⊥ (⊥)	S6
T	**t**ime	+ ×	+ ×	+ ×	T
W	**w**ait	II	II	II	W
Y	**y**ou	~ (Z)	~ (Z)	~ (~) Z (Z)	Y
Z’	**th**rough	(∃) (E) ↓	(∃) (E)	(∃) (E)	S5 equal to w
?	Q or same as III	≡	≡	≡	No difference III
?	T’ or H or â	IIII	IIII	IIII	Not mentioned
Signs	**Individual**	**22**	**22**	**22**	
TR	**tr**agic	⊕	⊕		B
WT	**out**	I+I	I+I		Not mentioned
YE	**ye**s	∿∿			Not mentioned
S’R	*I**sr**ael*	⊖[1]			Not mentioned
WR	***ur**gent*	⦶[1]			Not mentioned
Total	(with ligatures)	27	24		

TABLE 7.1. Proposal for Libyan-Berber alphabets of the Canaries (in vertical lines). The last five rows signify peculiar Canarian signs, not found in Numidian Masilius, which are largely discussed in the text. See also Belmonte et al. *(1998) for further details.*

NOTES

1 Problematic signs. See Fig. 7.4.

2 In brackets, sign rotated 90° in vertical text.

3 Unusual sign. It appears only once, in Lanzarote.

proximity. This possibility opens up new opportunties for the study of the Canarian inscriptions, allowing us to propose a preliminary classification of the symbols used. In Table 7.1 we show that two related “alphabets”, Western Canarian and Eastern Canarian, or Maho, were apparently in use on the islands in pre-Hispanic times. The former, used in El Hierro and Gran Canaria, is possibly the oldest and is apparently related to the alphabets in use in ancient Numidia from the second century BC to the second century AD, particularly the Numidian Masilius (see Fig. 7.1). The Maho alphabet was used in Fuerteventura and Lanzarote, presumably contemporaneously with the Latin-Canarian inscriptions on both islands (León Hernández and Perera Betancort 1995; Springer Bunk

1996; Pichler 1995; 1996). It was possibly also used in some inscriptions at Hoya de Toledo in Gran Canaria.

However, not all the symbols that are found in the Canaries are present in the standard Numidian alphabets. Some of them are found on the continent (in Algerian Kabilia, for example); others are peculiar to the islands. The last few rows of Table 7.1 show these special symbols. Belmonte *et al.* (1998) proposed several different interpretations of these symbols, one of them based on the existence of "ligatures" (i.e. bi-consonant signs) in Tifinag (Galand 1997). For instance, we can speculate that the sign ┼┼ could be considered as a single sign denoting a strong **S** (**S′**) or **Z** (**Z′**), as some scholars have suggested, or, as in Tifinag, a ligature of **=** and **+** in horizontal lines. Then again, considering that Canarian is normally a vertical script, it could be a ligature of **II** and **+** (the letters **WT**) or *vice versa*. Following the same line of argument, ⊕ could be the letter "B" (as is the case in Eastern Canarian), but also the ligature **O +**, i.e. **RT** as in Tifinag, where it stands for *d wR Tanna*, meaning "do not talk!". However, this association with a possible taboo suggests that "ligatures" are hiding something relevant, beyond our present-day scope, and for this reason we believe that ⊕ might be read **+ O**, i.e. **TR**, with intriguing implications (see below).

Landscape, astronomy, rock art and writing

Although inscriptions are very frequent in El Hierro and also abundant in Gran Canaria, Fuerteventura and Lanzarote, they are extremely rare in La Palma, Tenerife and La Gomera. Moreover, the places where inscriptions are found are often exceptional in one way or another. Some of them, such as El Julan in El Hierro and Balos in Gran Canaria, are found at marvellous rock art locations, where gravures of different forms and techniques are found. Some of these engravings resemble the alphabetical symbols, but they are usually much larger and are also found in isolation (see Fig. 7.2).

*FIG. 7.2. Rock art at El Julan (El Hierro). To the left, there are some clear alphabetical symbols, reading **MSF** (bottom to top) or **FSM**. However, most of the "inscription" is formed by various symbols (**θ**, **⊕**, **≡**, etc.) of different sizes and shapes, located apparently chaotically.*

Several inscriptions are found at the top of mountains or rocky outcrops with a clear view of the horizon. In many of these places—examples being Roque Bentayga (Gran Canaria) and Cambados (the only inscription in Tenerife)—we have found astronomical associations. Until now, the vast majority of inscriptions have been found in places of probable cultic or religious significance, so the idea that the inscriptions relate to indigenous beliefs becomes, in our opinion, something more than mere speculation: indeed, a hypothesis worth testing.

It is well known that astronomy, in its cultural context, has played a significant role in the decipherment of forgotten scripts: the case of the Maya is paradigmatic. However, it was whilst reading an essay on the Indus inscribed tablets (where the name of the Pleiades in the Deccan languages, Arumin, possibly appears; see Robinson 1996, 148) that we really realised it was worth the effort of studying the Canarian inscriptions not just in regard to the linguistics, but in a more general cultural context.

The sun and the moon

It has been demonstrated that the indigenous inhabitants of the Canary Islands, like their continental cousins, the Libyans, who “only reverenced the Sun and the Moon” (Herodotus IV, 188), had an astral religion (Tejera Gaspar 1991; Jiménez 1994). In this respect, the most ancient references are very clear *...as in Canaria and other neighbour islands, ... they are worshippers of the Sun and the Moon...* (Urbano V., Bula Ad Hoc Semper, 1369).

Reports from the time of the conquest are still more vivid. According to Alvise di Cadamosto, reporting on the islands of Tenerife, La Palma and Gran Canaria, while they were still unconquered in 1450: “they have no faith, worshipping on the contrary, some people the Sun, others the Moon and other planets. They have nine forms of idolatry...”

The information supplied by the first “historian” of the islands, Don Tomás Arias Marín de Cubas, is also very clear. In the only manuscript of his that has been published, written in 1687, he states *... parece que adoraban al fuego, al Sol, a la Luna y a alguna estrella...*(Marín de Cubas 1694[1986]). In an unpublished manuscript from the same year, he is even more explicit: *...parece que adoraban a el fuego, a el Sol y a la Luna y a la estrella de los caniculares* [perhaps Sirius] *de onde empesaban el año con grandes fiestas …* (Marín de Cubas 1687, fol. 81).

Amongst the Berbers, the custom persists even today of blessing houses, rocks, trees, fountains and so on, by inscribing on them, sometimes repeatedly, the names of God, *Allah*, and of the Prophet *Muhammad*. This tradition is evident from the lava-carved houses of Matmata, in Tunisia, to rock carvings in the High Atlas Mountains of Morocco. Could a similar situation hold amongst the insular proto-Berber populations of the pre-Hispanic Canary islands? We believe so.

In Belmonte *et al*. (1998) we reported a symbol apparently representing the letter “R”, namely **O**. We have discovered that there are many more of these symbols than would be expected in Canarian inscriptions. There is also a marginally significant excess of symbols representing the letter “S”, on the assumption that the symbols **8** and **θ**—symbols that were difficult to explain on a linguistic basis—are equivalent in Western Canarian writing. There are three possible explanations for this:

1. The names of indigenous gods and goddesses are likely to appear frequently in inscriptions (see above). Given this, we would expect to see the names of the moon, the sun and some stars or planets among the Canarian inscriptions. A problem is that among the Libyan-Berber family the moon receives various names (*ayur*, *aiur*, *eor*, *iru*, *aggur*, etc.), connected with the Libyan root **YRW** or **YWR** (Camps 1987). This should be written **~ O II** or **~ II O** in Canarian. On the other hand, the sun only receives the name *Tafaukt* today (although this name may only represent the light of the Sun: Laoust 1920, 187, note 2). In fact, the original words for the sun are, apparently, either *ittih* or *ies* (also *yes* or *ias*). In Canarian, these might have been written **~ + + ~ ≡** and **~ ~ 8** or **~ ~ θ**, respectively. Since in Libyan it is not frequent to see geminate consonants (Chabot 1941), the series of signs **~+~≡** and **~8** or **~θ** would be also possible. Although not very frequent, these series of signs can be found in inscriptions on islands such as La Palma (at Tajodeque), El Hierro (at El Cuervo) and Gran Canaria (at Balos).

   Panel 3 at Tejeleita (El Hierro; Springer Bunk 1994) is particularly relevant. Here we find the series of signs **Z 8 Z O II** on a flat slab. If there were no other indication, it could be read vertically as **YSYRL** or **LRYSY**, or horizontally as **WRYSY** or **YSYRW**. However, the position of the sign **8** suggests that it should be read horizontally and so we speculate that, in fact, the inscription names the main divinities of the Bimbaches (the ancient inhabitants of El Hierro): the Sun, **YS**, and the Moon **(Y)WR** or **YRW**. (In the former case, the last **Y** of **WRYSY** might be the conjunction, equivalent to the Latin *que*.) Following this line of argument, Cubillo (1980) has suggested that the name of the moon, *Eor*, could be included in the name of the main male god of the Bimbaches, *Eoranzan* or *Eoranhan*, as stated by the chroniclers. This idea relates to our second possibility.

2. Proper names, including those of divinities, such as John, Isidorus, Dorotheos or Abdallah, occur very frequently. (The phenomenon is known for some Numidian kings such as

Mastanabal.) Again, Tejeleita offers a good chance to test our hypothesis. There, two parallel series of signs can be found in a vertical panel, **+ – ~ O II** and **• I+I – ~ O II**, to be read from bottom to top **WRYNT** and **WRYNWTA** or, from top to bottom, **TINYRW** and **AWTNYRW**. The latter is much better for our purposes since then the inscription would then say *tiniru au tiniru*, i.e. (a)Tiniru son of (a)Tiniru, and could refer to a parent and a child both called "He or She of the Moon", a common proper name among the Berbers.

3. Certain inscriptions could hide some sort of calendrical or time-reckoning information since, in most Berber languages, the same words are used for the moon and the month, and for the sun and the day. To further develop this hypothesis, we would need to know how the ancient Canarians wrote their numbers, something we currently ignore. We will leave this possibility open for future investigations.

The indigenous Canarian people not only worshipped the sun and the moon but also certain stars or planets. The word for "heavenly body" in most Berber languages is *itri* (plural *itran*), whilst the female form *titrit* stands for a single star. Here we return to the hypothesis stressed in the introduction that the sign ⊕ might be a ligature of the signs **+ O** , i.e. the consonants **TR**. In this case, in Canarian, we would write **~⊕~**, **~⊕ –** and **+ ~⊕ ~ +** for *itri*, *itran* and *titrit*, respectively; or better, suppressing the normal vowels (not written in Libyan or Tifinag), simply ⊕, ⊕ **–** and **+ ⊕ +**. Such series do occur in Canarian inscriptions (see e.g. Fig. 7.2), including the last one (e.g. Hoya de Toledo; Springer Bunk 1994).

In Fig. 7.3 we show a very beautiful example from Lanzarote island which supports our hypothesis. Here we find a single Libyan-Berber vertical line, **⊕ = 8**, close to a Latin-Canarian inscription. Under Pichler's (1996) hypothesis, it might be read **SLB** or **BLS**. If we are right, it could be read **SLTR** or, much better, **TRLS**. The latter are the consonants of the well-known Berber name, *itri ilas*, of the most important celestial body besides the sun and the moon, namely

*FIG. 7.3. Alphabetical inscription at Montaña Tenesera (Lanzarote). A horizontal Latin-Canarian inscription is carved on the rock together with a three-sign vertical Libyan-Berber text. Under our hypothesis, the Libyan-Berber signs would read **TRLS**, i.e.* Itri ilas *(Evening Star). The Latin-Canarian would read **RTA(T)NV** (left to right) or, even better for our purposes, **VN(T)ATR** (right to left), i.e. **VeNA iTRi**, (star of Venus) in which case both texts would be mentioning the same object.*

the Evening Star. The Evening Star, under the name *Estrella Vena* or *Venus*, is a very important reference for present day Canarian farmers and shepherds, since it is a rain carrier (see Belmonte and Sanz de Lara 1998). In fact, one of us (JAB) believes that this tradition could hide an ancient cult of a proto-Berber god or goddess associated with this planet (a *Venus* or an *'shtrt*; Fantar 1989). This could have persisted in all of the islands after the conquest, transformed into the important cults of the Virgin Mary, since the Guanches of Tenerife ... *adoraban por cosa celestial, y suprema deidad a la Virgen de Candelaria...* (Marín de Cubas, 1694[1986]).

The earlier chronicler, Father Espinosa, also wrote at the end of the sixteenth Century that

> ..que si la fe no les enseñara la Candelaria ser madre de Dios, y no Dios, la confesaran a ella y tuvieran por tal..., since ...esta es (la Candelaria) ACH MAYEX, GUAYAX-XERAX, ACHORON, ACHAMAN, la madre del sustentador de cielos y tierra (Espinosa 1980).

We might speculate that, behind the name of this "goddess", Mayex, hides the Berber term "Mother of the sun", a quality common to many other great erotic goddesses of the ancient Mediterranean. However, Barrios (1997) suggests that La Candelaria could be the star Canopus.

To complete this line of argument, we must consider the several instances where the signs **O**, **8** or ⊕ appear either in isolation or repeated many times within a single site or even a single panel. Many such examples exist on the island of El Hierro, examples being El Julan, Cueva del Agua, La Candia, Tejeleita and Los Signos (Jiménez Gómez 1996; Steiner 1998), although good examples can also be found on other islands. However, our solution to this enigma represents a further, important step in our argument and we prefer to open a new section to deal with it.

Astronomy and symbolism

As a result of a commonplace convergence phenomenon (Eliade 1979), symbols representing the divinity often have peculiar origins. This includes alphabetical symbols: nobody would doubt that the Greek letters α and ω found in a church were representing Christ.

In this section we propose that some Canarian letters, such as **O**, **8** or ⊕, suffered a transformation into logograms (see Fig. 7.4), and that these may have represented some of the most important symbols of the prevailing mythology, the moon (*aiuR* or *iRu*), the sun (*ieS*) and a certain planet or star (*iTRi*). This was possible owing to the fact that Libyan-Berber scripts generally contain only consonants, the vowels being included only when they play the role of semi-consonants (e.g. **II** for **W**) and, even then, not in all cases. Consequently, we believe that each time one of these symbols appears in isolation or within a larger group of individual symbols, we are in fact seeing a sacred representation of the ancient divinities either for the protection of, or for consecrating, a certain site. In this sense, they played the same role as the much more recent crosses found at several rock art sites.

Symbols	Single Signs	Transcription	Reading	Meaning
⊕	+ **O**	TR	itri	star (αστηρ)
O	**O**	R	aiur or iru	Moon, month
8	8	S	ies, ias, ius	Sun, day, God
θ	θ	S	ies, ias, ius	Sun, day, God
∿∿ θ	~ ~ θ	YYS	ies	Sun
⦷	**O II** or **II O**	RW, WR or ...	iru or ¿?	Moon, Mars, Saturn, ...
⦹	⊥ **O** or **O** ⊥	S'R, RS' or ...	síri or ¿?	Crescent, Jupiter, ...

FIG. 7.4. *Astronomy, writing and symbolism. This figure summarises our hypothesis for the conversion of pre-Hispanic Canarian alphabetical symbols into artistic images of their mythology, representing the sun, the moon and certain planets (or stars) as stated in the chronicles. See text for further information.*

The idea of astral symbolism in Canarian inscriptions has already been suggested by Muñoz (1994, 93) in the special case of the *Chajasco* of Guarazoca. The *Chajasco* (a human-sized wooden board) was found in a burial cave in El Hierro, and is famous owing to the presence of a peculiar Libyan-Berber inscription on one of its sides (Diego Cuscoy and Galand 1975). Muñoz identified a section of this inscription as an astrological map.

In discussions with the authors, Professor Antonio Tejera has suggested that the *Chajasco* could have been a funerary stele similar to those found in their hundreds in the north-west of Africa (Chabot 1941, Galand 1966). A burial text and the name of the dead person were normally inscribed on these. However, several of these stelae also show divine symbols, such as the typical crescent and star (or "heavenly body") inherited from Middle Eastern representations. Thus, following our hypothesis of ancient Canarian symbolism, the symbols O, representing the moon, and ⊕, representing the star, should be found more or less isolated in the *Chajasco*. It actually contains an isolated O **II**, then an isolated ⊕ with a = sign on one side, then the signs ∩ and ∪. After this comes what is perhaps the name of the dead person and another part of the inscription. We speculate that the first symbols actually stand for the moon and the star, paralleling completely what is found on the continental stelae.

In order to support his astrological map proposal, Muñoz (1981) mentions the existence of a medieval work (in both Spanish and Arabic versions) called *Libro de las* +++ [sic], i.e. the "Book of the Crosses" (Muñoz 1981). A passage in the Spanish version reads: *son los iudizios que usaban los de las partidas de Occidente del tiempo antigo, et los de tierra de Affrica, et los de Barbaria, et una partida de los romanos de Espanna; todos estos solian iudgar por estas costellationes generales*, i.e. "these are the astrological predictions used by the ancient people of Al Maghrib [Morocco], and of the land of Ifriqiya [Tunisia], and Barbaria [Algeria] and a part of the Romans of Hispania [Spain]; all them were used to judge through these constellations". Nonetheless, we believe Muñoz's hypothesis of an astrological map to be less probable than ours.

The Arabic manuscript identifies certain symbols as representing the "planets": O, or perhaps ⊙, for the sun; •• for Mars; ⊥ for Jupiter; = for Saturn; and, perhaps, ∪ for the moon. Curiously, only the "exterior" planets are taken into account in these predictions. Surprisingly, all these symbols are also Libyan-Berber letters: O is **R** in all alphabets; ⊙ is **S** in Tifinag or **B** in Numidian and related alphabets; •• is **W** in Tifinag; ⊥ is strong **S** in Numidian; =, depending on its orientation, is **L** (in all alphabets) or **W** (in Numidian and related alphabets); and ∪ is **M** or **D**, depending on its orientation.

Here we relate these symbols to the last two listed in Table 7.1, which are highly problematic. In Fig. 7.4 we speculate that they could have followed the same rule as the symbol ⊕ and might represent the "ligatures" ⊥ O (**S′R**) and **II** O or O **II** (**WR** or **RW**), standing for *síri* , meaning perhaps "crescent" (Abercromby 1990 reported that the new moon was called *sel* in Lanzarote), and once more *aiur* or *iru*, respectively. However, if the "Book of the Crosses" represents some sort of pre-Islamic "astrology" of the south-western Mediterranean regions, these strange signs might well represent other "planets" worshipped in ancient Canarian mythology: perhaps Jupiter, in the case of ⊥ O, and either Mars or Saturn (the sign •• does not exist in Canarian), in the case of **II** O. These hypotheses are, however, highly speculative and must be taken with extreme caution.

As we have mentioned previously, the symbol ⊕ is very common in El Hierro, in many shapes and forms, especially at the sites of El Julan and Los Signos. In these places, certain other motifs occur frequently (see Fig. 7.5) which have the appearance of several grouped ⊕ signs (sometimes the symbols O and/or θ also appear in the grouping or nearby). We propose that symbolic representation is at work once more and that this could depict a grouping of heavenly bodies such as an asterism, a double star, a conjunction, or a stellar cluster. One such motif, which is especially fascinating and puzzling, seems to group five to seven ⊕ signs, i.e. five or seven stars under our hypothesis. Are we dealing with the representation of an important asterism or stellar cluster? Perhaps it is a representation of the Pleiades cluster, seen by the Kabilian Berbers as the seat of immortality (Allen 1963, 294) and a very important astronomical reference for present day Canarian farmers and shepherds (Belmonte and Sanz de Lara 1998).

One fascinating but highly speculative possibility takes into account the fact that the name of God in Berber, *ius* or *yus*, is very similar to that of the sun, *ies*. In fact, if we forget vowels and

*Fig. 7.5. Rock art at El Julan (El Hierro). We speculate that this represents a celestial view of the moon (*aiuR *or* iRu*, represented by the symbol* **O***), in conjunction with a group of stars (a cluster?), perhaps the Pleiades, represented by six or seven adjacent symbols ⊕. This configuration is commonly referred to in many Mediterranean cultures, although represented in various ways. Surprisingly, present day farmers in some islands give the Pleiades the name* El Siete Estrellas*, i.e. the Seven Stars (Belmonte and Sanz de Lara 1998).*

semi-vowels, both could be written in the same way, **8** or **θ** in Libyan and Canarian or **⊙** in Tifinag and, perhaps, other Saharan writings. Some rock art sites of the Sahara and neighbouring regions (e.g. Tinizouline, in Morocco; R. Springer Bunk, priv. comm. 1998) have large panels with several isolated **⊙** signs. Also, in the High Atlas and Anti-Atlas we have studied (in collaboration with our colleague César Esteban) some sites where the signs **θ** (or occasionally **8**) and ⊕ are extremely common, in groupings or in isolation, both in Libyan-Berber inscriptions and in other engravings (shield-disks, spirals, lunar crescents, footprints, etc.). Our final hypothesis regarding these inscriptions is that a phenomenon similar to the one we have discovered in the Canaries was perhaps produced in the north-west of Africa, including the Saharan regions. However, this raises a question: why did an interchange of meaning take place in Tifinag between **⊙** and **θ**, transforming **B** and **S** into **S** and **B**, respectively? We need to study the problem carefully, but we believe that it might have something to do with the confusion of the terms "god" and "sun", the frequent use in the Mediterranean of the symbol **⊙** to represent the sun (e.g. in Egyptian hieroglyphics and Roman astrology), and the common use in Libyan stelae of the letter **B**, i.e. the sign **⊙**, to denote the whole name of the supreme Punic god *B'al* (Alvarez Delgado 1964), assimilated by the Libyan populations, who had a strong solar character. We hope that future studies in these regions will give a better answer.

A key example: the "pintaderas"

One last consequence of our discoveries relates to the ancient seals, or painting devices, known as "pintaderas" (Martín de Guzmán 1984). Their purpose and use have been extensively discussed but without agreement. Yet many of them contain clear astral symbols (see Fig. 7.6). However, if our hypotheses are correct and the symbols **O**, **8** (or **θ**) and ⊕ stand for the moon (*iru*), the sun (*ies*) and a generic celestial body (*itri*), respectively, we can go even further in our argument. In Fig. 7.6 we show some good examples of astral representations (panels *a* and *b*) with an eight-pointed "star" and a six-ray "wheel" (perhaps a solar or stellar symbol). Panels *c* and *d* show motifs which could be astral, but this is not as clear unless we assume that **O** represents the moon: we can then speculate that the symbol ◎ represents the disc of the full moon, as we have proposed elsewhere (Belmonte 1997), and that ⊕ represents a celestial body. Then the symbolism is evident. Panels *e* and *f* would be more problematic, although we propose that they represent the symbol **8** and, consequently, might be solar or daytime representations.

Further support for our hypothesis might come from Fig. 7.7, where we show the results of our numerical analysis of the "pintaderas". We have studied 125 pintaderas, counting the numbers of strokes, small triangular or squared divisions, or other decorative elements within them. It was really astonishing to notice that the highest peaks within the distribution were centred at key astronomical numbers (12–13, 18–20, 28–30 and 60). The chances of this phenomenon having occurred fortuitously are extremely small. Consequently, we believe that some astronomical skill or tradition, either religious, calendrical or both, is represented in a large number of "pintaderas", some of which were "decorated" accordingly with astral symbols.

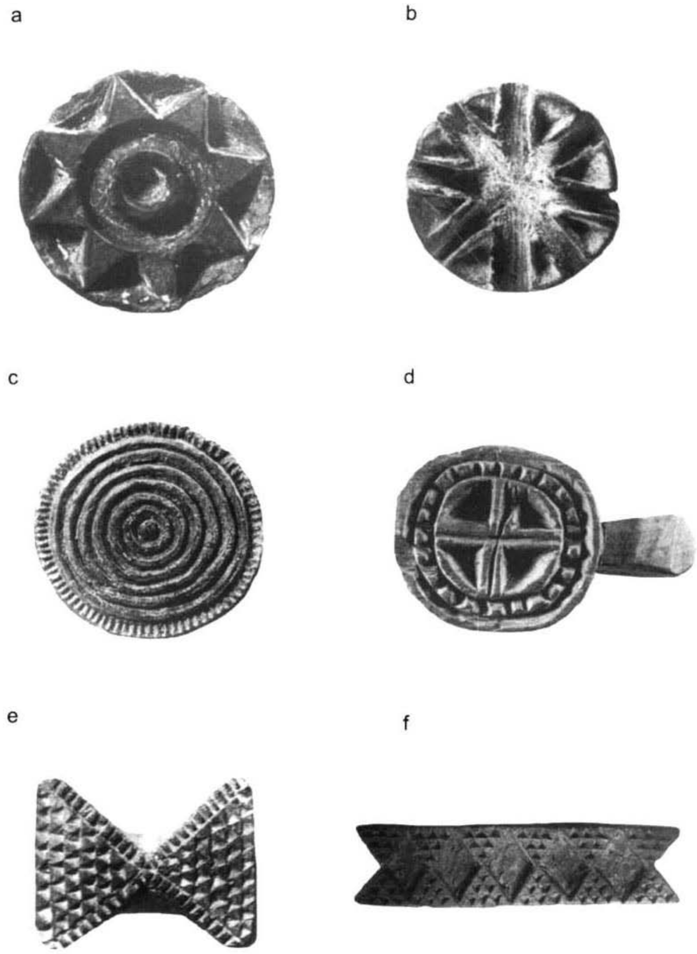

Fig. 7.6. Six examples of "pintaderas" from Gran Canaria.

(a) An eight-pointed star, perhaps a representation of a star god or goddess (presumably a form of Punic 'strt' *or Roman Venus).*

(b) A six-ray wheel, a common symbol for the sun in the north of Africa.

(c) An astral symbol with many concentric circles (i.e. **O** *signs, equivalent to **R**). We speculate that this is a representation of the moon.*

(d) An obvious iTRi *sign. It could represent various heavenly bodies, perhaps the sun, a planet or a certain star.*

(e) Bi-triangular symbol. Under our hypothesis, it would be the symbol 8 representing the sun or the day. Notice the 30 small triangular divisions within each triangle and the four 12-stroke lines on the outer border of the whole symbol, giving support to the "astronomical" interpretation.

*(f) Following the same line of argument, six contiguous symbols **8**. In this case, each of them includes 12 small triangular divisions.*

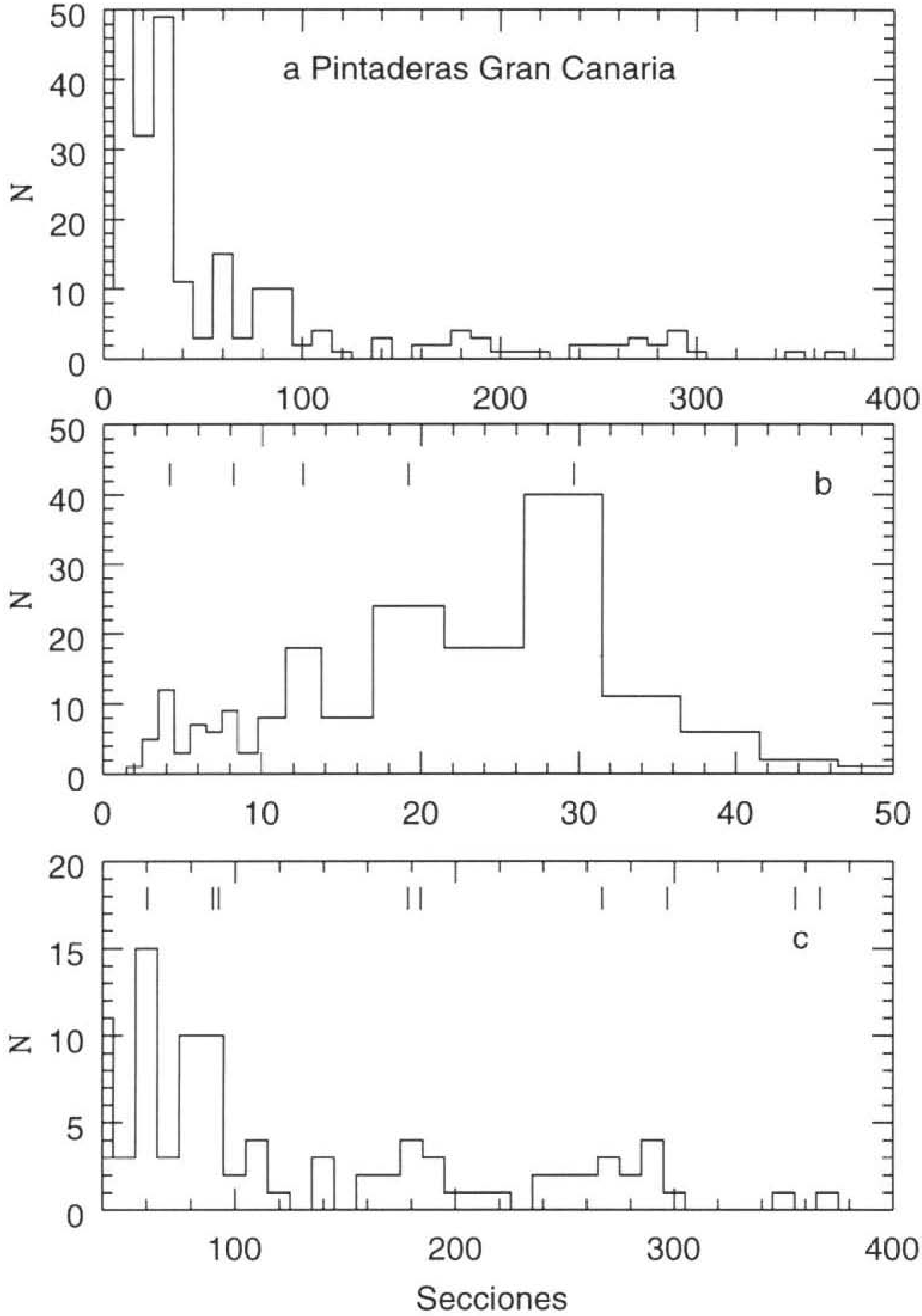

Fig. 7.7. Histogram showing numerical abundances (numbers of internal triangular divisions, strokes, rays on the border, etc.) in the "pintaderas" of Gran Canaria. More than 125 instruments have been analysed. The small strokes indicate relevant astronomical numbers (i.e. 4, 8, 12·4, 19, 29·5, and so forth up to 365·25). Most of them have relevant associated peaks. Several triangular-shaped (vulva) "pintaderas" contain numbers between c. 240 and 270, i.e. the period of human gestation.

Conclusion

We conclude that a very curious phenomenon took place in the Canaries in pre-Hispanic times. Some of the Canarian "letters", presumably used to write part of the names of their astral divinities ("the Sun, ... the Moon and other planets") or, perhaps, their time reckoning units (day, month, etc.) were converted into symbols representing these same items in rock art and other symbolic representations. This phenomenon would have been especially striking in El Hierro and Gran Canaria. In the latter island, it developed one step further when these symbols were incorporated into the design of some of the "pintaderas" whose general interpretation remains controversial. Consequently, we are facing a curious transformation of useful tools (writing signs) into plastic images of the natives' mythology.

It is possible that a similar phenomenon took place in the neighbouring continent, since similar symbols have been found in the rock art of the region (e.g. at the sites of Ighrem and Tainant). Investigating this further will be the objective of future investigations.

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8

The transmission of Graeco-Roman astronomy

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Abstract. We have established a list of astronomers who lived between 800 BC and AD 500, and compiled a list of their surviving books. We infer that about 90% of the literature that once existed is lost, a percentage that is close to what is found for Classical literature. Among the surviving books, the majority have been preserved because they were used as textbooks. We conclude with an analysis of other difficulties encountered in the study of Graeco-Roman astronomy.

The purpose of the present paper is to analyse some of the difficulties encountered when studying the history of Graeco-Roman astronomy.

It is a well-known fact that few books on astronomical matters written in antiquity have survived. Nevertheless a detailed census does not exist, to our knowledge. A census of this type reveals very well the fragmentary state of the surviving material and shows clearly that the history of ancient astronomy is a reconstruction based upon small, and often dubious, fragments. For many people this comes as a disagreeable surprise, since the history of ancient astronomy seems an undertaking that is essentially complete. This is true in terms of what can be extracted from the known literature, but it is certainly not true if one takes into account the large periods from which nothing has survived.

We started with an inventory of the names of all those astronomers that have been transmitted down to us by the various ancient authors. From this, we have tried to establish a list of their works, indicating in each case whether the complete work has survived, or only a fragment, or only its title. Lists of authors have been composed in the past by Lundmark (1937) and Neugebauer (1975), and Aujac (1995) has produced a provisional list of titles. We shall compare the different lists shortly.

Our list of astronomers, which we limited to the year AD 500, comprises 126 names. We have tried to include all those who have written on astronomical matters, although admittedly this definition is somewhat ambiguous, since as a result we include Cicero and Aristotle, who surely by modern criteria would not be called astronomers. We have also included writers on matters which nowadays would be called astrology. In antiquity there was no clear separation between astronomy and astrology. Finally, our list also contains poets such as Aratus, who would not be considered astronomers today but were called so in antiquity. In short, we preferred to follow ancient rather than modern definitions in order to achieve historical coherence.

These 126 astronomers are distributed over eleven centuries, a fact that at once reminds us how few astronomers we know of in each century. Table 8.1 gives an idea of their distribution over time. In order to assign each individual to a particular century we have adopted what the ancients considered to be their acme, that is their most productive years, ignoring where necessary the years close to birth or death.

TABLE 8.1. The number of astronomers per century.

8th BC	1	1st BC	10
7th BC	1	1st AD	14
6th BC	4	2nd AD	11
5th BC	7	3rd AD	7
4th BC	19	4th AD	10
3rd BC	21	5th AD	10
2nd BC	11		

The fluctuations from one century to the next surely reflect the incompleteness of our knowledge and the table can thus only indicate a general trend. We can consider the number of astronomers per century to be 15 to 20 after the fifth century BC. If we consider one generation to last 25 years, this yields some 4 to 5 astronomers per generation. In the earlier centuries quoted in Table 8.1 this refers to the Greek-speaking world, whereas the later ones refer to the inhabitants of the Roman Empire. Estimates put the population of the Roman Empire at 55 million when at its most extensive. Obviously it would be preferable to quote the proportion of astronomers to literate people in general, but we lack information on this point. If we estimate the proportion of people who were literate to have been of the order of 10%, then in most countries in twentieth-century Europe the proportion of astronomers is greater than one in every one hundred thousand inhabitants, which shows the enormous difference in the number of astronomers between ancient and modern times. One of us (Jaschek 1991) has shown that in ancient times the proportion of astronomers was comparable not to that of modern Europe, but to medieval Europe, before the invention of print.

We can next compare the figures in Table 8.1 with those given by other authors. Lundmark (1937) counted 74 astronomers between Hesiod and Stephanos (acme around AD 640) and Neugebauer (1975) counted 99 for the same interval. Our number is larger, even if our time interval is shorter. This is due to our adherence to the ancient criterion for defining astronomers, which led us to include a certain number of scientists omitted from both previous lists.

We now proceed to examine the list of books written by these authors. Since our knowledge is very fragmentary, the list of books would be nothing more than a list of titles and we prefer therefore to provide only the titles of those works that have been preserved completely. This list is given in Table 8.2 for times up to the year 0 and in Table 8.3 for years thereafter.

Table 8.2 is very instructive. The first point to notice is the language. All the works apart from the last three (Cicero, Hyginus and Vitruvius) were written in Greek, which was the scientific language of the time. Among the sixteen preserved titles, which represent all we have inherited from eight centuries of astronomy, we find many that deal with the classical parts of descriptive astronomy, but only one that we could call a research work: the one of Aristarchus. That so many descriptive astronomy books have been preserved is due to the fact that they were used as text books in later times. If we were to judge only by the astronomy taught in these books, we would conclude that Greek astronomy was just concerned with the stars, the sun and the moon, and that no mathematical theories on the motions of the sun, the moon or the planets were available. Everything we know on these matters comes from more or less extended fragments preserved in the literature. In fact, planets are mentioned by Aristotle, but that reflects the view of his time and we have no testimony to the developments after his time in the astronomy books that have been preserved, until the time of Ptolemy.

TABLE 8.2. Books on astronomy preserved completely, up to the year 0.

Century	Author	Books
8th BC	Hesiod	*Works and Days*
4th BC	Aristotle	*Of the Heavens*; *Meteorologics*
4th BC	Autolycus of Pitane	*The Sphere in Motion*; *Heliacal Sunrises and Sunsets*
4th BC	Euclid	*Phaenomena*
3rd BC	Aratus of Soles	*Phaenomena*
3rd BC	Aristarchus of Samos	*Dimensions of the Sun and the Moon*
2nd BC	Hipparchus	*Comments to the Phenomena of Eudoxos and Aratos*
2nd BC	Hypsicles	*On Ascensions*
2nd BC	Theodosius of Bithiny	*Sphaerics*; *Geographic Places*; *Nights and Days*
1st BC	Geminos of Rhodes	*Isagoge*
1st BC	Cicero	*Aratea*
1st BC	Hyginus	*De Astronomia*
1st BC	Vitruvius	*On Architecture*

Nevertheless the situation accords with what we might expect. In the first place, text books are preserved more easily, since more copies of them are produced. This is true even today: the average print run for a textbook is of the order of 4000, compared to 500 for a research book. Thus the chances of survival today are in the ratio of one to eight. Among the ancient books preserved, the ratio is 15 to one. Furthermore, in ancient times the number of copies of any book was considerably less than today, simply because of the material difficulties of reproduction. According to Cavallo (1995), editions of one thousand copies may not have been uncommon for literary works, but then surely for scientific books the editions were far smaller—perhaps fewer than one hundred copies.

Secondly, scientific books have a rather limited lifetime, since the results obtained are incorporated into more recent textbooks, implying that the original texts lose their value. This is what happens today with Newton's *Principia*: the book is not read except by specialists in the history of science, but the results obtained by Newton are incorporated in all (recent) physics books, often without mentioning the original author. In this sense, a modern text book replaces a library of old authors. In antiquity this role was taken by the *Almagest* which swept away all ancient literature, with the exception of books on the description of the heavens, which were still used as introductory textbooks.

The loss of the original scientific writings is regrettable, and for the historian of science it is disastrous. There exist whole periods from which nothing survives, such as that between the third and the first centuries BC. The reconstruction of "what must have happened", even if it is extremely careful, cannot replace the missing information. For instance, we know of no manuscript referring to planetary motion theories between the third century BC and Ptolemy—a gap of four centuries! Even Ptolemy himself alludes to this when he speaks of the books of Hipparchus "which have come down to us": it seems that not even he was sure to have copies of everything written by his predecessor.

TABLE 8.3. Books on astronomy preserved completely, after the year 0.

Century	Author	Books
1st AD	Pliny the Elder	Book II of the *Natural History*
1st AD	Marcus Manilius	*Astronomica*
1st AD	Plutarch of Chaironea	*De Facie in Orbe Lunaris*
1st AD	Cleomedes	*De Motu Circulari*
2nd AD	Theon of Smirna	*Useful Notions for the Lecture of Plato*
2nd AD	Claudius Ptolomaeus	*Syntaxis Mathematica* [later known as the *Almagest*]; *Planetary Hypotheses*; *Tetrabiblos; Analemnata*; *Handy Tables*; *Scheme and Handling of the Manual Tables*
2nd AD	Vettius Valens	*Anthologiae*
2nd AD	Hyginus	*Poetica Astronomica*
3rd AD	Porphiry	*Isagoge*
4th AD	Pappus of Alexandria	*Comments on the Syntaxis*
4th AD	Chalcidius	*Comment on the Timaeus of Plato*
4th AD	Ausonius	
4th AD	Firmicus Maternus	*Mathesis*
4th AD	Theon of Alexandria	*Comment on the Syntaxis*; *Comment on the Use of Manual Tables* [The so-called "Large and Small Comments"]
4th AD	Paulus Alexandrinus	*Elementa Apotelesmatica*
5th AD	Macrobius	*Comment on the "Insomnium Scipionis"*
5th AD	Hephaistus Thebanus	*Apotelesmatica*
5th AD	Martianus Capella	*Nuptials of Philologia and Mercury*
5th AD	Proclus	*Hypotyposis Astronomicorum Positionem*

The fact that the book *Planetary Hypotheses* could eventually be shown by Goldstein to be due to Ptolemy (see Goldstein 1967) invalidated many things written before that discovery. This demonstrates that assertions made by modern historians of science may be rather fragile and often do not survive when new documents are discovered. It also underlines the fact that the reconstruction of history without documents is a risky undertaking which should never be used to infer the non-existence of a given development. For example, many ancient authors stress the fact that they learned astronomy in Egypt. Such statements are ignored in peremptory pronouncements that Egyptian astronomy was on a very primitive level: the fact is simply that we have no surviving texts. To imply that these did not exist is to ignore the testimony of Greeks who lived at that time.

We are better off in Roman times, because many more manuscripts were preserved. What has come down is listed in Table 8.3.

The language of the majority of the books is now Latin, instead of Greek. The list contains twenty five books from five centuries, which is significantly larger than for the preceding centuries. Comparing the data in Tables 8.2 and 8.3 with that in Table 8.1, it is clear that the number of astronomers in the years before Christ is larger than the number from the later years, whereas with the books the opposite happens. In the 4th century BC we have 5 books preserved from 19 astronomers, whereas in the 2nd AD we have 9 books from 11 astronomers (although six are from a single author). This implies that, with one exception, the number of astronomers exceeds the number of preserved books by a factor of 3-4. If one makes the reasonable assumption that the productivity of astronomers has not declined, it is obvious than many books have been lost. This is a well-established fact, since we have long lists of titles of ancient books that did not survive. If we make the minimal assumption that each astronomer wrote two books, we have lost 33 books from the 4th century BC and 17 from the 2nd AD. Extending the calculation to cover the whole period, one concludes that 85% of the literature has been lost; and this is a minimal estimate. Worse still, included among the many books lost is the *History of Astronomy* by Eudemus, which could have supplied many of the missing names of both authors and books.

The percentage of lost books found here is in broad agreement with estimates for Classical literature, where it is stated that about 90% are lost. We have, for instance, lists of authors, such as that of Stobaeus of the 4th century AD who quotes in his *Antology* 1430 titles, 1115 (78%) of which are lost. We could continue with examples, but let us only consider two, both of which refer to well-known authors. We know that Sophocles wrote 123 tragedies and Aeschylus 70, yet only 7 works from each author are preserved, which represents a loss of 93% (Labarre 1985).

Returning to Table 8.3 we see that, once again, textbooks predominate, but we also see the appearance of something new: books on what we call astrology. This has led some to conclude that the Roman epoch was a period of general scientific non-productivity, but this contention could only be defended if we could be sure that all the “scientific literature” had been preserved, and no historian is likely to provide such a guarantee. What is true is that textbooks are abundant, and their general level declines with the centuries after Ptolemy. This fact has also been used to characterize the gradual decline of scientific production in the Roman era, but here again we can provide an alternative explanation.

For instance, we should take into account the number of students who took courses in astronomy in each epoch. To judge from the situation in modern times, if this increases rapidly in a given epoch, then there may be a diminution in the level of the available textbooks. Imagine what conclusions a hypothetical historian of the future would draw about the level of university teaching if the only things preserved were the photocopied class notes that are used in many courses in present-day universities.

A problem deriving from this is the incompleteness of our census of astronomers. If we have lost the scientific books where the names of colleagues are quoted, it is dangerous to replace the list of names we might have derived from these by the set of names quoted in scientific encyclopaedias. Suppose that we were to attempt to construct a census of modern scientists simply by noting the names of all scientists quoted in the works of philosophers or in the general encyclopaedias of our time. The first case would be equivalent to the use of Chalcidius, a philosopher of the 4th century; and the second to the quotations given by Pliny the Elder (1st century). In the second volume of his *Natural History*, for instance, Pliny quotes the names of some thirty authors, not all of whom are astronomers. In one modern encyclopaedia, in the chapter devoted to the Universe and its evolution, the number of names quoted is also about thirty. We have not counted the names quoted in any book by a modern philosopher, but it would certainly not be very large.

To this we may add the conclusion reached by modern scientometrists, that half of all scientific papers are never quoted at all in the literature. This implies that a sizable fraction of all authors has already been lost.

Another perturbing problem is the practically total loss of the instruments and of the tables which inevitably accompanied astronomical practice. It is true that instruments have been described by Ptolemy, but a number of significant details are missing, such as the materials used in their construction, their size, and the technical procedures. How, for instance, were the graduations of the circles produced? Some celestial globes have admittedly been preserved, but here the problem is that we do not enquire whether they were constructed for decorative or for scientific purposes. As far as tables go, Neugebauer and Parker have transcribed a number of fragments of papyrus that date generally from the era under consideration in this paper, a fact that demonstrates that there must have existed a large number of almanacs or ephemerides. These would have been necessary for the practice of astrology, among other reasons. The fact that only fragments survive leaves us with many problems concerning the practical calculations underlying the ephemerides. Notice also that we have practically no fragments from the period after Hipparchus but before the year 0.

We are in a similar situation with regard to astronomical machines, whose existence was denied emphatically by historians of science in the first half of the twentieth century. The discovery of the mechanism of Antikythera, found in a submarine location, has shown that the craftsmen of ancient Rome were perfectly capable of constructing complex mechanisms. For the moment this is the only astronomical mechanism that has been found, but it would be strange if it were the only one built. We are ignoring the question of its purpose, but the chances are that it was constructed to abbreviate the complicated calculations of planetary positions necessary for the establishment of horoscopes.

Yet another problem, one that is doubtless connected with the preceding one, is the artificial separation we make in the history of ancient astronomy between astronomers and astrologers, in the modern sense. Today we make a sharp distinction between these categories, and with good reason, but in antiquity such a difference did not exist. Hipparchus, for instance, is described by several independent sources as (what we would describe as) an astrologer. Ptolemy, besides the *Syntaxis*, also wrote the *Tetrabiblos*, an astrological reference book. These facts tend to be ignored or bypassed in modern books on the history of ancient astronomy, written from the point of view of modern Western science, which has scorned astrology since the seventeenth century. [But see, for example, North 1994, 119–24; Hoskin 1997, 41–2. Ed.]

If one examines the situation dispassionately, one arrives at the conclusion that ancient astronomy did not develop further after Ptolemy, because he had solved all the problems that observational astronomy posed. What other problems could people have tackled?

This is a question that has never, apparently, been asked by historians. The fact that neither Babylonian nor Chinese astronomy progressed beyond planetary theories shows that in Babylonia and China, as in the Greek and Roman world, there was a general feeling that nothing else was worth doing. It is true that ancient astronomers did not worry about the structure of the Milky Way, nor the constitution of the Universe, nor scientific cosmology. But we should ask how ancient astronomers could have tackled such problems without the necessary instruments. In fact, such problems only appear in Western astronomy in the eighteenth and nineteenth centuries, well after the invention of the refracting telescope and once astronomy had liberated itself from the weight of theology. To such open questions one could add two problems often quoted by modern writers. One of these is that the parameters of Ptolemy’s theories could have been checked and improved immediately by systematic observations of the sun, the moon and the planets, which would have demonstrated “forcibly” the inadequacy of his theory. Why was this not done? Then again, we are told that Ptolemy could have improved the inadequate underlying (Aristotelian) physics. But while the modern mind can reanalyse Ptolemy’s data, the question might have had no relevance in a different epoch. Systematic observations never were a speciality of Greek astronomers and the conditions were unsuitable for carrying them out (in Europe the first to do this was Tycho Brahe). To us it seems natural that once a theory is formulated, it should immediately be checked to establish its accuracy and scope. This again is a modern preoccupation, based upon an abundance of means and of astronomers (more than ten thousand). Compare this with the one or two observing sites in antiquity and the small number of astronomers!

Ancient physics had reached its limits. These would only be overcome when physicists came to change their postulates and to develop modern equipment. To say that Ptolemy should have revolutionized physics is like thinking that the astronomers of the nineteenth century could have produced the theory of relativity.

In his works, Ptolemy mentions a number of unresolved problems. These particularly concern astrology, as he says himself in the introduction to the *Tetrabiblos*. Thus it seems reasonable to suppose that many of his successors devoted their energy to resolving those problems, rather than to continuing in astronomy (in the modern sense), for here it seemed that Ptolemy had resolved all the problems. Astrology can only be fully developed when there exists a solid basis, comprising ephemerides or almanacs, rules for computing the positions of the planets, and/or mechanical devices for the same purpose. These ensure that the practitioner is able to calculate the position of the planets at any time. In this sense, astrology is a close relative of astronomy (using the modern definitions) and each time astrology is seen to exist, one can be sure that somewhere in the background there are astronomical theories and tables. The necessity of handling tables makes it mandatory for astrologers to have at least a small collection of books on astronomy, which supply the practical basis for the work. The relationship between astronomy and astrology is thus very close, and it is this that has saved the works on astronomy at times when many other scientific textbooks were forgotten. This clearly applies to Byzantine and Early Arabic times. To this we should add the fact that astrology became also important for medicine. The relationship between astrology and medicine became established in Greece with Hippocrates, but only became fully influential in Roman times, with the work of Galen in the 2nd century AD. Even though medical astrology concerned itself only with the positions of the moon and the sun, and exceptionally those of the planets, the link with medicine, via astrology, was another factor that helped to ensure the survival of astronomy.

The connection between astronomy and astrology has only been partially explored, in large part due to our modern prejudice against astrology. The same can be said with regard to the association between medicine, astrology and astronomy.

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9

Aztec star constellations and Aztec cosmology

Uta Berger

Summary

The ancient texts describing the stars of the Aztecs, together with pictorial sources, have been studied in order to define the stars according to European constellations. An attempt has been made to identify the constellations reported in the sources. The constellations were compared with those of European astronomy. Two ancient authors, Sahagún and Tezozomoc, are known to have reported about the stars. Both wrote with different intentions and aims: the first collected material to understand Indian thoughts important for teaching Christian Doctrine; the other, a descendant of the royal family, wrote a history of his people and recalled the glorious past of the Mexica. However, both sources mention the same stars. This is an important fact which has been investigated in more detail. It is suggested that the constellations reported by Sahagún and Tezozomoc represent the Aztec view of the order of the world with respect to time, space and cardinal directions mirrored into the sky.

Introduction

The stars of ancient Mexico have been studied by several scholars (Schultze Jena 1950; Coe 1975; Aveni 1980a, b; Leon-Portilla 1990; Köhler 1991). However, there are still some unresolved problems. The sources and the iconography have been reviewed in order to obtain further information on the star constellations and to confirm Anthony Aveni's suggestion that the stars of the Mexica are related to the cardinal points (1980a, 36).

Pictorial records of comets and other celestial events such as eclipses of the sun, meteorites, northern lights (for example C. Rios fols 85r,v, 90r,v) and the calendar testify to the profound knowledge of astronomy in ancient Mexico. Priests used astronomical instruments to observe the sky (C. Mendoza fol. 63r). There were places with observatories such as Tlaixco, an ancient settlement in the Mixtec region (C. Bodley 15-V; C. Selden 14, I; Hartung 1977). Stellar constellations are rarely mentioned in Mexican manuscripts. To my knowledge a constellation of stars is shown only once in a Mixtec codex (Smith 1973), and once an anonymous author associates the stars of Ursa Major with the god Tezcatlipoca (*Historia de los Mexicanos* 1971, 233). There are only two post-conquest sources describing the stars, one written by Bernardino de Sahagún and the other by Hernando Alverado Tezozomoc, both authors of the sixteenth century.

The ancient authors

Bernardino de Sahagún, a member of the Franciscan order, reported in detail about the life, thoughts, culture, fauna and flora of the Mexicans. He arrived in Mexico in AD 1529. Some years later he was instructed by his superior, the Provincial Fray Francisco de Toral, to collect material which could be used for the christianisation of the Indians and for teaching the Doctrina Cristiana. Sahagún mentioned that he was ordered to employ Nahuatl, the language of the Mexica, for this matter (D'Olwer and Cline 1973, 187; Garibay 1981 vol.1, 21, 105; Anderson and Dibble 1953–82, part i, 12, 53). He worked in a trilingual system: Nahuatl, Latin and Spanish. The texts were initially closely connected, but with various revisions and additions there resulted different manuscripts (Garibay 1981, vol.1, 14–6, 106).

According to D'Olwer and Cline (1973) the various manuscripts are:

1 *Primeros Memoriales*, Nahuatl with illustrations (1559–61).

2 *Segundos Memoriales*, Nahuatl (1561–65).

3 *Memoriales in Tres Columnas*, Nahuatl, Spanish with notes in Spanish-Nahuatl (1563–65).

3a *Memoriales con Escolios*, revised copy of (3) (1565).

4 *Historia General de las Cosas de Nueva España*, Nahuatl (1565–68).

4a Florentine Codex, copy of (4), Spanish, Nahuatl, with illustrations (1578).

4b Tolosa Codex, revised copy of (4a), Spanish (after 1580).

Tezozomoc wrote a history of the Aztecs and of the conquest of Mexico (1980, 151–2). He was a member of the royal family. His father Cuitlahuac, the penultimate king of Mexico, died in AD 1520. Tezozomoc's work dates from AD 1598. It can be seen as a reconstruction of the past from recollections of his own, and based on tales from his family and on books.

Both authors wrote their records with different aims. However, both saw the necessity of preserving the ancient ideas and thoughts since the influence of the Europeans was causing a rapid change in the Indian culture and loss of indigenous knowledge.

The sources describing the stars

In Sahagún's records there are several sections concerning the stars. The most detailed of these are the paragraphs on celestial phenomena in the *Primeros Memoriales*, since the text is accompanied by drawings of the constellations (Baird 1993, figs 39, 42; Schultze Jena 1950, 56–9).

There is further information in the Florentine Codex, the *Historia General de las Cosas de Nueva España*, with a section on the celestial bodies in book 7, chapters 3 and 4 (Garibay 1981; Anderson and Dibble 1953–82, part viii, 11–15) and in the *Memoriales con Escolios* (Anderson and Dibble 1953–82, part viii, 60–7). These texts record partly the same, partly different aspects of astronomy and of the stars (see Appendix). All the various texts concern the same five constellations of stars, but the revised versions amplify the explanations with myths and religious background.

Tezozomoc's information is in connection with an address to a newly elected king. After the death of Ahuitzotl, king of Mexico, Moctecuhzoma II was elected as his successor to the throne of Tenochtitlan. On the occasion of his enthronement the king of Tezcoco, Netzahualpilli, gave a speech of admonishment with respect to the duties and behaviour a king has to observe. One of these duties was to watch the events of the sky. Tezozomoc wrote: "...y sobre todas estas cosas de avisos y consejos, el tener especial cuidado de levantaros á media noche, que llamaban yohualitqui mamalhuaztli las llaves que llaman de San Pedro de las estrellas del cielo, Citlaltlachtli el norte y su rueda, ytianquiztli las cabrillas, la estrella de la alacran figurada colotlixayac, que son significadas las cuatro partes del mundo, guidas por el cielo; y el tiempo que vaya amaneciendo tener gran cuenta con la estrella xonecuilli que es la encomienda de Santiago, que es la que está por parte del Sur, hácia las Indias y chinos, y tener cuenta con el lucero de mañana, y alborada que llamaban Tlahuizcalpan Teuctli..." (1980, 574).

The new ruler was advised "....to get up at midnight to watch what they called yohualitqui mamalhuaztli, the (stars) are also called the key of St. Peter, then the stars of the sky [called] citlaltlachtli, the north and its round; and tianquiztli, the Pleiades; the stars which build the scorpion, colotlixayac. These stars describe the four parts of the world shown in the sky. When the sun rises then special attention should be given to the star xonecuilli, that is 'La encomienda de Santiago', in the south in the direction to India and China. The morning star and the sunrise need to be observed intensively which they called Tlahuizcalpan Teuctli..." (author's translation). The royal address records five Mexican constellations of stars.

Table 9.1. The six constellations known from the writings of Sahagún and Tezozomoc.

Sahagún	*Tezozomoc*
Mamalhuaztli	Mamalhuaztli
Miec	
Tianquiztli	Tianquiztli
Xonecuilli	Xonecuilli
Colotl	Colotlixayac
	Citlaltlachtli

Both authors record the same constellations, with one exception. Sahagún called the Pleiades by the indigenous name Miec; but Tezozomoc reports that these stars are named Tianquiztli. The expression Tianquiztli is also mentioned by Sahagún, but according to his record this constellation is not identical with the Pleiades. An additional constellation, Citlaltlachtli, is mentioned by Tezozomoc. A figure shown in Sahagun's work may represent these stars (Anderson and Dibble 1953–82, part viii, fig. 21). Altogether we know six constellations (Table 9.1). In addition, Tezozomoc mentioned the sunrise, which was called Tlahuizcalpan Teuctli.

Review of the literature

Previous studies have identified Mamalhuaztli as the sword and the belt of Orion (Coe 1975, 26; Aveni 1980a, 35–6; Broda 1986, 80; León-Portilla 1986, 15; Köhler 1991, 259). Schultze Jena (1950, 64) points out that some stars of Orion, the stars of the belt and sword, agree with the picture shown by Sahagún (*ibid*., 402, fig. 5). Molina (1977, 52) calls Mamalhuaztli "astillejos", Gemini. Aveni (1980a, 36–7) discusses the translation of Anderson and Dibble (1953, part viii, 60), who used the expression "Castor and Pollux" in connection with the stars of Mamalhuaztli.

The stars of the Pleiades are identified as Tianquiztli (Coe 1975, 23; Aveni 1980a, 33–4, Broda 1986, 80; León-Portilla 1986, 14–15). The Pleiades are called Miec according to Köhler (1991, 257) who assumes that the stars of Xonecuilli are Ursa Major (*ibid*., 260). Other authors suggest that Xonecuilli are the stars of Ursa Major (Schultze Jena 1950, 64) or Ursa Minor (León-Portilla 1986, 15). Seler thought that the Southern Cross was intended (see Coe 1975, 26) or even the stars of Hercules and Draco (*ibid*., 27). Aveni suggests that these stars are either Ursa Minor or the Southern Cross and pointers (α and β Centauri) (1980a, 34, 36, fig. 12). Broda (1986, 80) and Coe (1975, 26) do not identify these stars.

The stars of Colotl are near the Raven (Schultze Jena 1950, 64). Broda (1986, 80) and Coe (1975, 24) thought them to be the old-world constellation of Scorpio. Köhler does not exclude this possibility, but believes the constellation is unidentified (1991, 261). Aveni (1980a, 37, fig. 12) assumed a constellation which comprised Castor, Pollux and Rigel.

The constellation of Citlaltlachtli is not mentioned in Sahagún's text, but there is probably a depiction of these stars. Tezozomoc described them as the "north and its circle". Aveni finds it difficult to indentify Citlaltlachtli with the Twins (1980a, 36, fig. 12). According to Broda these stars are unidentified (1986, 80). Tianquiztli and Citlaltlachtli might be the same constellation, perhaps Gemini (Köhler 1991, 262).

León-Portilla (1990, 50) gives a short review of the Aztec stars and mentions that Ursa Major, the tiger, was called Tezcatlipoca; Ursa Minor was named Citlalxonecuilli; Scorpio, Colotl, and the three stars which form the head of Taurus were called Mamalhuaztli; and the Pleiades were called Tianquiztli.

Analysis of ancient sources

Six ancient Mexican stellar constellations are known. Four constellations appear in both sources, but Miec is only mentioned by Sahagún. Tezozomoc omitted this name, but mentioned the stars of Citlaltlachtli.

Mamalhuaztli

First there is Mamalhuaztli, the "fire drill" (a wooden instrument for lighting fires). It is identified as the sword and the belt of Orion. Sahagún placed the stars near the Pleiades. However, a contemporary of Sahagún, Molina (1977, 52), translates Mamalhuaztli as "astillejos", i.e. Gemini, although according to Coe (1975, 26) the word also means "little sticks". In his Spanish version Sahagún used the expression "mastillexos" ("mástil" means stick, handle, or stake). This translation could be interpreted as the pieces of wood used to make fire.

Tezozomoc calls Mamalhuaztli the keys of St. Peter. This name is in accordance with medieval European astronomy which used to associate certain stars with the Saints (see Coe 1975, 26).

Sahagún refers to the similarity of the constellation to the pieces of wood used to light a fire. Indeed, the drawing is identical with the iconographical convention of such pieces of wood which is used in many Mexican painted books to depict the ceremony of the New Fire (C. Rios fol. 82r; C. Mendoza fol. 2r; C. Aubin fol. 7r). Recent ethnographic studies of modern Indians confirm that the stars of Orion's belt and sword are identical with Mamalhuaztli (Köhler 1991, 259; Figs 9.1a–d).

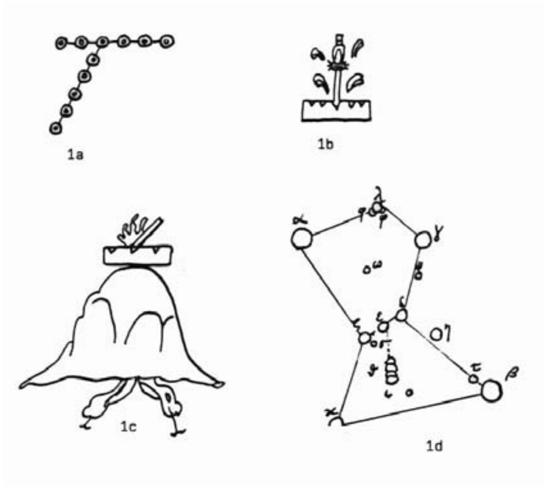

Fig. 9.1. Mamalhuaztli.
a. Sahagún's drawing.
b, c. Pictograms from C. Mendoza (b) and C. Aubin (c) showing a "fire drill".
d. The stars of Orion including the belt and sword.

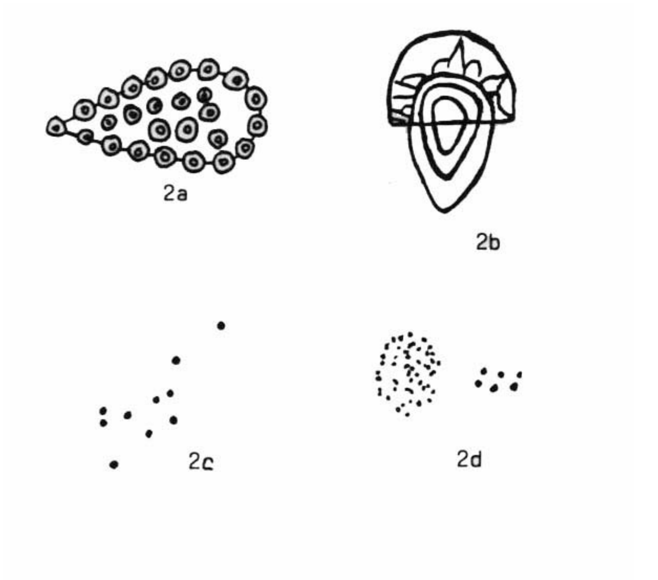

Fig. 9.2. Miec.
a. Sahagún's drawing.
b. Pictogram from C. Muro (see Smith 1973): "The Pleiades on the zenith".
c. The stars of the Pleiades (after Aveni 1980a).
d. The constellation of Miec drawn by modern Indians (after Köhler 1991).

Miec

Next Sahagún describes Miec. Miec, which means the multitude, are stars not mentioned by Tezozomoc. Ethnographic studies assure us that Miec are the Pleiades. Even today, the expression Miec for the Pleiades is in use among Indian people (Köhler 1991, 257).

The stars of the Pleiades were important in the agricultural cycle of the Aztecs (Aveni 1980b, 174), and exceptionally so during the ceremony of the binding of the years, the feast with which a new 52-year cycle started (Aveni 1980a, 33). The fires in the whole country were extinguished. At midnight of Nov 16, when the Pleiades passed the zenith, there was a human sacrifice upon which the new fire was kindled. With the lighting of the fire, the existence of the present world was ensured for the next period of 52 years. Sahagún noted that the rising and setting of the stars was correlated in time to Mamalhuaztli. On the margin of the page at the level of the paragraph there is a drawing of stars arranged in the shape of a drop of water which is placed underneath of the picture of Mamalhuaztli. The iconography of the Pleiades is also shown on page 7 of Codex Muro (see Smith 1973, 94), where Lady Seven Grass is portrayed together with the symbol of the sun or sky and a symbol like a drop. The picture has an alphabetical note written in the Mixtec language which says: "The horizon with the Pleiades at the zenith" (Smith 1973, 84). Iconography, ancient sources and ethnographical research together seem to prove that Miec is identical with the Pleiades (Figs 9.2a–d).

However, the Pleiades are also identified as Tianquiztli according to several authors (Coe 1975, 23; Aveni 1980a, 33; Broda 1986, 80; León-Portilla 1986, 14–15) as well as Tezozomoc (1980, 574).

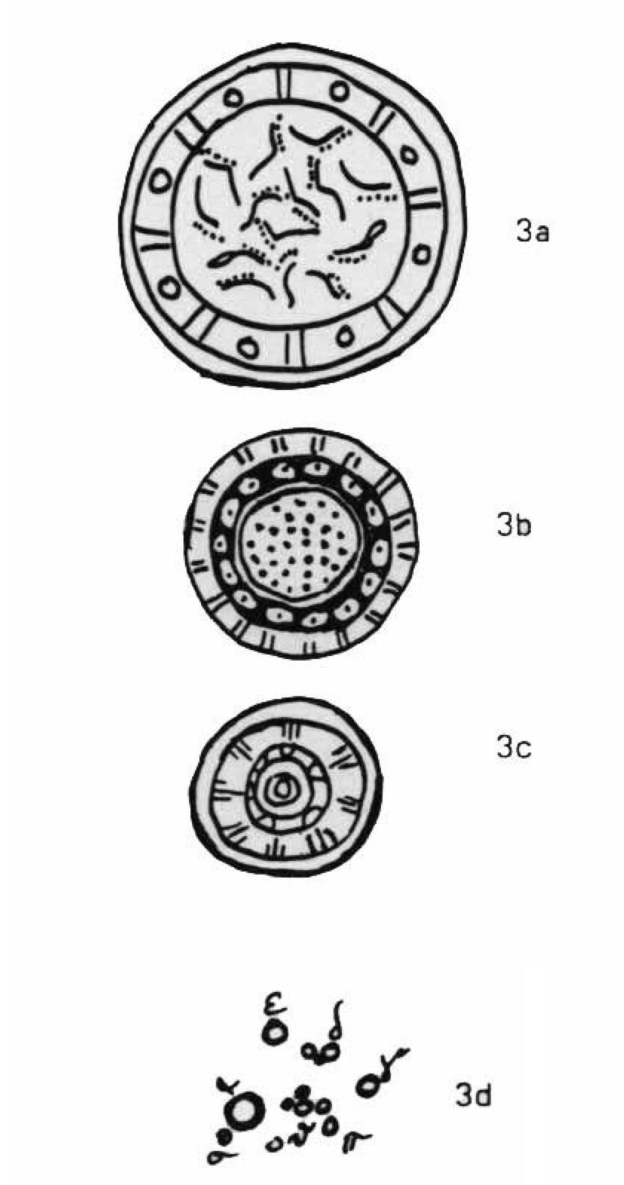

Fig. 9.3. Tianquiztli.

a. *The signs of Tianquiztenco (Matricula de Huexotzinco).*

b. *Xaltianquizcopan (C. Mendoza).*

c. *Tianquitzçolco (C. Tepotzotlan).*

d. *The constellation Tianquiztli (Hyades of Taurus).*

Tianquiztli

Tianquiztli is the third constellation mentioned by Sahagún. The word means market or place. According to Sahagún's text, Miec and Tianquiztli are two different constellations, because Sahagún utilized in his description the Nahuatl word "yuan" which means "and". The word is used to connect nouns in the same position and subjects in the same local vicinity according to Molina (1977, 73) and Siméon (1988, 211). In the Spanish versions of Sahagún's work the word "y" is employed. But Tezozomoc maintained that "ytianquiztli" are the Pleiades.

There is certainly an account of three constellations in Sahagún's Nahuatl record, because he wrote that Mamalhuaztli, Miec and Tianquiztli were visible at midnight and disappeared one after the other. Regarding the constellation of Tianquiztli it is obvious that even Sahagún had some problems with this constellation according to the arrangement of the drawings in his manuscript. The textual part is limited to the first and second drawing. The third picture is placed aside a broad empty section between two written paragraphs. The empty space indicates that Sahagún was concerned about the discrepancy between the written information and the picture, since he was aware that the name mentioned in the text did not match the third drawing. Sahagún used to insert the text after the pictures were drawn (Baird 1993, 34; Anderson and Dibble 1982, part i, 12). Sahagún probably hesitated to equate a rectangular shape with the expression tianquiztli. Sahagún had a broad knowledge of the Mexican language and thoughts. He was probably familiar with frequently used pictograms in the Mexican writing system. The

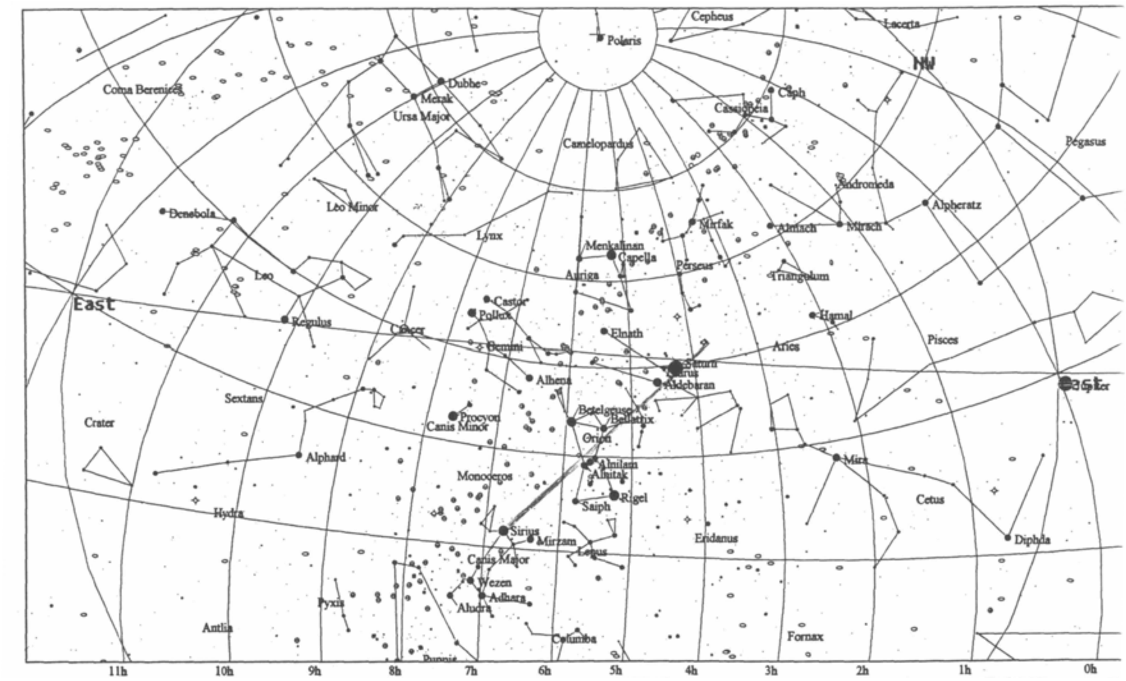

Fig. 9.4. The Pleiades, the Hyades and Orion pointing towards Sirius, in December at midnight.

names of the stars agreed with well-known expressions and pictures utilized in Mexican painted books, as for example that shown with the name of Mamalhuaztli, the "fire drill". The third picture bears no similarity to the generally known pictographical convention of tianquiztli for which the symbol of a circle was conventionally used. This is demonstrated in many place symbols: for example it is shown in the Matricula de Huexotzinco (fol. 451r), C. Mendoza (fol. 16r) C. Aubin (fol. 47r) and Codex Tepotzotlan (Brotherston 1992, 31, fig. 21). It is very likely that Tianquiztli is the name for the Hyades, a group of stars near Orion and the Pleiades. The times of rise and set correlate with both. Perhaps Sahagún thought the second picture would suffice for both constellations, since both are clusters of stars (Figs 9.3a–d).

During the winter Mamalhuaztli, Miec and Tianquiztli begin to set after midnight. Midnight was the time when the Mexican kings commenced their observation of the stars. The correlation with the rise and set of Orion and the neighbourhood of the Pleiades may explain Tezozomoc's erroneous information. Gregory of Tours (c. AD 540–594) in his work "De cursu stellarum ratio" had already named the Hyades the Pleiades (Bergmann and Schlosser 1988, 60). Even today, Maya people call both the Pleiades and Hyades "mötz", which means handful (Tedlock 1992, 29).

The Pleiades, the Hyades with Aldebaran, and the belt of Orion are in line, visible at the time of the winter solstice, and point towards Sirius (Fig. 9.4). Sahagún was probably most interested in these three Mexican constellations. The linear formation of stars aligned with the bright star Sirius could be associated with Christmas.

There have been suggestions that Tianquiztli and Citlaltlachtli might be the same constellation, or perhaps Gemini according to Köhler (1991, 262), but other authors believe these stars are unidentified (Broda 1986, 76, 80).

Citlaltlachtli

Tezozomoc mentioned the constellation Citlaltlachtli, the ballcourt of stars. The third drawing shown by Sahagún depicts stars in a rectangular formation. The rectangle is a well-known pictographical representation of a ballcourt and matches the star constellation shown in Sahagún's work. Tezozomoc explains that these stars are also the north and "its round", i.e. the Northern region. The north was associated with the stars of Ursa Major and the deity Tezcatlipoca (*Historia* de los Mexicanos 1971, 233). However, Sahagún's configuration does correspond to Gemini (Figs 9.5 a–d). During the wintertime Gemini, the northernmost constellation of the ecliptic, is opposite to the sun in the sky and reaches the highest position in the sky during the night. The stars are visible in November from about 21:00 in the ENE and are still present at sunrise in the WNW.

Xonecuilli, the crozier

The constellation Xonecuilli is described by both ancient authors, Sahagún and Tezozomoc. The stars have the name of a special cake which was shaped like a reversed S. This special bread was only prepared for feasts. Xonecuilli also means "baston" (Molina 1977, 161), a staff with knobs used by pilgrims. Such staffs were also used as offerings to the deities.

Sahagún mentions that the stars were very bright and isolated. According to Tezozomoc the stars were connected with

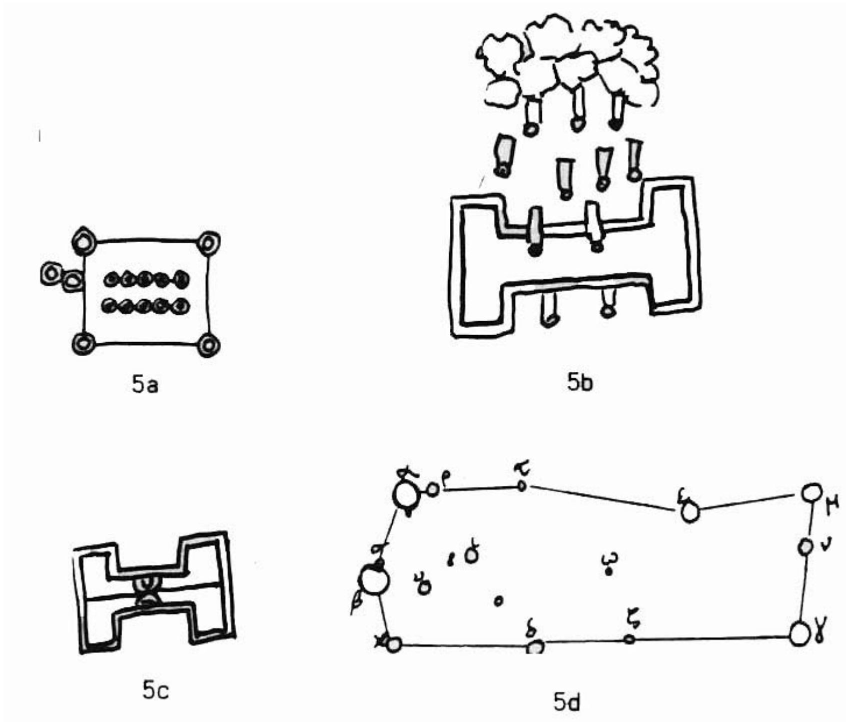

Fig. 9.5 (top). Citlaltlachtli.
- *a. Sahagún's drawing.*
- *b. Pictogram of the place Tlachquiauhco (C. Rios).*
- *c. Pictogram of the place Tlachco (C. Mendoza).*
- *d. The stars of Tlachtli (Gemini).*

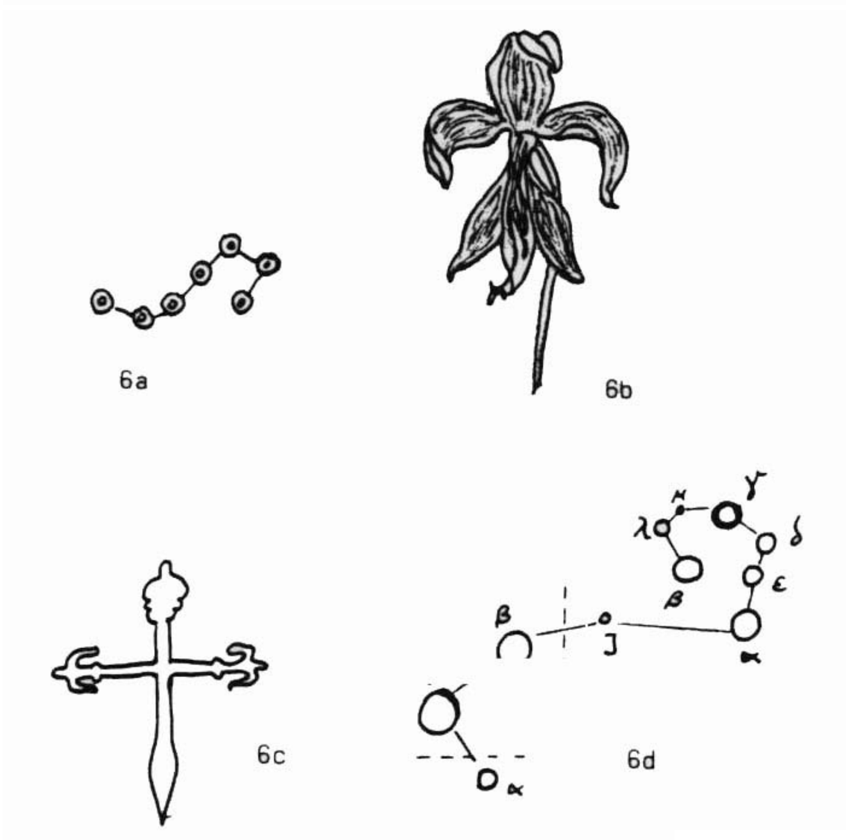

Fig. 9.6. Xonecuilli.
- *a. Sahagún's drawing.*
- *b. The Jacob lily.*
- *c. The cross of St Jacob.*
- *d. The constellation of Xonecuilli comprising α and β Centauri and the Southern Cross.*

the south and also called "encomienda de Santiago". "La encomienda de Santiago" is another expression for the lily of St. Jacob, *Sprekelia formosissima*, or Amaryllis. The red flower has similarities to the cross of the knights of St. Jakobus of Calatrava (see Schwarz-Winklhofer and Biermann 1980, 99, fig. 392). The European name together with the direction indicate a shape like an elongated cross which, together with other stars, form a crosier with the bend open to the north as Sahagún mentioned.

The Southern Cross and pointers form a distinctive shape (Figs 9.6a–d). These stars were visible in the south 15° above the horizon (Aveni 1980a, 36). The brightness and isolation mentioned by Sahagún (Schultze Jena 1950, 45; Anderson and Dibble 1953, part viii, 13, 67) would imply the southern direction. Sahagún mentions in the Spanish part of the *Memoriales con Escolios* and the *Historia General* that the stars are "la boca de bozina del norte" (the opening of the trumpet to the north). "La bozina del norte" is the Spanish name for Ursa Minor (Köhler 1991, 259). But Tezozomoc, who knew the Spanish terms for the stars and used them, introduced the name "lily of St. Jacob" for these stars. The Southern Cross has only been known and defined in Europe as a constellation since the seventeenth century. Therefore Sahagún and Tezozomoc could only define these stars by local Nahuatl names or local Spanish expressions used in Mexico or elsewhere where they were visible.

Schultze Jena (1950, 64) reported that the Indians of Zitlala named the brightest stars of Ursa Major Xonecuilli. Ursa Major and Minor or parts of them have been suggested as being Xonecuilli (Coe 1975, 27; Aveni 1980a, 37; Köhler 1991, 260). But the stars of "el carro" (Ursa Major) are recorded and discussed by Sahagún in the following paragraph, a fact which suggests another constellation. Köhler indicates that the use of the Spanish word "arado"—plough—by modern Indians for these stars could be a sign of acculturation. This word was probably introduced into the Nahuatl language since Ursa Major was not an indigenous constellation. Sahagún may imply that the seven stars were arranged with the opening to the north.

However, both ancient authors' accounts point towards the Southern Cross and pointers. Tezozomoc describes the configuration of a cross, the southern direction and the visibility in the early morning hours; and Sahagún informs us that the stars were isolated and bright. In November the Southern Cross and pointers are visible at 04:00 in the SSE. They reached their highest position above the horizon at 15° northern latitude in March at midnight.

Citlalcolotl

The last star constellation mentioned by both authors is called Citlalcolotl, the scorpion of stars. There are many pictures showing a scorpion: for example, one is depicted on the Aztec stone-chest of the Uhde collection in Berlin and such animals are also portrayed in Mexican pictorial manuscripts (Relaciones geográficas: Tlaxcala, fol. 286r, C. Fejérváry-Mayer p. 27, C. Borgia p. 18). The picture of Citlalcolotl shown by Sahagún does not agree with pictographical conventions for a scorpion. In the Spanish version Sahagún used the expression "el carro" and "el esculpion" instead of Citlalcolotl. Neither term may indicate the European constellation. They are Spanish loan words introduced after the Conquest. Quauhtemalacatl (Molina 1977, 25) was the usual Nahuatl word for "carro", but this term does not occur in Sahagún's text. In about AD 1550 the Nahuatl term began to be replaced by Spanish expressions such as "carreta" or "carro" (Lockhart 1992, 267–9). Sahagún noted that some of the Indians said "carro" and some others "scorpion". It is therefore possible that the stars are identical with the Scorpio of the Old World. Indeed, if Citlalcolotl had been clearly one or the other of the European star constellations Sahagún would have pointed out this fact. In ancient times Scorpio was correlated with Libra which was called "the Claw of Scorpio" (Moore 1995, 198; Mazal 1993, 127). The stars of Scorpio together with other stars in the vicinity form a shape which accords with Sahagún's drawing (Figs 9.7a–e). In November at midnight this "extended" Scorpio was not visible, but during wintertime Antares (the brightest star in Scorpio) appears in the early morning hours: around 04:30 in December and around 03:00 in January.

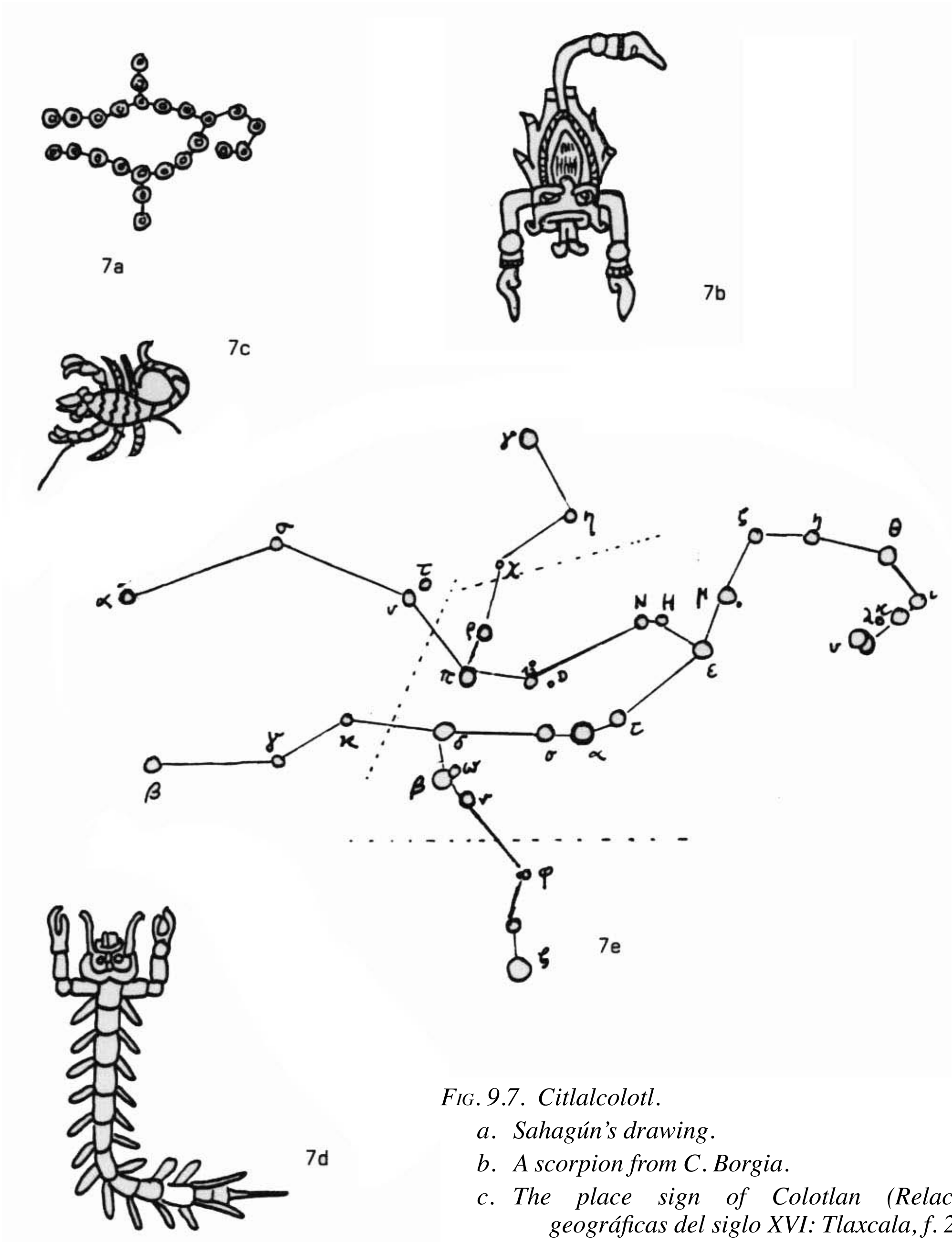

Fig. 9.7. Citlalcolotl.
- *a. Sahagún's drawing.*
- *b. A scorpion from C. Borgia.*
- *c. The place sign of Colotlan (Relaciones geográficas del siglo XVI: Tlaxcala, f. 286r).*
- *d. A scorpion or centipede shown in C. Fejérváry-Mayer.*
- *e. Citlalcolotl built from stars of Libra, Lupus, Ophiuchus and Scorpio.*

Discussion and analysis

Computer simulation was used to check the ancient information of time and direction of these stars for the years AD 1500, AD 1550 and AD 1600. Computer maps confirmed that the star constellations we have discussed were visible in the night sky of Tenochtitlan (Mexico City) during December at midnight and between 04:00 and 05:00 (Figs 9.8, 9.9; Table 9.2). There is no apparent deviation of position, and rising and setting times during the period of a century.

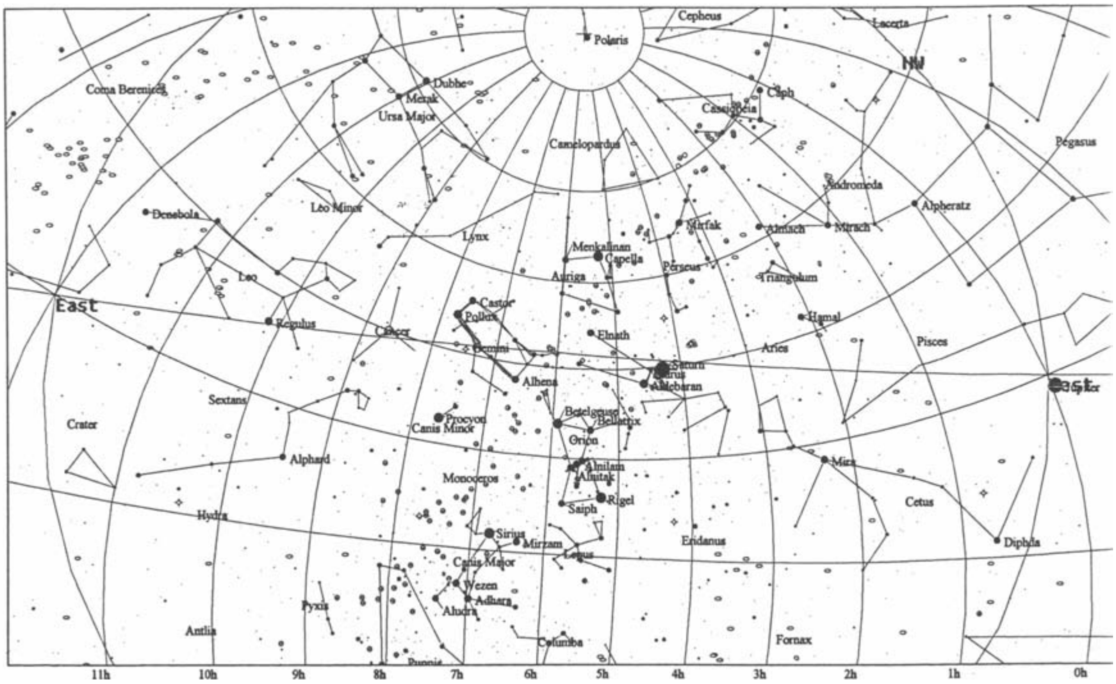

Fig. 9.8. Map of the sky for Mexico City at 00:00 on December 21, AD 1500.

Sahagún probably started collecting material on astronomy in Tepepulco in AD 1558, to judge by the few dates which accompany his work and according to the reconstruction of his work by modern authors (Garibay 1981, vol. 1, 14–15). His informants were educated Indians of the upper class, probably educated in a calmacac—a school for the sons of nobility—where astronomy was taught. Sahagún was aware of the highly developed astronomical knowledge of the Indians. He even had heard that the Mexica had special names for the stars (Anderson and Dibble, 1953–82, part xi, 168–9). However, he was not very pleased with the results of his interrogations and felt his

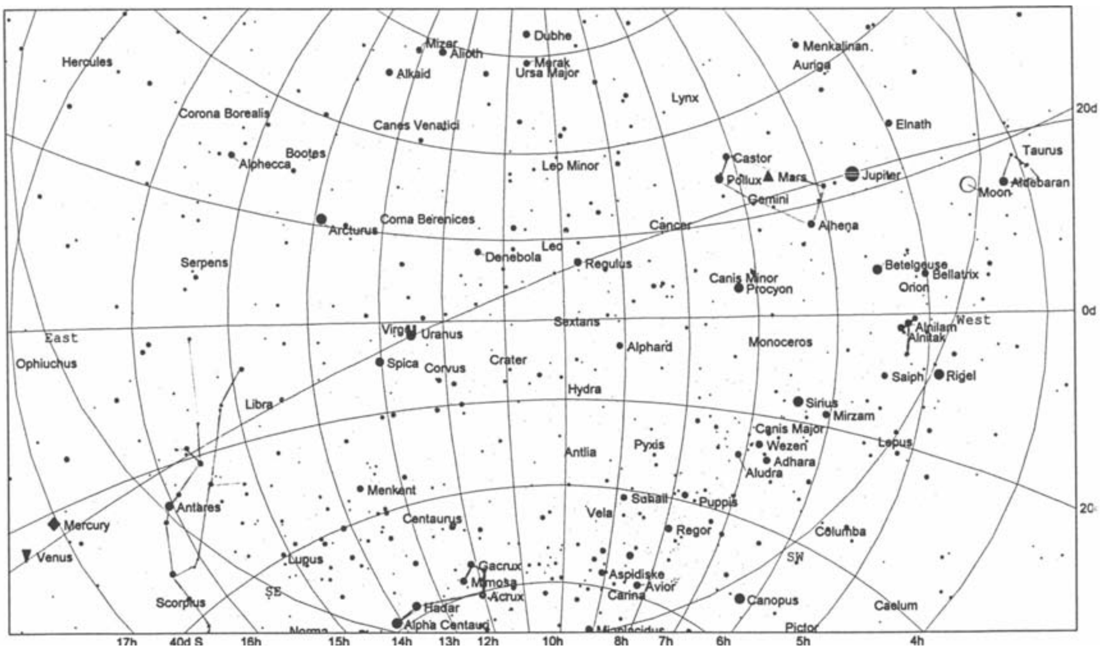

Fig. 9.9. Map of the sky for Mexico City at 04:45 on December 21, AD 1550.

Table 9.2. Rising and setting times and directions of the stars and constellations discussed, from Mexico City:
(a) on June 21, AD 1500 (upper table)
(b) on December 21, AD 1500 (lower table)

Stars	Rise	Direction		Direction
Orion (belt)	05:30	East	17:00	West
Hyades (Aldebaran)	03:45	ENE	16:30	WNW
Pleiades	02:40	ENE	15:45	WNW
Gemini (Castor and Pollux)	06:20	ENE	20:00	WNW
Crux (and α and β Cen)	14:30	SSE	22:00	SSW
Scorpio (Antares)	16:35	ESE	03:20	WSW

Stars	Rise	Direction	Set	Direction
Orion (belt)	17:30	East	05:00	West
Hyades (Aldebaran)	15:45	ENE	04:30	WNW
Pleiades	14:40	ENE	03:45	WNW
Gemini (Castor and Pollux)	18:20	ENE	08:00	WNW
Crux (and α and β Cen)	02:30	SSE	10:00	SSW
Scorpio (Antares)	04:35	ESE	15:20	WSW

material was inadaquate. The reason for this discontent was probably his approach to the subject, which was a theoretical one; he was questioning the Indians without observing the night sky together with his informants (see Schultze Jena 1950, 64).

Sahagún's concept of studying the Indian culture was based on European science (see Aveni 1980a, 39). He assessed Indian culture in relation to European concepts and principles of order. Sahagún studied in Salamanca. In the Old Library of the University of Salamanca is a large ceiling fresco painted by Fernando Gallego in AD 1480. This fresco is called the "cielo de Salamanca". It demonstrates the stars of the zodiac and the astronomy of the time. Sahagún's astronomical knowledge was based on this zodiacal scheme.

The astronomical knowledge of the Indian informants was based on a different conceptual scheme. The structure of their perceptions was formed in the context of another world-view. World-view effects the way thoughts are organised and concepts are formed, and moulds the way ideas are expressed and communicated. The statements of the Indians reflect their knowledge and training which was very different from Sahagún's (see Cledinnen 1991, 234–5).

The first page of C. Fejérváry-Mayer demonstrates the Mexican cosmos including directions, gods, the natural world with trees and birds, and time. Stars are associated with world order. The Indian informants describe to Sahagún the stars important in their view of the cosmos where time, space and direction are transferred into the sky. Tezozomoc's report confirms clearly that stars are part of the world order. Nezahuapilli's address reminded the new elected Mexican ruler of his obligations to the world, and to take on his official duties like his predecessors of supporting the existing cosmos by prayers, offerings and regular observation of the stars. In the Aztec view, the ordering of the terrestrial world into four regions is mirrored by the stars in the sky. Citlaltlachtli (Gemini) are the northernmost stars mentioned. Citlaltlachtli represents north. Mamalhuaztli and Colotl, both rising close to east and setting in the west, but visible at different seasons of the year, may represent these two directions. Colotl (Scorpius with other stars) runs with the sun during the winter: in December and January it is only visible shortly before dawn in the ESE. In the west at this time Mamalhuatzli is setting: it has been visible the whole night. In the south is Xonecuilli (the Southern Cross and pointers). In the winter sky these stars are visible during the early morning hours between 04:00 and 05:00. In the world order, the Pleiades, Hyades and the belt of Orion represent time, because these constellations rise or set at timely intervals of about three quarters of an hour. The new 52-year cycle starts with the Pleiades on the zenith and the New Fire ceremony. It assured the people that the present world and world-order would continue to exist. The Aztec calendar stone (see Aveni 1980a, 33, fig. 11), with the sign of the existing world, the sign "4 Movement" and with the stars engraved on one side, also reminds us that the stars reflected the existing order of the terrestrial world in the sky.

In conclusion, two ancient authors, Sahagún and Tezozomoc, both recorded the stars of ancient Mexico. They wrote with different intentions and aims, but mention the same stars. Having investigated this important fact in some detail, we conclude that the constellations reported by Sahagún and Tezozomoc apparently represent the Aztec view and world-order with respect to time, space, and cardinal directions projected into the sky.

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Appendix

Sahagún's texts concerning the stars (Nahuatl and Spanish) according to L. Schultze Jena (1950, 44–6, 56-8, from "Códice matritense del Real Palacio" ed. Francisco del Paso y Troncoso 1905–6) and Anderson and Dibble (1953–82, part viii, 11-13, 60-7).

Mamalhuaztli

Iniquac oya tonatiuh, yye tlayacavi, icuac çeppa tlenamaco, ic mitoaya: "Ovalvetz yiovaltecutli, yacaviztli! ye tequitiz, ye tlacotiz!".

auh inic opa tlenamaco, iquac yn tlaquauh tlapoyava. inic 3 tlenamaco, iquac yn netetequizpa.

inic 4 tlenamaco, iquac in tlpitzalizpa: auh yn machiyotl, yn mamalvaztli yoan miec yoan tiyanquiztli yquac nepantla omomanaco, nima ye ic tlatlapiçallo; ic mitoaya tlatlapiçalizpa.

inic 5 tlenamaco, yquac yn mitoaya ticatla, iquac nezovaya, vitztli mocui, nevitzmanalo, auh yn machiyotl, yn mamalvaztli yoan miec yoan tiyanquiztli omopiloto.

inic 6 tlenemaco, yquac y valcholoa citlali, auh ynic 7 tlenamaco, yquac yn tlatlalchipava, auh ym machiyotl quipatla in citlali, yn miec.

Yniquac valneci, valmotema, tlenamacoya, tlatotoniloya. yc mitoaya: Ovalhuetz in yoaltecutli, in yacauiztli. quen vetziz in youalli? quen tlathuiz?

Auh ynhin tlenamacoya expa, yn muchiuaya: yquac yn tlapoyava, tlaquauh tlapoyaua, yoan netetequizpan tlatlapitzalizpan, yquac hin neçoaya, neuitzmanaloya.

yc expa tlenamacoya: yquac yn tlavizcalleua, tlauizcalli moquetza, yn tlatlachipaua, yn ye tlathuinavac.

Auh ynic mitoa mamalhuaztli, ytech moneneuilia yn tlequavitl yehica yn yquac tlequauhtlaxo, ca momalmali yn tlequavitl, ynic vetzi, ynyc xotla, ynic mopitza tletl.

no yoan ynic nematlatiloya, ynic momatlatiaya toquichti, yehoatl quimacacia. mimacacia, y macaxoya, mitoaya, quilmach, yn aquin amo nematlatile, ymac tlequauh tlaxoz yn mictlan, yniquac omic.

yehica yn toquichti muchi tlacatl momatlatiaya, nenecoc ynmac quiuiuipanaya, quitetecpanaya yn innematlatil. yc quitlayehecalhuiaya yn mamalhuaztli yniuh vipantoc, tecpantoc, no yuh quiuiuipanaya, quitetecpanaya yn inmac ynnematlatil.

Hazia esta gente reuerencia y particulares sacrificios a los mastelexos del cielo que andã cerca de las cabrillas que es el signo del toro. hazian estos sacrificios y ceremonias qñ nueuamente parecia por el oriente depues de las puesta del sol. Despues de auer ofrecidole encienso, dezian ya salido youaltecutli y yacauiztli, que acontecera esta noche o que fin abra la noche prospero o aduerso. Tres vezes ofrecian encienso y deue ser porque ellas son tres estrellas, la una vez a p'ma noche. la otra vez a hora de las diez. la 3.ª quando comiença amanecer. –llaman a estas estrellas mamalhuaztli y por este mismo nõbre llamam a los palos con que sacan lumbre porque les parece que tienen alguna semeiança cõ ellas y que de alli les vino esta manera de sacar fuego. De aqui tomaron por costumbre de hazer vnas quemaduras en la moñeca los varones a honrra de aquellas estrellas. Dezian que el que no fuese señalado de aquellas quemadura quando se muriese que alla en el infierno avian de sacar el fuego de su moñeca barrenãdola como qñ aca sacã el fuego del palo.

Citlalxonecuilli

Tlanextia

Çan yyoca onoc, iyoca neztoc, tlanextitoc, cuecuepocatoc, auh ynic mitoa citlalxonecuilli ca quineneuilia.

Vel no yuhqui centlamantli tlachichiualli, tlaxcalli anoço tzoualli, nenecoc cecentlapal quacoltic, quateuilacachtic.

xochihuitl ypan yn quaqualoya, noviyan cecencalpan quitzacutimanca, yn noviyan techachan nechiuililoya.

A las estrellas que estan en la boca de la bozina llama este gente citlalxonecuilli. pintanlas a manera de ese rebuelta siete strellas, diezen que estan por si aptadas de las otras y que son resplandecientes. llamanles citlalxonecuilli porque tienen semejãça con cierta manera de pan que hazen a manera de ese al qual llaman xonecuilli, el qual pan se comia en todas las casas vn dia el año que se llama xuchilhuitl.

Citlalcolotl

Çan onoc tlanextia.

Çan no yuhqui quineneuilia, quinamiqui yn itlachieliz tequani colotl cuitlapilcocoltic; mamalacachtic, teteuilacachtic yn icuitlapil. ypampan yc mitoa citlalcolotl.

Aquellas estrellas que en algunas ptes el carro, esta gente las llama esculpiõ porque tienen figura de esculpion o alacran.

10

The Mexica (Atzec) Milky Way

Carmen Aguilera

Introduction

The female aspect of the Milky Way played a very important rôle in Mexica (Aztec) religion and culture. Even today, the image of the Milky Way as *La Llorona*, "The Weeping Lady", is still very much alive in Mexico. The object of this paper is to review briefly Mexica beliefs about, and images of, the Milky Way from earliest times to the arrival of the Spaniards in 1519.

The Mexica (AD 1168–1521) came from the desert areas in the north of the Mexican republic. They reached the periphery of the Toltec empire (AD 900–1168) around the eleventh century. In the beginning, the Mexicas served only as mercenaries for the Toltecs, but as a result of their contact with that civilization their desert culture was considerably enriched. They were so eager to succeed that within roughly two centuries they had come to control most of Mesoamerica and had become the richest, most feared people in the land.

Citlalinicue, the goddess of the Milky Way

Citlalinicue, "She of the Starry Skirt", was the ancient goddess of the Milky Way. Another name for Citlalinicue is Citlalcueitl, which has the same meaning, and Serna (1953) says explicitly that Citlalcueitl is the Milky Way. Her name is a clear simile for the astral body. It has to be remembered that the skirt of indigenous women consisted of a very long strip of cloth pleated to fit a woman's waist. The particular skirt of this Indian goddess was dotted with stars. These were the eyes of the night and, in Mesoamerica, they were represented as round white discs, sometimes with a red eyelid.

The first mentions of the Milky Way in Mexica sources date from the Classic period (AD 200–750), when Teotihuacan was the most important city in central Mexico, and from the Early Postclassic (AD 950–1168), when Tula was the capital of a powerful empire. The veneration of this astral body in the clear northern desert skies of Mexico had very probably originated hundreds of years before.

During the Classic period, Citlalinicue was already an important goddess. Legend relates that she sent sixteen hundred men to Teotihuacan, no doubt to subdue this empire. However, all of the warriors died, in other words they were defeated (Historia de México 1985, 109) and the goddess did not have her way.

In the beginning, Citlalinicue acts by herself with no companion or husband; this seems to indicate an epoch in Mesoamerica when women played a preponderant role in the culture. In later accounts, Citlalinicue has a partner called Citlalatona, "Shining Stars", but her name is mentioned first in Anales de Cuauhtitlan (1992, 9), Leyanda de los Soles (1992, 120) and *Codex Vaticanus* (Códice Vaticano-Rios 1964, III:XV). Only later did the Franciscan friar, Gerónimo de Mendieta, mention the name of Citlalatona first and then Citlalinicue in second place (Mendieta 1945, I:80).

Citlalinicue's deeds

Citlalinicue lived in the highest heaven and for this reason she would never die (Historia de los Mexicanos por sus Pinturas 1985, 69). She was the regent of each *trecena* or "week" of the *tonalpohualli* or ritual calendar, where she was drawn at the top (Codice Borbonico 1980, 3–20) to indicate her high position and status. Her importance can be measured by the fact that she was known as the creator of the stars, the sun, and the moon (Historia de México 1985, 110). After this she mothered all the gods, who then had the duty to serve her. In another legend, the earth existed but was dark, so she joined two of her sons, the gods Tezcatlipoca and Quetzalcoatl, in making a sun (*ibid.,* 109).

Once Citlalinicue created the stars, the gods, the sun and the moon, Tlontli the hawk suggested that she needed men to serve her (Mendieta 1945, I: 78). Quetzalcoatl went to the underworld to obtain bones from a former humanity in order the create the new men.

Citlalinicue was also responsible for giving animals their characteristics. She decided that Yappan, the scorpion, should not have an apparent head and should have its arms raised (Serna 1953, 227–8). Tezcatlipoca, under Citlalinicue's orders, cut his head off because he had sinned with Xochiquetzal, at which moment he raised his arms in despair.

Citlalinicue in the Codices

Citlalinicue appears in the *Codex Borbonicus* (Códice Borbónico 1980) as an old lady; she exhibits wrinkles (Fig. 10.1). Her head is a skull, showing that she is a dreadful heavenly being, already dead to the world but forever alive in heaven. Her open mouth with visible teeth and a red tongue indicates that she is hungry and thirsty for the flesh and blood of men (Aguilera n.d.a). She has the dark curly hair of the night gods, with small banners that signify death, because she brought death to men. She wears the *quechquemitl*, the upper garment of ancient goddesses, and the two skirts of the Milky Way: the first is as blue as the day sky, with white discs, and the second, called specifically *citlalinicue* ("Star Skirt"), is red with a border of sea shells.

Fig. 10.1. Citlalinicue*, from* Codex Borbonicus *(after Códice Borbónico 1980, 9).*

The Milky Way in Toltec times

In the Toltec era the name of the Milky Way changes from Citlalinicue to Cihuacoatl. The *Leyenda de los Soles* states that the god Quetzalcoatl of Tula still prayed to Citlalinicue and Citlaltona (Leyenda de los Soles 1992, 8), but in another story both gods disappear, and the creators of humanity are Quetzalcoatl the emissary and Cihuacoatl the creator goddess. Here, it is Qutezalcoatl who went to the underworld to obtain bones from a former humanity in order to create a new one. On the way back, his companion fell and the bones broke into pieces. This is why there are men of all sizes. After the incident, Quetzalcoatl took the bones not to Citlalinicue but to Cihuacoatl, "Serpent Woman". This goddess ground the bones, Quetzalcoatl drew blood from his penis over them, and men were created (*ibid*., 12).

Two stories that tell of the birth of Quetzalcoatl as a semi-god also reflect the change from Citlalinicue to Cihuacoatl. According to the first:

> A god that called himself Citlaltona, that is the sign seen in the sky called Camino de Santiago, "Saint James Road", or the Milky Way, sent an ambassador from heaven with a message to a virgin in Tulan called Chimalma, "Shield". She had two sisters, one called Coatlicue and the second Xochitlicue. When they saw the ambassador they were frightened and died. The ambassador said to Chimalma that his lord wanted to have a child with her. The virgin got up and swept the house and, as soon as she did so, she conceived and bore a son who was called Quetzalcoatl (Códice Vaticanos-Rios 1964, III:XV.)

In this legend Quetzalcoatl is born from Citlaltona as a Chimalma, a mortal, rather than Citlaltona's wife.

In the second story, Quetzalcoatl's father is Mixcoatl, "Cloud Serpent", another name for the Milky Way. Mixcoatl inaugurated the New Fire ceremony in heaven and invented war on earth in order to capture prisoners whose blood would feed the gods. He descended to earth as a warring Chichimec, a desert dweller, to secure victims for sacrifice. He conquered many peoples thanks to a magic deer that Cihuacoatl had given him; in reality it was the goddess herself in one of her disguises (Historia de los Mexicanos por sus Pinturas 1985, 40).

Near Tula, Mixcoatl fell in love with Chimalma. He shot her repeatedly with his arrows until she accepted him and became pregnant. Cihuacoatl, in a jealous rage, took the miraculous deer away and Mixcoatl's victorious streak came to an end. In due course Chimalma gave birth to Quetzalcoatl, but she died in childbirth and Mixcoatl took the baby to be raised by Cihuacoatl (Leyenda de los Soles 1992, 124). In this story Quetzalcoatl is born, as before, from Chimalma but the father is now Mixcoatl. He (Mixcoatl) is subsequently killed by some of his other children, and Quetzalcoatl finds his remains, burying them at the Tlillan Calmecac, Cihuaccatl's temple.

The sources never say explicitly that Cihuacoatl is Mixcoatl's celestial wife, but the data in the legends confirm it. Cihuacoatl always protects Mixcoatl, who wanders on earth but always returns to her. The best evidence, however, is that the new gods of the Toltec Milky Way are Cihuacoatl ("Serpent Woman") and Mixcoatl ("Cloud Serpent"). Both are appropriate similes for the Milky Way. This probably alludes to the fact that in winter the Milky Way seems divided into two cloud snakes.

The Mexicas adopt Cihuacoatl

The city of Tula fell to nomadic peoples from the north in AD 1168, and a group of migrating Toltecs installed the lordship of Culhuacan on an elevated peninsula in the south-eastern part of the five lakes of the Basin of Mexico. Being Toltecs, their patron deity was Cihuacoatl.

When the Mexicas arrived in the valley, Culhuacan was a thriving city. To emulate the Toltecs, whom they admired, they adopted Cihuacoatl as their goddess. Later, with the apotheosis of Huitzilopochtli, they modelled Coyolxauhqui after Cihuacoatl (Aguilera 1978; n.d.b), but without displacing Cihuacoatl as the main Mexica goddess (Códice Florentino 1979, I: fo.2v). The present study is concerned only with Cihuacoatl.

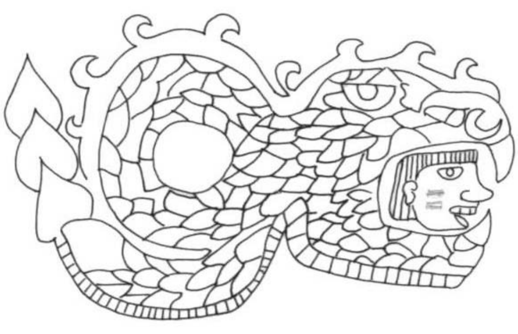

Fig. 10.2. Cihuacoatl, from Codex Huamantla *(after Códice de Huamantla 1984, 16).*

The main source for the study of Cihuacoatl in Mexica times is a legend recorded by the Franciscan Juan de Torquemada (1975, I:117). Herein the goddess declares that she is the sister and friend of the Mexica people and discloses four of her names that tell of her character and attributes: Cihuacoatl, Cuauhcihuatl, Yaocihuatl, and Tzitzimicihuatl.

Cihuacoatl ("Serpent Woman"). Cihuacoatl as a snake is represented in the *Codex Huamantla*, the largest cartographic codex known (Aguilera 1984). It was painted by the Otomi people from Huamantla, a town east of the city of Tlaxcala, around 1580. The face of the goddess emerges from a green rattlesnake (Fig. 10.2). Her face has two small rectangles on the cheeks to denote the syllable *hua* of *cihuatl* which means "woman", leaving no doubt about the gender of the deity. Another Serpent Woman appears in the Florentine Codex (Códice Florentino 1979, I: fo.3r) in a less spectacular representation. There she is shown as an omen that announces the fall of Tenochtitlan. She is pictured as *La Llorona*, the "Crying Lady", because of the terrible fate that awaits her children, the Mexicas.

Even today, in all parts of Mexico, *La Llorona* wails at night, especially in the rural areas. She appears to man as a beautiful woman dressed in white like a palace lady, who attracts men only to disgrace them. The real Cihuacoatl, however, is different: "She is an evil omen, a savage beast, dreadful, that wailed at night like a coyote and frightened people" (Códice Florentino 1979, I: fo.2v).

Cuauhcihuatl ("Eagle Woman"). The eagle is astral because it flies very high. It is an eagle that appears to the Mexica at the beginning of their pilgrimage and invests them with the insignia of true Chichimecs: the bow, arrows, and the *chitatli* or basket to carry the products of the hunt or the hearts of men (Fig. 10.3). She paints a stripe across the faces of the Mexicas with a black ointment and glues eagle down to their ears. Some authors have argued that the eagle is Huitzilopochtli the sun, but the arrow piercing her underbelly indicates that she is Cihuacoatl, whom two Mexica captains tried to shoot. This seems to prove that the eagle is Cihuacoatl, as Cuauhcihuatl, and not Huitzilopochtli.

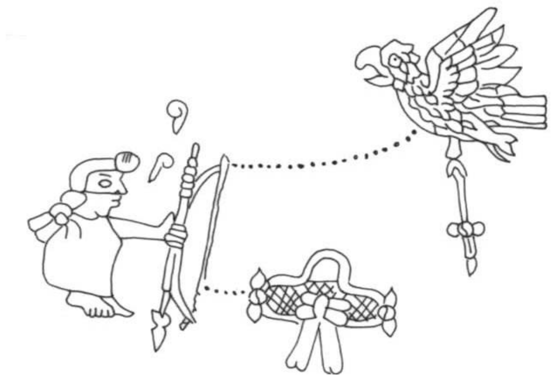

Fig. 10.3. Cuauhcihuatl, from Códice Tira de la Peregrinación*, a manuscript dating to the second half of the 16th century, in the Bóveda Documentos Pictográficos, Museo Nacional de Antropología, México, D.F.*

Yaocihuatl ("Woman Warrior"). Yaocihuatl, as the eagle, is the epitome of aggressiveness and war. She appears as a warrior in the *Codex Telleriano-Remensis* (1985, 46) (Fig. 10.4). Her name-glyph is the *atl-tlachinolli*, "water fire", the symbol of war. Another significant element is the *cuauhpilolli* or "hanging of eagle feathers" that relate her to Mixcoatl her husband. The *cuauhpilolli* is the emblem of the Milky Way and among the male gods only Mixcoatl wears it. Yaocihuatl's gold earplug and noseplug indicate that she is an astral fire. She wears a rich necklace fringed with gold bells, a *quechquemitl* or upper garment, and her dark-coloured skirt, like the night, has eagle down balls in place of the discs or stars. Another important piece of her attire is the *maxtlatl* or loincloth, a male garment. It means that the goddess Yaocihuatl, brave and manly, is a fearless warrior.

Fig. 10.4. Cihuacoatl as Yaocihuatl, from Codex Telleriano-Remensis *(after Codex Telleriano-Remensis 1985, 46).*

In the Codex Magliabechiano (1983, 79), she appears as Citlalinicue and as Yaccihuatl (Fig. 10.5). The head is very similar to the one in Fig. 10.1; she wears a short blouse or *huipil*, a blue and white necklace, a blue pectoral that is related to fire, and over it a gold disc that signifies fire and light. Her skirt is now as black as the night sky with the white stars, and in the border appears the *citlalinicue* with a red fringe and shells. We know she is Yaocihuatl because she wields weapons, the *tzotzopaztli* or weaving stick that she uses as a sword in her right hand, and the shield and the banner of death in her left hand.

Tzitzimicihuatl. The etymology of this word is probably a repetition of the onomatopoeic syllable *tzi*, the sound the arrow *mitl* makes when thrown, and *cihuatl*, "woman". The Spaniards translated the word as "Infernal Woman", but for the ancient Mexicas the *tzitzimitl* was an awesome feminine astral being that dwelt in the sky, a woman who, having died in childbirth, has ascended to heaven as a star. However, her head is a skull because after death everyone becomes a skeleton, and as such she will appear at the end of time. Citlalinicue is portrayed as Tzitzimicihuatl in Figs 10.1 and 10.5.

Fig. 10.5. Cihuacoatl as Tzitzimicihuatl and Yaocihuatl, from Codex Magliabechiano *(after Codex Magliabechiano 1983, 79).*

Conclusion

Citlalinicue, the Milky Way, was venerated at least as far back as Classic times. Her name changed with time, but not her importance or main attributes. The Toltecs called her Cihuacoatl, and later the Mexicas also worshipped her. Citlalinicue or Cihuacoatl created the sun, the moon, the stars, and the gods who, under her command, created men and the animals. The goddess had four names that are portrayed in coloured images in the codices. Each detail of her attire reiterates her attributes, power, and importance. In this case, as in others, it was found that the glyphic way of writing, with forms and colours, says much more than the four names Torquemada mentions in his story. The study also shows the power of women among the Mexicas, as well as among other ancient cultures of Mesoamerica.

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11

Hunting the European sky-bears: the Candlemas Bear Day and World Renewal ceremonies

Roslyn M. Frank

Abstract

The "good-luck visits" and other related performance pieces represented during the European Spring Carnival period are analyzed with respect to their connections to the pan-European set of Hartzkume (Bear Son) folktales and related social practices. It is argued that these are best understood as remnants of ritual behaviour motivated originally by Bear Ceremonialism. When they are read through the cognitive frames and image schemata pertaining to this earlier pattern of belief, their connections to the more archaic cosmovision and the conviction that humans descended from bears, come into focus. The genre of the "good-luck visits" is explored in detail as well as its linkages to Candlemas Bear Day and the timing of the beginning of Carnival. By means of cross-cultural analogies to other ritual theatrical pieces, e.g., those of Saami and Algonquian peoples, the "proxemics" of the European performances—that is, the ways in which space is manipulated symbolically—are examined, particularly in reference to the manner in which the backgrounded cosmovision with its figure of a Celestial Bear is commented upon in the performances. Finally, two Pyrenean performance pieces, the Basque Maskaradak and Pastoralak, are put forward as prototypes of the genre in question.

Introduction

Scholars have long assumed that the European spring rituals, grouped under the rubric of Carnival, represent indigenous phenomena that from the early Middle Ages onwards were simultaneously suppressed and reinterpreted by the emerging Christian elite. The Christian reinterpretation of these folk rituals centres on ceremonies related to the death and resurrection of the anthropomorphic figure of Christ. Yet it would appear that in Europe the older indigenous scenario was one in which the Bear Son, the half-bear, half-human intermediary, played a major role along with other celestially coded Spirit Animal Guardians. In addition, collectively considered, in Europe these spring-time performance pieces appear to have functioned as World Renewal Ceremonies intended to ensure the health and well being of all creatures (Frank 1999a). Moreover, in the timing of the ceremonies themselves we can detect the presence of ritual calendar keepers, a class of proto-astronomers. Undoubtedly such individuals played a key role as overseers of ceremonies dedicated to renewing the cosmic order and balance as well as determining the actual date when such rituals were to be initiated. The present study will examine the European data through the cognitive filter provided by a cross-cultural analysis of data emanating from other geographical zones where performances related to the Celestial Bear have been recorded. In this way the backgrounded symbolism and morphology of the European performances will be brought into clearer view.

Overview of European Celestial Bear ceremonialism

The Great Bear constellation has been classified as belonging to the most archaic stratum of star figures. It has been assumed that scenes portrayed by certain other constellations were associated with some half-forgotten sky text handed down to us, albeit incompletely, through Greek mythology (Gingerich 1984). Although previously, in Europe, no archaic set of stories connected to the Sky Bears had been clearly identified, extensive fieldwork over the past twenty years in the Basque region of the Pyrenees allowed me to discover the existence of an archetypal hero called Hartzkume. In Euskera (Basque) the name Hartzkume translates as Little Bear. The figure of the Bear Son, born of a Great Bear and human female, far from being exclusive to the Pyrenean zone, is identified with a cycle of stories and related ritual performances found throughout Europe. Today the latter include a mimed bear hunt and what are called "good-luck visits". These folk performances are related to Candlemas Bear Day and the Carnival period. Indeed, variants of these stories and related ritual practices have survived surprisingly intact into the twentieth century (Alford 1930; 1931; 1937; Fabre 1986; Frank 1996; Molina González and Vélez Pérez 1986). Indeed, they constitute a rich legacy of popular performance art still encountered in many parts of Europe. As we shall see, the performance pieces have acted as a vehicle for the cultural storage and preservation as well as oral transmission of the tenets of the earlier European belief system, through mechanisms typical of oral cultures. These include public dramatizations and vignettes that reproduce scenes from this earlier cosmogonic story of ursine origins.

The Bear Son tales themselves represent the most common and widespread motif of European folklore (Cosquin 1887; Frank 1996). The widespread distribution of the motif is best understood once we recognize that we are dealing with relatively archaic materials deriving from an earlier European ecocentric[1] cosmovision. The latter continue to project the tenets and ceremonial practices related to the earlier European story of origins, namely, one that holds that human beings descend from bears. Indeed, for Europe there is reason to believe that the Bear Ancestor progenitor of humans is linked symbolically with both the Great Bear and Little Bear constellations. In fact, it would seem that these two star figures represent the exteriorization of the earlier belief system itself with the tracings in the sky acting as visual supports, as a kind of pictorial mnemonic. They were illustrations that aided the tellers in the narration of the tales.[2] In addition, as we shall see, the metaphorical understandings projected and manipulated by the ritual space(s) of the belief system itself make repeated reference to the backgrounded star figures. They are part of the conceptual grid upon which the cosmogonic drama is played out.

The Bear Son's adventures portray the protagonist first as a young shaman apprentice, a medicine man initiate who sets out on a vision quest to acquire his Spirit Animal Guardians and his medicine bundle (Frank, n.d.b). Indeed, the scenario is quite similar to the age-old vision quest known as *hambleceya* encountered among the Plains Indians of North America, a ritual that is a focal point in the religious life of most Native Americans (Brown 1990, 1993; McGaa 1990, 75–83; Time-Life Books 1992, 125). Later, as an adult, the Bear Son engages in a series of ritual battles with another shape-changing shaman while the latter character has his own Spirit Animal Guardians. The battles between the two shamans take place on a ritual landscape typical of shamanism where the hero is seen climbing or flying up and down along a vertical axis. In some cases the movement is from Middle Earth (where we reside) to the Under World. In others the shamanic figure's journey takes him from the Upper World back down to Middle Earth.[3]

According to the spatial coordinates intrinsic to such a shamanistically coded landscape, the vertical axis is often portrayed as a smoke-hole, a shaft. It is through this aperture that the healer intermediary descends and ascends on his journeys, for example when seeking information about his patients, hunting and retrieving their "lost souls" (cf. Brunton 1993; Frank 1996, n.d.b; Hoppál 1992, 1993a, 1993b). In a sense, the ritual journeys of the shaman healer are directly linked to the actions carried out by the spirit of the earthly bear representative itself. A fundamental component of Bear Ceremonialism has been a bear hunt in which the ancestral animal was sacrificed and its blood and flesh eaten at a banquet (cf. Milkovsky 1993; Shepard and Sanders 1992). Today in Europe such hunts are encountered as performances in which a human actor mimes the role of the earthly bear. Subsequently, there is a ritual intended as a sending home ceremony in which the earthly bear's soul is sent back up the Sky Pole to heaven. Once there, it gives a report to the Great

Sky Bear concerning the overall comportment of its human descendents, for instance, whether they treated the animal properly prior to killing it, whether they expressed their humility and gratitude for the sacrifice made by the animal when it gave up its life (Frank 1996, n.d.c; Hollingsworth 1891).

In short, the earthly bear's report served to inform the Celestial Bear of the details of the behaviour of its human offspring (Frank n.d.c). A positive report card guaranteed the health and well being of the Celestial Bear's human descendents. If the ceremonies were properly performed, in the spring the bones of the earthly bear would take on flesh anew in the form of bear cubs. Meanwhile the souls of all the other beings were thought to be released by the bear in the spring when it awoke from hibernation (Chiclo 1981; Elgström and Manker 1984; Fabre 1986; Lebeuf 1987; Praneuf 1989; Tiberio 1993). Hence, as we shall see, in Europe the date assigned to the awakening of the bear has been linked to the beginning of the World Renewal Ceremonies.

In the tales and related folk performances found across much of Europe, the Bear Son hero often appears dressed as a bear or bear shaman alongside his traditional Spirit Animal Guardians.[4] Ritual bear hunts are still performed in the Franco-Cantabrian region and the Pyrenees, where today they are acted out publicly during the period of Spring Carnival although also at times during Winter Carnival. In Andorra, for example, the *Festa de l'Ossa* is celebrated during the period of Spring Carnival and on December 26 (Praneuf 1989, 62; Giroux 1984). The main character, a live bear or an individual miming him, is regularly accompanied by a number of musicians and false faces, masked figures representing the Bear Shaman's Spirit Animal Guardians (Fig. 11.1). In many parts of Europe the Bear Shaman and his/her bear(s), along with the other guisers (masked performers), once at their destination, still perform an abbreviated play in which the bear's hunt, death and resurrection are re-enacted. In the Pyrenees these folk plays integrate events contained in the cosmogonic story of ursine origins. Indeed, in some locations scenes from the initial chapters of the Bear Son story are recognizable elements in the performances. In many cases a rather ribald report, a sermon, that calls into question the behaviour of the members of the audience is read or sung by a member of the troupe of actors and musicians (for a discussion of contemporary samples of such "sermons", see Fabre 1986; Fernández de Larrinoa 1997).

Fig. 11.1. Bear Leader and Musicians. Source: Engraving from Olaüs Magnus, Historia de Genitbus Septentrialibus*, Rome, 1555. Reproduced in Michel and Clébert 1968, 329.*

As we shall see, when considered collectively—particularly in terms of their ritual role as shamanic healers—the European performers differ little from the members of the societies of medicine men and women found among Native Americans (Time-Life Books 1992, 141–8). For instance, the European "good luck visits" were conducted for the purpose of healing: they were perceived as ceremonies with specific cleansing and prophylactic functions (for a detailed discussion of the typology of the "good luck visits", see Halpert 1969). As such they were considered fundamental in order to guarantee the health and well-being of the household visited and all its inhabitants. In addition, the "good luck visits" appear to have acted also as a complex mechanism for inculcating and reinforcing the belief in the importance of proper behaviour, i.e., in behaving according to the tenets of Bear Ceremonialism itself. Thus, there was an educational component involved in such visits.[5]

In Europe the ritual cleansings included fumigations, incensing by smoke and flailing the person with aromatic branches. Such ceremonies recall similar healing techniques involving smudging with the sacred smoke of juniper branches, still performed today by Native American medicine men and women (Brunton 1993, 138).[6] In short, from a comparative point of view the European whipping customs are perhaps better understood not as "punishments, but kindly services; their purpose is to drive away evil influences, and to bring to the flogged one the life-giving virtues of the tree from which the twigs or boughs are taken" (Miles 1912, 207). For this purpose wands were often constructed from a birch bough with all the leaves and twigs stripped off, except at the top, to which oak-leaves and twigs of juniper pine were attached along with their bright red berries. Devoid of decoration these rods or switches became splint broom-like devices which were used to sweep away unhealthy influences.[7] Pig bladders attached to poles were also used in such prophylactic flagellations. In short, blows delivered by the switches and bladders were believed to ensure good health and to promote fertility in animals and humans alike as well as the fruitfulness of crops. They were intended to bring about prosperity in general. In sum, a major motivation for the European performances lies in the fact that the motley crew of masked actors along with their earthly bear or a man dressed as a bear, was (is) believed fully capable of carrying away with them the illnessess and misfortunes of their patients (Frank 1996; Vukanovic 1959).[8]

Timing of the European World Renewal Ceremonies

In order to examine in more detail our hypothesis that the timing of the Spring Carnival period in Europe was directly motivated by the tenets of Bear Ceremonialism, we need to turn our attention to the astronomical significance of Candlemas Bear Day. In reference to the European Celestial Bear, Gaignebet (1974) appears to be the first to offer a lunar-based ethnoastronomical explanation for the well-known European folk belief related to February 2, the day the bear (or the groundhog in the USA) supposedly emerges from its lair. Gaignebet's interpretation contrasts with the modern solar-oriented version of the belief which portrays the bear as a kind of weather forecaster. If it is cloudy, he will not see his shadow and spring will begin immediately. Hence, in the modern solar-oriented reading of the folk belief, the bear will not go back to sleep. If, on the other hand, when he emerges from his cave it is sunny, the animal will see his shadow and go back inside with the result being another six weeks of winter.

In 1987 Lebeuf published a remarkable article which served to correct several errors in Gaignebet's astronomical calculations.[9] Nonetheless, Gaignebet seems to have been the first to argue that originally it was the lunar shadow with which the folk belief was concerned. Consequently, we discover the bear observing the moon's phases, in other words the presence or absence of a moonlight shadow. The observation of the lunar phases serves to synchronize the luni-solar calendar and determine the date of the first full moon after the Spring Equinox. In Christian tradition the latter movable feast is identified with the first Sunday after the spring Equinox and the resurrection of Christ in preparation for the ascension of his soul and return to heaven.

Lebeuf (1987) suggests that the lunar observations conducted on February 2 actually triggered the date of the beginning of the bear hunt itself. Obviously, such celestial observations were carried out not by a bear, but rather proto-astronomers as part of a ritual process of synchronizing and adjusting their luni-solar ceremonial calendar. Nonetheless Lebeuf, in his own discussion of the problem, describes the scenario as if it were the bear himself who "wakes up" and examines the night sky. Specifically, the scenario can be summarized in the following way, keeping in mind that ultimately the folk belief refers to an earlier stage of actual observation of the lunar phases for ritual purposes. According to Lebeuf (pers. comm. 1993), if on the second of February when the bear wakes up in the morning, i.e., at the end of night, and looks up at the sky, he doesn't see the last crescent any longer, it means that the moon is near conjunction. In that case, one and half lunar cycles later, the full moon will fall on the first day after the spring equinox (March 21). Hence, the date of Easter will coincide with its root or earliest possible date. Preparations for the bear hunt and the Carnival period itself must begin immediately. As a result, the bear cannot possibly go back to bed. If, on the other hand, in the evening of the second of February, the bear already sees the new crescent in the evening sky, it means the full moon some forty-five days later will have occurred one or two days before the equinox. Hence, the date of Easter will be relegated to its latest possible limit, April 23. Furthermore, Urbeltz's interpretation concurs with that of Lebeuf for he argues that the bear figure literally brings in the Carnival period, leading the procession on the first day (Urbeltz 1994).

Identifying European and New World parallels

Since most Europeans are unfamiliar with the basic tenets of the shamanic cosmovision associated with Celestial Bear Ceremonialism among traditional peoples world-wide, before examining a concrete World Renewal Ceremony from North America, we need to summarize the main patterns of this belief system itself. We can begin by stating that it is a cosmovision that has at its centre a Celestial Bear along with the related conviction that humans themselves descend from bears: they have animal ancestors. Our overview will allow us to identify, classify and, consequently, bring into clearer focus certain structural elements embedded in the European Carnival period and related performances. These are aspects that otherwise might go unattended cognitively; in other words the viewer may be unaware of the backgrounded cognitive material that shapes the performances. Stated differently, once the morphology of the traditional cosmovision associated world-wide with Bear Ceremonialism has been investigated in more detail, we will perceive that the symbolism of its "proxemics", i.e., the spatial relationships,[10] encountered in the performance pieces and their related metaphysics, is connected to the cognitively backgrounded figure of the Celestial Bear constellation, Great Bear, and the associated shamanistically coded belief holding that humans descended from bears. Yet such spatially embedded meanings frequently go unnoticed or misread by an individual not conversant with the cultural coding of the traditional imaginary/imagery in question. This effect can be explained by the fact that such an outsider is normally competent only in interpreting image schemata from his or her own cultural system, which for many is grounded in the belief in an anthropomorphically imagined high god(s). Thus, such an individual works with a different logic of metaphorical understandings, a different conceptual framework, in which only certain things "count" as part of the mapping, and they "count" only in certain systematic ways (Turner 1991, 175).

On the other hand, once the metaphorical understandings intrinsic to the cultural system underpinning Bear Ceremonialism are brought into focus, elements previously viewed as unimportant will become highlighted and attended to cognitively. Otherwise the cultural outsider will draw, quite automatically, on his or her interpretative competence based on the cognitive grid provided by the culturally backgrounded meanings found in his or her own cosmogony. Furthermore, these metaphoric understandings are for the most part automatic, non-reflective: they are not based on extended discursive commentary. As a result, a cultural outsider will not necessarily be aware of his or her misreading of a given "text", e.g. the misapprehension of the meanings manipulated ritually by the performance piece in question as well as the proxemics embedded in it. The reading or understanding of the spectator is based on his or her interpretative competence of the metaphoric coding of the elements being brought into play, elements that derive ultimately from this earlier pan-European ecocentric cosmovision and its exteriorization in the two Bear constellations, Great Bear and Little Bear.

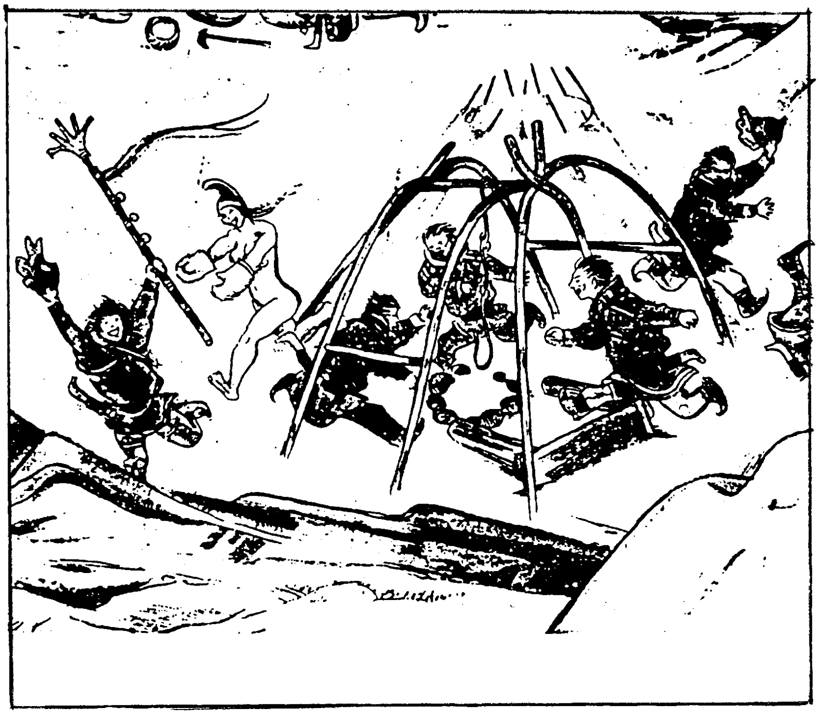

Fig. 11.2. Saami sexual revelry (Elgström and Manker 1984, 25).

Once the European data are reframed in this way the structural parallels will become apparent. For example, we shall find striking similarities between the World Renewal Ceremonies of the Munsee-Mahicans of Canada and those of Europeans. We shall discover that in both settings ritual acts linked to the bear's return to the world are keyed by lunar events; in both cases there are elaborate performances carried out by masked actors who, in the case of Europe, are also perhaps best described as False Faces. Indeed, their actions point to the prior existence in Europe of what might be better categorized as relatively highly structured societies of medicine men (and women), local healers and their retinue who combined herbal and psychic curing techniques with performance art, dance, song and mime. These were the individuals in charge of conducting the "good-luck visits". Today these performances are relatively informal in nature. Yet when the duties of these European actors are reframed conceptually by the shamanic structures found in the New World data, their functions become more obvious. These are:

1) coordinating and acting out public reenactments of the cosmogonic story of origins;

2) conducting communal "good luck visits"; and

3) participating in a final apocalyptic "war dance", a ritual closure reconciling the colour-coded opposing, yet complementary, "poles of being".

It can be alleged that in Europe such communal encounters also served to reaffirm the group's cultural identity and, in the process, to celebrate anew their relationship with their ancestors. The latter, in turn, were visualized not only as bears but also in the form of other Spirit Animal Guardians who aided the archetypal shaman apprentice on his vision quest and subsequent journeys.

In the section that follows we shall review the tenets of Celestial Bear Ceremonialism as they are manifested among Finno-Ugric and Altaic peoples focusing on the spring hunt and the portrayal of an earthly bear willingly giving up its life at the hands of its human hunter descendents. The hunters, too, are fully appreciative of the great sacrifice made by the animal. Thus, the hunters initially beg the bear's forgiveness. Then after the earthly bear is killed and skinned, he becomes the guest of honour at his own last supper where the participants, including the bear itself, partake of a meal consisting of the animal's own flesh and blood. The fresh skin and head of the newly sacrificed bear are usually decorated, the head especially being decked out with ribbons and flowers, and placed at the head of the table so that the animal can take part, at least symbolically, in the banquet held in its honour. Finally, after some days of feasting and related ceremonies, including revelry and sexual excesses (Fig. 11.2), the soul of the earthly bear is sent back home, back up the great Sky Pole to where the Celestial Bear Ancestor resides among the circumpolar stars (Elgström and Manker 1984; Hallowell 1926; Labbé 1903; Scheube 1882). Through ritual performances the spirit of the earthly bear, the one actually killed, is sent back to the Upper World so that it can give a detailed report to the Celestial Bear Ancestor concerning the comportment of its human offspring (Chiclo 1981; Milokovsky 1993; Shepard and Saunders 1992).

In some cases, such as that of the Saami of Lapland, great care must be taken so that none of the bear's bones is broken in the process of preparing the meat. Subsequently, the slain bear's skeleton is carefully placed in a small cairn, an artificial dolmen-like cave constructed specifically for that purpose (Fig. 11.3). In fact, it is widely believed that the bones of the slain bear take on flesh and return to life "born again as cubs within a year or so, provided that the slaying has been done in conformity with certain rules" (Speck 1945, 57).

Thus, the proper performance of these World Renewal Ceremonies guaranteed a favourable report card as well as the health, balance and stability of the cosmos. This, in turn, was understood to result in the well-being of humans along with the abundance and fertility of other animals and Nature as a whole. We must remember that according to the tenets of this belief system, it is the bear that through its miraculous powers of hibernation, gathers up the souls of all creatures in the autumn. By this means they can be released to propagate Nature once again in the spring. This is a belief that still exists today in the Pyrenees. In this sense the bear is the Guardian Keeper of all beings and because of its knowledge of medicinal plants, it is viewed as the ultimate healer (Rockwell 1991). Thus, objects belonging to the bear are manipulated by the bear's human counterparts in their own healing ceremonies: for example, a tuft of the bear's hair or a bear claw is carried about while a bear robe is often donned by the human healer in the process of curing a patient (Conway 1992; Mathieu 1984; Rockwell 1991; Vukanovic 1959).

In Europe the deeper ecocentric meanings of many aspects of Bear Ceremonialism have been lost, at least at a conscious level. Nonetheless, in many regions during the Carnival period the Celestial Bear's representatives still come out to roam the streets, leaping about, dressed in skins and daubing the faces of unwilling passers-by with soot and ashes (Frank 1999a). In some cases the ashes are those saved from the ritual burning of the Solstice Yuletide Log. In fact, we might argue that the first day of Lent called Ash Wednesday might well have been an attempt on the part of the Christian authorities to co-opt and appropriate this much earlier custom by assigning it a Christian interpretation.

The polyvalent nature as well as the deeper significance of these unruly masked characters is evident. These are actors who appear at Carnival time, sometimes alone, sometimes in a group traveling in single file, moving across the countryside from farmstead to farmstead, "ritually stealing" chickens, rabbits, and other food, even invading private dwellings and turning them into shambles. In many parts of Europe groups of young people, dressed in bizarre costumes with their faces blackened—imitating their elders—also take advantage of the license of Carnival to go about demanding

Fig. 11.3. Saami dolmen-like Resurrection Cave (Elgström and Manker 1984, 29).

and/or ritually stealing food from the other villagers. The food thus collected is eaten by the group at their banquet (Alford 1930; 1937; Caro Baroja 1965; Tiberio 1993).

The Big House: allegorical meanings coded into its spatial relationships, proxemics and stage design

At this point we shall begin to analyze a concrete example of New World Celestial Bear ceremonialism. The example in question is based on fieldwork carried out by Frank Speck among the Munsee-Mahican Delaware of Canada. His book, published in 1945, represents a truly remarkable study of one aspect of the ceremonial life of these people: the sacrifice of an earthly bear and its sending-home ceremony, a ceremony dedicated to sending the earthly bear's soul back to the realm of the Celestial Sky Bear. These acts were conducted in the Big House, a ritual space especially designed for ceremonial purposes. We begin by analysing the timing of the performance and its allegorical meanings, those coded into the spatial orientation and, hence, the architectural design of the Big House (Fig. 11.4). Having examined this ceremony and the symbolism of its spatial coordinates—its proxemics—we shall turn to its European counterpart. Specifically, we shall review the prototypical elements manipulated metaphorically in two Basque performance pieces, the Pastoralak and Maskaradak, from the Pyrenean region of Zuberoa in Euskal Herria (the Basque Country). These performance pieces belong to the same genre of "good-luck visits" discussed earlier.

According to native informants, the Munsee-Mahican version of the World Renewal Ceremonies lasting twelve nights, commenced with a bear hunt triggered by the new moon of January.[11] This marked the end of the old year while the moon or month itself was called "New Year". No mention is made of synchronizing the luni-solar calendar. The location of the bear's lair was determined by means of a dream by a senior female of the tribe. The animal was brought into the Big House, alive, through the east door and sacrificed[12] after ceremonies had been held that pleaded for its understanding and forgiveness (Speck 1945).[13]

Once the animal was skinned, the pelt of the previous year's bear was removed. Then the skin of the newly slain animal was carefully wrapped around the Sky Pole at the centre of the Big House. Speck explains this part of the ceremony in great detail: "Each year when the skin of the

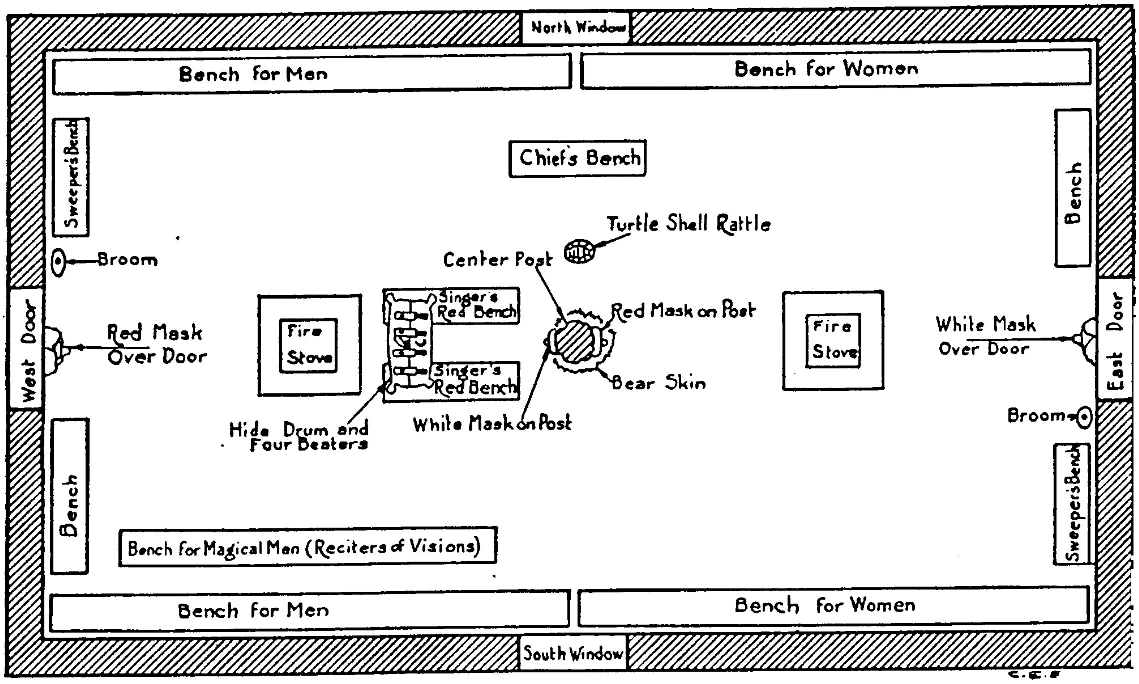

FIG. 11.4. Plan of the Munsee-Mahican Big House (Speck 1945, 38).

sacrificed bear was brought into the Big House it was hung on the east side of the center-post after the old skin which had hung there during the year was taken down. The reasoning behind this formality of placement was that the bear makes its winter den of hibernation on the east side of the tree and sleeps there until its revival in the spring. The allegory of the sky-tree, the sky-bear, the earth-bear, and the earth tree is thus carried out" (Speck 1945, 40). An additional detail indicates that when the dried bearskin, which had remained tied about the centre-post since the last occasion of sacrifice, was untied and the skin of the fresh sacrifice fastened in its place, the fresh bearskin was hung on the east side of the centre post in such a way that "the tip of the nose of the animal reached to and touched the bottom of the white mask hanging on that side of the post" (Speck 1945, 64, citing Jesse Moses). The metaphorical significance of this detail will be discussed shortly.

The five nights following the bear sacrifice were dedicated to songs sung by the elders, the Spiritual Men, and to feasting, although the feast itself terminated on the sixth night. These ceremonies began at dark and lasted until the new moon rose above the trees. At that point the singing ceased; in other words, the sessions began and ended in the dark while the length of the preaching periods dedicated to the sermons automatically shortened, by about one hour each evening with the moon waxing ever larger. The second half of the ceremonies, lasting six days, included related rituals, recitation of dreams and formal and social dancing. The latter events coincide closely with the third quarter and the full phase of the "night sun".

In addition there was a final sending-home ceremony on the Twelfth Night for which the tribe members dressed up in all their finery and "symbolically entered heaven. The morning after, they returned to earth, prayed a thanksgiving, and again took up their daily tasks..." (Time-Life Books 1992, 164). The acts in question appear to be linked to the perceived need for special ceremonies to be conducted that would aid the earthly bear's soul on its journey back to the sky realm. In the allegory, the bear climbs up the Sky Pole located at the centre of the Big House, and goes back to its home in the Upper World. In this fashion the bear is able to give its report to the Celestial Bear who, in turn, is identified with the stars of Ursa Major. Given the lunar keying of the performance, the timing of the ascension and journey of the slain bear's soul, along with its human offspring, back to heaven appears to coincide closely with the appearance of the full moon.

In summary, we can argue that the Big House itself constitutes a ritual landscape, a symbolic replica of the cosmos. It is a simulacrum that constantly alludes to the Bear Ancestor in ways that would go totally unnoticed by a cultural outsider. For example, during the ceremonies the Spirit Men would take up positions in such a fashion that the locations they marked out on the (earthen) floor corresponded to those of the seven stars of the constellation of Great Bear. At another point, a turtle-shell rattle was passed around and when it was finally placed on the floor, its placement was understood to mark the tiny star Alcor near Mizar (Speck 1945, 71). Thus, the orientation of the turtle-shell rattle is yet another example of the allegorical fusion of the two spaces: the floor plan of the Big House reflecting the spatial coordinates of the firmament above and especially the stars of the Great Bear constellation.

The allegorical linkages between the life of the earthly bear and the Celestial Bear above can be seen in a variety of associated astral beliefs. The stars of Ursa Major were believed to represent a bear hunt. The four stars forming the irregular rectangle marked the body of the bear. The three stars forming the handle of the Dipper, according to popular observation, were three hunters (the bear had no long tail), while the "little star" (Alcor), just visible beside the second one from the body, was understood to be the dog of one of the hunters. And the entire cluster was the Indians' guide: "By watching its position and knowing their bearings in relation to it at given times of the night in different seasons they would never become lost in their wanderings" (Speck 1945, 56). Furthermore, if we picture the constellation of the Great Bear with an Algonquian eye for metaphor, according to Speck, we see it "revolving around the North Star, upright in position in the middle night sky in mid-summer, prostate on its back in mid-winter, ascending head up in mid-spring, descending head down in mid-autumn. With the Algonkian [sic] mind, imagine the panorama of movement of the celestial bear as typifying the annual life cycle of the earth bear, upright and active all summer, prostrate and dormant all winter, then emerging from its den head up in the spring (March), and finally entering its den head down in the beginning of Winter (December)" (Speck 1945, 56–7).[14]

Colour coding

The Oshweken Delaware informants regarded their band to be a fusion of two groups, one coming from a eastern latitude and known as Wapanaki ("The people of Sunrise" or "The East"); the other group coming from a region west of them and identified as the Unami. The symbolism of the spatial coordinates in question was read into the proxemics found in the Big House. In an arrangement previously agreed upon, each of the parties held and occupied opposite halves of the Big House. An imaginary line separated the two halves into an east and west portion. The Wapanaki occupied the eastern half, the Unami the western half. Each maintained its separate council fire in its apportioned half. Hence, each group had its appropriate door for entering and exiting the building. Above each door hung a wooden face, or mask, representing the group on that side. Above the east door was the mask of the Wapanaki, a white (unpainted) one; above the west door was the one associated with the Unami and painted red. Two face images were also carved back to back and hung on the east and west sides of the centre post of the Big House. The red mask hung on the east side of the pole so that those sitting in that the section of the building—in other words, those associated with the white mask (Wapanaki)—were faced by the red mask of their allies and erstwhile rivals (Unami) and vice versa (Speck 1945, 21–2).

However, at another level it would appear that in the Munsee-Mahican Big House the colours of the two masks expressed a more complex psycho-social coding. It is an epistemology that, while latent in other aspects of the belief system, was symbolized and therefore exteriorized in the spatial segregation of the sexes. Men occupied the western half of the building, that is, the Munsee (and Unami) side with the red mask as the patron, while women sat on the east half or Wapanaki side situated under the white mask. Among eastern tribes, the colour red seems to symbolize aggressiveness or "males" in their monologic capacity of uncompromising warriors, protectors of the tribe; while white symbolizes peace and reconciliation, or "females" in their dialogic capacity of peace-makers, the non-violent element associated with females, especially post-menopausal females, and older men, the elders.[15] Not strictly a sex-colour symbolism (Hewlett 1916a; 1916b; Speck 1945, 23), the colour coding points to a complementary opposition, with red referring to the physical vigour, zeal, bravery, temerity and general impetuousness of youth when reproductive hormonal activity is at its peak. These qualities are contrasted and balanced by those linked to white, the cooler emotions, distance and circumspection conferred by age, when the rage and often violent passions associated with the peak of reproductive activity have died down. The former qualities are essential in battle, in protecting the band and one's offspring; the latter in reaching a workable and lasting compromise with one's opponents at that point in time when calmer heads must prevail. The dualism in question is, in brief, a dramatization of the relationship of male and female principles of nature in forms of governmental organization: in the designation of an individual as a war chief to work along with the members of the council of war, and yet a different individual as a peace chief to work alongside the members the council of peace (Hewlett 1916a; Time-Life Books 1993, 47–8).

These epistemological understandings are exteriorized metaphorically in the colour-coding. Conflict is inevitable and natural. Disagreement is part of the natural order of things, otherwise there would be no vehicle for initiating change and the innovations necessary to adapt socially to changing conditions and circumstances, adjustments that in turn are inevitable. In short, the epistemological foundations of the colour-coding in question demonstrate recognition of two ontologically based complementary poles of being which are exteriorized and reinforced in social and ceremonial practice. Given that conflict is recognized as part of the normal course of things, mechanisms are needed for dealing with it and bringing about its resolution. For instance, Hewlett (1916a, 243–4; 1916b, 128) has argued that Iroquois dualism is a dramatization of the relations of male and female principles of Nature in forms of governmental organization. The implications of Hewlett's remarks have been commented upon by Speck (1945, 24) in the following manner: "[His remarks] are brought together here to show reason for regarding combined sex-functioning and local group-complementation in social and ceremonial actions as factors in Iroquois and possibly also Delaware history". In short, the gender identities conferred by the colour terms are fluid and dynamic in nature, rather than immutable and static. Moreover, in bear shamanism, speaking broadly, gender identities are constructed in a radically different fashion (cf. Mandelstam Baltzer 1996; Shepard 1992).[16]

As has been mentioned previously, the centre pole has two carved faces affixed to it, one white and the other red, corresponding respectively to two groups, the Whites and the Reds.[17] Thus, the masks are joined together, back to back, by the pole itself while they face in opposite directions, i.e., looking to either side of the Sky Tree Centre Pole, just above the slain bear's head. In this sense, the faces in question and their colour-coding must be understood metaphorically: they respond epistemologically to the opposing yet complementary ontological principles of being and their ultimate union.

Two classes of performers

Situated at the east and west doors of the Big House, respectively, we find two Sweepers. In their ceremonial tasks they originally used an eagle or turkey-wing sweeper, replaced at a later period by a shaved splint broom (Fig. 11.5). These actors entered first, ahead of their respective dancers, in order to sweep away evil influences, "purifying the premises of malevolent forces that might have intruded in the shape of witches or spirit agencies whose motives are baneful to human welfare" (Speck 1945, 54). At other points in the ceremony they also served as ushers, as Doorkeepers, seeing that the persons who entered the sanctuary, whether strangers, spectators or those having duties to perform in the rites, went to their proper places on the benches.

Fig. 11.5. Algonquian splint-broom (Speck 1945: 49)

While the Sweepers were in charge of clearing the way for the other dancers and therefore were assigned a prophylactic role in the proceedings, there were other actors whose role as healers was well-recognized by all: the False Faces. These were composed of two sets of colour-coded dancers who entered the dance floor after the Sweepers. The False Face dancers constituted the society of medicine men in charge of expelling disease and other unhealthy influences from the Big House, while their functions extended beyond the confines of the building itself. In order to fully comprehend the nature of their duties we can divide them, although somewhat arbitrarily, according to the role played by the False Faces when conducting communal and individual healing performances. The morphology of these performances is analogous, in many respects, to the structures encountered in the European "good luck visits". For example, in the New World, when making ritual house calls, the False Faces travelled in single file with their female leader at the head of the procession.[18] The members, imitating the forest spirits (namely the ancestral Animal Guardians, would run from lodge to lodge emitting eerie cries, entering each dwelling on hands and knees, scattering ashes about the room and covering the family members with them, an action that was understood to bestow health.[19] Meanwhile youngsters, also imitating the forest spirits, would run around the village begging and sometimes stealing food and tobacco. The members of the Society of False Faces received their vocation as a result of visions or dreams.[20] In part, their strange actions can be better understood by recognizing that they are inspired by the belief that the actors are imitating wild animals, viewed as ancestral forest spirits with healing powers. Furthermore, the Society of False Faces acts out chapters from a story of cosmogonic origins at the major Iroquois festivals (Time-Life Books 1992, 142–3).

At this juncture we can turn to the functions the False Faces fulfil at communal events, and in particular at the Bear Sacrifice Ceremony where they would appear on the fifth and succeeding nights of the celebration. The ritual they enacted was called "False Dance", the pattern of which is as follows: "The False Face company consisted of twelve men of which one or two were Spiritual Men … Six of them wore white masks representing the Unami moiety group and came into the Big House, creeping on the floor and entering by the west door. As they reached the interior, they split into two parties of three each, going down the north and south sides of the building toward the center. By the east door, the other six entered, wearing red masks representing the Wapanaki moiety group and crept in two similar parties of three down the north and south sides of the house. The twelve False Faces met at the center-post, stood up, and began the False Face Dance. Each of them carried a large Snapping-Turtle rattle and used it with vehemence" (Speck 1945, 75). The function of the False Faces' performance at this stage seems to be to clear away evil spirits from the proximity of the Big House and its occupants.[21]

At this point in the performance, according to Speck's translation of his informant's testimony, the master of ceremonies, the chief, stood before his bench and, addressing the dancers, said the following: "Take this in good part and dance the War Dance". By this announcement he made known to the False Faces that they were to change from their usual role and take up the actions of the dance participated in by men enlisting for a war expedition. According to Speck (1945, 75), there seems to have been little to differentiate the movements of the War Dance, so-called, from those of the False Face Dance. The War Dance was performed three times by the dancers and at the conclusion of each the actors gave the "war-whoop". When the third dance of this series was finished and the whoop uttered, the False Faces suddenly ran out of the building through their respective east and west doors (Speck 1945, 75).

Counterparts of the Big House in the Basque Pyrenean zone

At this juncture we can turn our attention to an analysis of the proxemics of the Basque counterpart of the Big House, focusing on the ritual manipulation of space as it is manifested in the architecture and stage design encountered in two related types of contemporary popular performances: the Maskaradak and the Pastoralak. We shall concentrate our attention primarily on the latter variant. Because of the complexity of the dances performed and of the accompanying story-line, the Basque Maskaradak are, in all probability, the most complex and intricate of the genre of "good-luck visit" performance pieces found in Europe. However, it is the stage design of the contemporary Pastoralak that is of more interest here. The Pastoralak represent a type of folk operetta with dance interludes, written and performed each year by members of a different village of Zuberoa in the Northern Basque Country. Although the actual script is invented anew each year, it follows a rigidly ordered set of dance interludes and respects the traditional symbolic and spatial coordinates.

The genealogy of the Basque Pastoralak is, indeed, remarkable. Because of their archaic nature, they are understood to represent the sole survivor in an indigenous language of a genre that scholars refer to as Medieval Mystery Plays. According to the canonical reconstruction of events, these dramas, inspired in Christian themes, were performed initially inside the church and/or in an area immediately adjacent to it. Again, following the canonical version, over time, some of these performances came to be viewed as too risqué by the Church authorities. Another contributing factor was certainly the tendency of the performances to criticize the civil and religious authorities themselves, although in a somewhat veiled fashion through the subterfuge of a religious text. Hence, according to the standard view, the Mystery Plays were originally sacred in nature, solemn in demeanor and respectful in their attitude toward authority. Over time the population strayed from the narrow Christian path they had previously followed and that fact, supposedly, contributed to the numerous bans and condemnations issued against the performances, the actors, and the musicians as well as the animal impersonators involved (Frank 1989). We also know that the admonitions frequently extended to the dances and related festivities were an intimate part of the performances themselves.

Yet quite a different interpretation can be offered, more in accord with the facts of the case as best we can reconstruct them in Euskal Herria. First, we are dealing with indigenous structures, ceremonies including dance, song and mime, that were grounded in the earlier cosmovision and belief in Bear Ancestors. The performances are directly linked to the genre of "good-luck visits". As we have noted, in their indigenous form these appear to have included a report on the behaviour of the Bear's offspring as well as the participation of ritual clowns. Furthermore, from the historical record we know that in Zuberoa, the specific zone with which we are concerned, the Basques frequently requested permission to put on Pastoralak, works that the French-speaking authorities believed were based on a relatively innocuous religious or historical theme. However, this was merely a pious ruse used by the Basques. It permitted them, by means of fictional encapsulation and other mechanisms of narrative subversion, to continue to perform their traditional pieces in spite of the ecclesiastical bans (Alford 1959, 513; Hérelle 1924; Veyrin 1955, 286–7).

In summary, the Basque Pastoralak along with a closely related member of the genre, the Maskaradak, can be considered prototypical of the transculturated performance pieces found in other parts of Europe (Frank 1989; Hérelle 1914–17; 1918, 1921, 1923a, 1923b). The transcultural, almost chameleon-like, nature of these popular dramas results from the following situation: that they undoubtedly were performed at least with the tacit approval of the local Basque-speaking clergy, although perhaps not that of the French-speaking civil and ecclesiastical authorities. And certainly the former, the Basque-speaking local Church officials, must have been keenly aware that the performances not only belonged to a deeply engrained tradition, but that they also functioned as important markers of cultural identity for the Basques themselves.[22]

In conclusion, the Basque Pastoralak along with a related piece called the Maskaradak can be considered prototypical representatives of the transculturated genre itself as well as emblematic of the underlying structures of similar performance pieces found in other parts of Europe. The genealogy of these popular dramas can be traced back to the larger cultural complex referred to as "good luck visits" and as such belong to the same genre of popular art that was frequently permitted during Spring Carnival. For this reason, the proxemics, the symbolic manipulation of space and artifacts, found in the Basque pieces are of particular importance. They provide us with information concerning the way in which the ritual landscape of Bear Ceremonialism was made manifest on stage, the way in which it was integrated as a cognitive backdrop for the performances. Furthermore, the interpretation of the colour coding of the two groups of actors in the Basque performance pieces provides us with another vehicle for reconstituting the underlying image schemata of the European belief system itself as well as its ontology.

The Basque Pastoralak and Maskaradak are performances that incorporate and manipulate elements forming part of more elaborate village-wide performances and, hence, the so-called "good luck visits" (see Fernández de Larrinoa 1997 for a recent discussion of other aspects of the Zuberoan Maskaradak). When the spatial backdrop is the entire village and its immediate surroundings, these component parts of the ceremonies are regularly spread out over three days during the period of Carnival. In these performances two opposing colour-coded factions appear (cf. Hérelle 1923a, 159–80) and engage in a mock battle. These are the Beltzak and Gorriak, the Blacks and Reds.[23] In Spain there is a closely linked performance piece known as *Moros y Cristianos*, while in the rest of Europe the ritual battle orchestrated by the dance is understood to be between Moors and Christians, as in Spain, or between Turks and Christians, as (for example) in Poland. In these cases, following the conventions of Christian colour-coding, the Beltzak or Blacks reappear playing the role of the enemy, that is, as the dark-faced Moor or Turk or even as Diablillos ("Little Devils") (cf. Cuadra and Pérez Estrada 1978; Warman Gryj 1972). In contrast, traditional Basque belief holds that black (*beltza*) is a positively coded colour, health giving and linked to notions of fecundity and wholeness (Frank and Susperregi 2000; 2001).[24] Thus, all of these dances hearken back to the more comprehensive genre and cultural complex constituted by the "good luck visits". As has been pointed out in the first section of this study, these "visits" along with the mock battle are still performed in many other parts of Europe during the Winter and Spring Carnival period as well as at Corpus Christi.[25]

Such performances regularly conclude with a dance interlude pitting two colour-coded groups against each other in a kind of ritualised battle. Stated differently, the ritual battles performed by dancers in *Moros y Cristianos*, as well as in the Basque Pastoralak, by the Beltzak and Gorriak represent the final act in a series of ritually ordered events. Just as was the case in the Big House, there is a mechanism for acting out, in artistic form, two ontological principles intrinsic to the cosmovision of the social collective itself. However, the ritual war-dances of the Europeans are best understood when they are related to the larger and more encompassing belief system constituted by Bear Ceremonialism. In this respect, when compared to other similar European performances, the prototypical nature of the Basque materials has been emphasized on a number of occasions (Alford 1928; 1978). In addition, it should be noted that the cast of Basque musicians, animal masks and actors corresponds closely with the one associated with the Morris Dances of the English-speaking world (Miles 1912, 298–301; Alford 1978).

When compared to the more extensive variants of the "good luck visit" performances, the Pastoralak are best appreciated as spatially condensed versions of them. In analyzing the spatial coordinates of the Maskaradak and Pastoralak, we need first to remember that today they are primarily public spectacles. They are performances whose proxemics, while still grounded in the symbolic coordinates intrinsic to earlier cosmovision, are nonetheless conditioned by the presence of a large audience composed of non-participants. For example, the Maskaradak are often held on a *pelota* court adjacent to the village church, in a public square or even in an open field. In the case of the Pastoralak, an open-air platform is erected by the members of the community in question. Traditionally, the Pastoralak are composed and performed by the local villagers. In short, it is the individual village itself that puts on the play and provides the actors who perform the dances and sing their lines (cf. Guilcher 1989; Alaiza 1992).

In comparing the two data sets, that of the Big House and the Basque one, we need to keep in mind the types of constraints imposed on the ritual spaces concerned. In the first case, a special building was erected specifically for the purpose of celebrating the events in question. Furthermore, the spectacle of the Big House was collective in nature and assumed that the majority of those attending were also participants. In the case of the Pastoralak the stage design integrates and highlights spatial coordinates intrinsic to the village-wide festivals. Yet in doing so, its proxemics are influenced by the limitations imposed by the nature of the spectacle itself. There is a large non-participating audience, often several thousand people, whose needs must be attended to in the open-air arena. Hence, the stage design must permit those present to see all the action all of the time.

In Canada the distribution of symbolic elements in the Big House was further conditioned by the shape of the building itself: the structure's architecture provided a rectangular enclosure that imposed certain limitations on the way in which the preexisting symbolic discourse could be exteriorized and configured spatially. Similarly, the proxemics in the Basque Pastoralak are conditioned by the fact that an open-air stage is utilized: this is a rectangular platform open on three sides to the audience with an elaborate curtained backdrop. Nonetheless, upon comparing the two ritual spaces, we discover that the stage design of the Pastoralak replicates the Munsee-Mahican

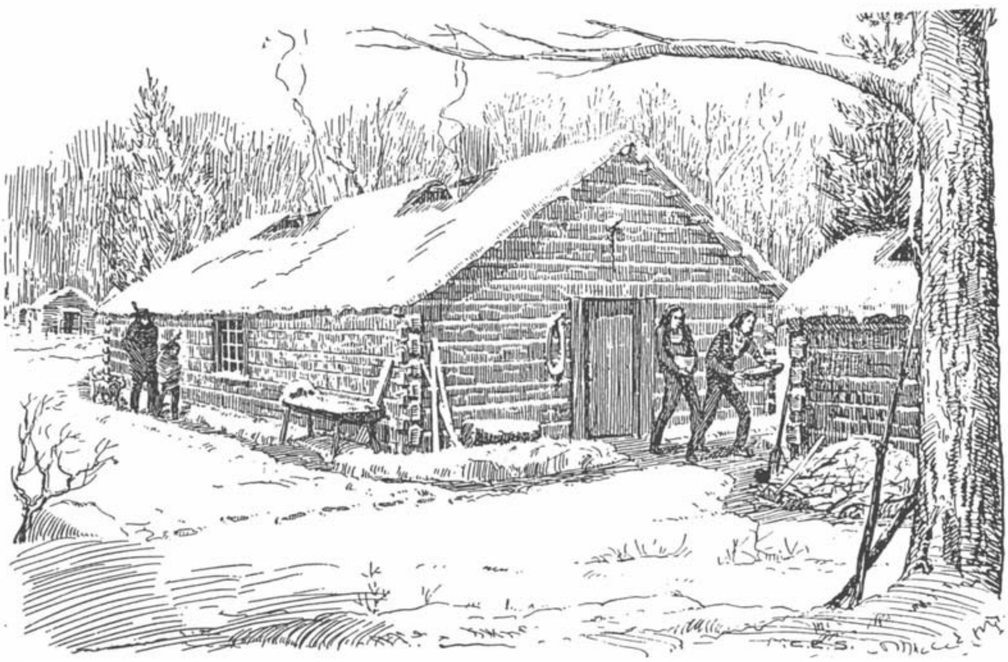

Fig. 11.6. Exterior of Munsee-Mahican Big House (Speck 1945: v).

solutions in many respects. For example, the single centre-pole of the Munsee-Mahicans has two masks, one red and one white, affixed to it. Similarly, above each door of the Big House we find the masks again (Fig. 11.6). In contrast, the space of the Pastoralak is adjusted in such a way that today the tall pole fitted over the doorway of the Gorriak could be interpreted as representative of the Sky Pole (Fig. 11.7). Then just above that entrance to the ritual arena we find the figure of a colour-coded puppet, painted red and black.[26] This arrangement coincides with the Munsee-Mahican solution to the problem, the difference being that the Basques utilize a puppet-like figure while the Munsee-Mahicans preferred masks. In the Pastoralak the space is also delimited by the presence of an invisible dividing line separating the two groups of actors from each other (see Fig. 11.7): the Beltzak march on stage right while the Gorriak do so on stage left (cf. Alaiza 1992, 42). That dividing line is reminiscent of the one dividing the two groups of False Faces, the Whites and the Reds, in the Big House. In the case of the Basque Maskaradak performances, there are often two lines of benches in the space set aside for the actors and dancers. These benches are occupied by the two sets of colour-coded actors, each with their respective Sweeper or *Txerrero*. These dancers, equipped with a horse-hair broom, enter the dancing floor ahead of each group of dancers.[27]

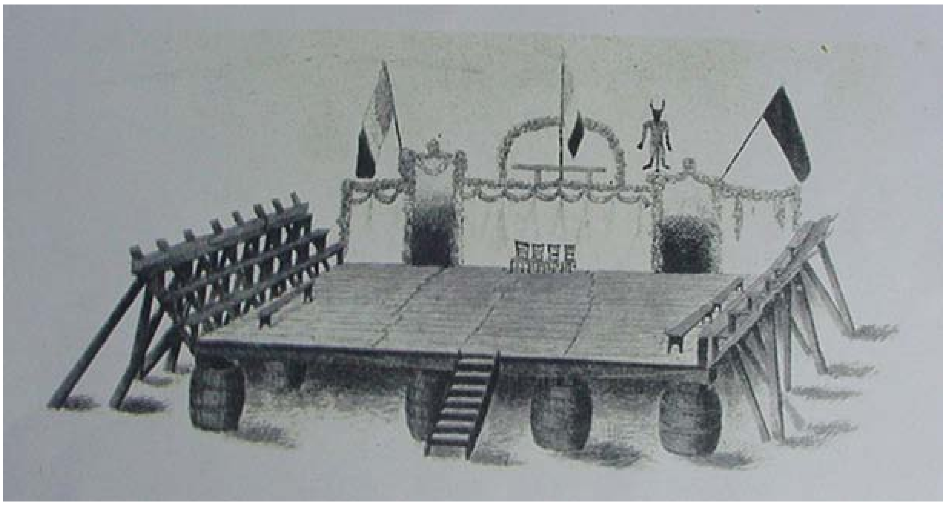

Fig. 11.7. Proxemics of the Basque Pastoralak: A. Black Zone; B. Red Zone. Water Colour by L. Colas, Musée Basque. Reproduced in Hérelle 1925, 76.

Similarly, in the case of the Pastoralak (Fig. 11.7) we see a stage divided into two sectors, each side being occupied by the singer actors and dancers of the respective colour-coded group. They emerge onto the stage by entering through an open archway, an aperture or open doorway concealed from the audience by means of a curtain. This cloth is carefully pulled aside by the corresponding Doorkeeper just before the respective performers appear on stage. The latter emerge into view after having climbed up a hidden stairway leading to the aperture itself. In the middle of the stage there is small table. Behind it sits an individual with two small flags in front of him, one black and one red. Each time one group or the other is about to enter the stage area, he raises the corresponding flag in a manner analogous to the actions of the Enseñaria dancers, the flag-bearers of the Maskaradak. In this fashion the individual signals to the Doorkeepers and musicians, indicating also to the audience what is about to happen.

Furthermore, as we have mentioned, above the centre of the Gorriak doorway we find a colour-coded *Hamalautxo* atop a pole (Fig. 11.8). The latter is a wooden puppet-like figure with strings attached to it. These are moved to indicate the actions of the Reds. The name of the puppet appears to be related to the expression “Little Fourteen”, a diminutive form of *Hamalau*. Significantly, *Hamalau* or “Fourteen” is the other name given to the Bear Son shaman apprentice, the intermediary between the Celestial Bear and its human counterparts. In the Basque Country in the Maskaradak performances as well as other dances, the *Hamalautxo* puppet dances at the summit of a long pole, the Sky Tree, where its movements mimic in a certain fashion the turning of the Great Sky Bear, dancing high above (see Frank n.d.a).[28] There is a suggestion that previously in European ritual performances the Sky Pole was symbolized by a long staff or sapling decorated with leaves and ribbons. Moreover this *axis mundi* appears to have been perceived as incarnate in the long heavy stick held by the dancing bear himself. In fact, at one point in the Pyrenean

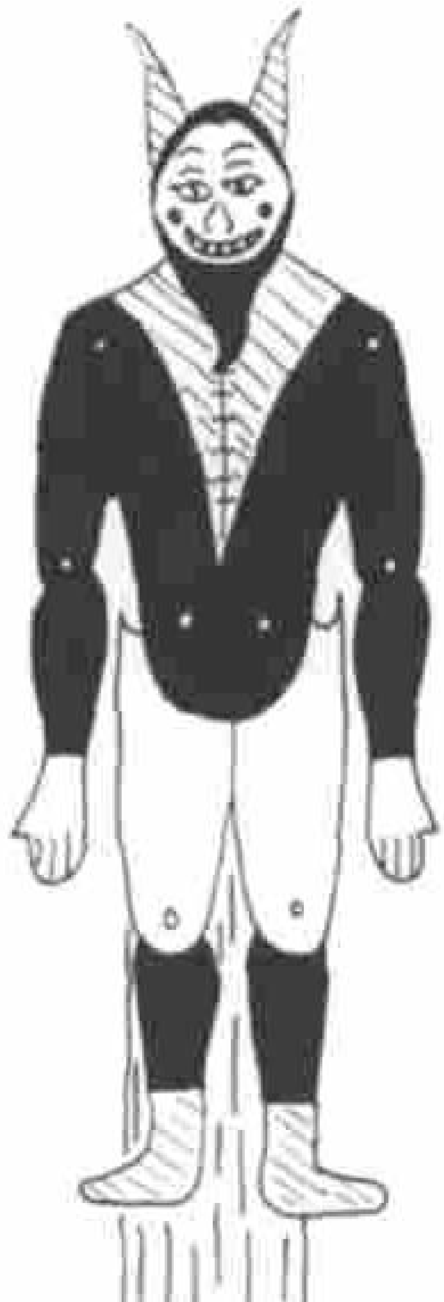

Fig. 11.8. Close-up of the Hamalautxo *Puppet. The puppet is black and red (diagonal stripes represent the colour red). White circles are bolts. After Marceline Héguiaphal, Unpublished Notes, Cheraute, 1976.*

performances the bear's trainer makes him climb up the pole (Alford 1930, 270). In contrast to the Basque choice in representing the vertical coordinates, the Big House sets up the Sky Pole as its centre axis. The sacrificed bear's head and skin are attached to it just below the two colour-coded masks, giving the impression that the bear is climbing up the pole. For additional information on the polar coordinates of the underlying cognitive framework see Frank (1997; 1999a; 1999b; n.d.b.).

Conclusions

The cross-cultural analysis of the morphology of Bear Ceremonialism has permitted us to recognize the remarkable ways in which the belief in the Celestial Bear has been articulated in symbol and dance. Artistic patterns of ritual behaviour demonstrate remarkable analogies in terms of the way the spatial coordinates are utilized to construct a highly complex text: a tightly woven network of symbolic commentary on the interactions of the actors with the sky above. Although integrated in a slightly different fashion, the phases of the moon itself are brought into play in the timing of the two performances. Moreover, the presence of colour-coding and ritual battles, both with deeper ontological implications, characterize the two data sets. Indeed, the fundamentally prophylactic role of the European "good-luck visits" themselves is highlighted when contrasted with the visitations by the False Face healers of the Algonquians and Iroquois. Especially remarkable is the way that the antics of both sets of ritual clowns come to symbolize and reflect the behaviour of the forest spirits and, thus, the ancestral Animal Guardians. In short, far from constituting a long forgotten tradition, there is every indication of the European Sky Bear's vitality and resilience as a source of inspiration for a wide variety of folk performances. These European spring rituals, grouped under the rubric of Carnival, are different intonations of the same metaphor. The performances represent World Renewal Ceremonies and as such constitute component parts of the same over-arching genre of "good-luck visits" revolving around the Celestial Bear Ancestor(s).

Notes

1. For an explanation of the term “ecocentric” see note 6 on page 34.

2. For a particularly lucid discussion of the interactive aspects of star figures in such narrative performances and initiation ceremonies, see Farrer 1992, 31–59.

3. It is tempting to see in these spatial coordinates a seeking of transcendence. However, as Brunton in his study of Kootenai shamanism has pointed out, in such a cosmovision all three of these “worlds” can be viewed as “altered time-sync extensions” of the one that we live in and experience cognitively.

   > “The visionary has not transcended one world to another; he or she has shifted consciousness so as to notice the approach of a spirit who has come to meet him or her. In Harner’s (1980) terms, the person has left the ‘ordinary state of consciousness’ (the OSC) and has entered the ‘shamanic state of consciousness’ (the SSC). … Ceremonies involve the same basic approach. In each the spirits are ‘called’ to join the Kootenai in the Middleworld to help resolve some problem or provide some information. … When Kootenai shamans do ‘journey’, they do so in the Middleworld in a clairvoyant journey” (Brunton 1993, 142–3).

   Hence, the Upper World as such is merely the space where birds fly, while the Under World is where roots grow and rabbits hide.

4. Materials used for the bear’s costume have included animal furs, sheepskins, dog pelts, and strips of cloth as well as moss and/or leaves. These actors, sometimes called “men of the forest”—as were bears themselves—are identified also as “wild-men” or *basa-jaunak* (cf. Bartra 1994; Giroux 1984; Truffaut 1988; Urbeltz 1994).

5. As is well known, violence as well as veiled and even overt forms of social protest were frequently associated with the “tricks” carried out on All Hallow’s and during the Christmas mumming season when the performances were utilized as a mechanism for enforcing community norms of behaviour and an opportunity to punish with relative impunity those who digressed. Certainly, the butt of these satires was often the Church and civil authorities, a fact that brought about repeated ecclesiastical and civil condemnations of the mummers and their plays (see Alford 1930; Caro Baroja 1965; Halpert 1969; Le Roy Ladurie 1979; Miles 1912; Szwed 1969).

6. For additional bibliography and a discussion of modern versions of the performance, see the collection of essays in Halpert and Story 1969.

7. Miles suggests a connection between the parts of the healing wand: “Or possibly the rod and the fruit may once have been conjoined, the beating being performed with fruit-laden boughs in order to produce prosperity. It is noteworthy that at Etzendorf so many head of cattle and loads of hay are augured for the farmer as there are juniper-berries and twigs on St. Martin’s *gerte”* (Miles 1912, 207). Praneuf (1989, 63–4) provides additional information on St. Martin’s *gerte*: “Presque partout en Europe, il y a un rituel de la dernière gerbe, laissée sur pied ou soigneusement conservée dans la grange, car, dans le champ fauché, elle est le dernier refuge de l’esprit de la végetation. En Allemagne, le moissonneur à qui il échoit de faucher les derniers épis (ou de terminer le battage) s’habille de paille et prend place sur la dernière charrettée de blé, parfois avec une ‘compagne-ourse’ ou un couple de ‘fiancés des blés’; (un équivalent ‘du rosier et de la rosière’); il ist à la fête de clôture des moissons. Parfois, les fille dansaient avec la dernière gerbe, apelée ‘l’ours’, qu’elles enlaçaient comme un cavalier”.

8. Some of the most archaic versions of these performances have survived in the Pyrenean region. Among them, the Basque *Maskaradak* is undoubtedly the most complete performance piece in terms of its robust repertoire of dances, songs and associated characters. Yet the same prototypical performance piece has its somewhat more learned

counterpart in the English Mummers' Play and Morris Dances, in the "St. George" dramas and Soulers' Play, performed on or near All Souls' Day, and in the continental "St. Nicholas" plays. The German "St. Nicholas" plays appear to be more Christianized and sophisticated forms of the prototypical folk-drama in question (cf. Miles 1912, 298–301; Alford 1978).

9. "Bien que ce ne soit pas ici le lieu de discuter en détail le travail de C. Gaignebet sur les fêtes calendaires dont nous apprécions beaucoup la richesse imaginative et la documentation, il est pourtant nécessaire de s'y attarder brèvement car nous restons très réservés sur la précision astronomique de ses décomptes. Un cycle lunaire et demi, ne correspond pas en effect à quarante jours comme il l'admit, mais à quarante quatre jours, sept heures et six minutes en moyenne, soit plus de quatre jours de différence avec ce qu'il soutient" (Lebeuf 1987, 267).

10. Briefly stated, proxemics examines the role of spatial relationships in a communication system; the ways that space and spatial arrangements are used and interpreted in a given culture. According to anthropologist Edward T. Hall (1959; 1966), who first introduced the term, proxemics can be understood to refer to the study of how humans construct and manage "microspace"—the distance between people in the conduct of everyday transactions, the organisation of space in their houses and buildings, and the design of their towns. In its broadest sense, proxemics refers to study of the cultural, behavioural, and sociological aspects of spatial distances between individuals and the way that a given spatial arrangement communicates meaning. Moreover, in any attempt to understand the performance art produced by a given culture, the correct interpretation of these non-verbal backgrounded understandings is essential, that is, the symbolic meanings communicated by the spatial relationships or proxemics embedded in the performance itself.

11. Speck does not define the ceremony as lasting precisely twelve nights; rather he argues, basing his calculation on the lunar-timing of the ceremony, that it might have lasted from between ten to twelve days, even though the ceremonies themselves were nocturnal in nature. Other data suggest a sacerdotal concept of twelve nights of duration for the ceremony (Speck 1945, 46), that duration being the same length as that assigned to the ceremony by the Delaware of Oklahoma (Time-Life Books 1992, 164).

12. It would appear that in later versions of the ceremony the laborious task of bringing the live bear back to camp was eliminated and the sacrifice was conducted near to the bear's lair.

13. According to Speck (1945, 27), the "time of the celebration was made the subject of some questioning among the Indians of the Six Nations Reserve. The results showed a consensus of opinion among them that the bear came out of its hibernating den about February 2 each year in that part of the country". However, it is possible that the precise date, i.e., that of February 2, derives from the influence of European missionaries. Moreover, it should be recalled that the actual date when a bear emerges from hibernation depends on the dominant climate of the zone in question as well as the severity of the winter that year. Hence, the setting of a date for the bear hunt responds to ritual considerations that, nonetheless, demonstrate synchronism with Nature's rhythms.

14. Further allegorical projections of the bear hunt and, consequently, the Celestial Sky Bear Ancestor onto Nature are found widely among the Algonquians: "The hunters pursue the earth bear in the fall as the three stars of the constellation, forming the handle of the Dipper, trail the celestial bear through summer and fall. … The poetic simile is carried still farther in the nature-explanatory mythology of the Wabanaki (Wapanachki) peoples by attributing the annual reddening of the forest foliage to the tinting of the leaves by the blood of the celestial bear slain at this turn of the season by the star-hunters, and the white mantle of early winter snow on earth to the coating of white bear's grease falling upon earth when the sky-hunters try out the fat of the slain bear" (Speck 1945, 57). A semblance of unity runs through the bear constellation tales from the Iroquois to the Wabanaki and Micmac of the extreme east coast.

15. Hewlett has also discussed the dualism running through all public assemblies of the Iroquois, tracing it to what he considers the dominant principles pervading life. It acted to conserve life upon earth through the complementary functions of sex, the male and female principles. Nonetheless, such an interpretation could lead the reader unwittingly into a conceptual trap: that of essentializing male and female human "nature" using a framework based on a deeply rooted Eurocentric dualism. The latter is capable of masking the implications of an indigenous cognitive framework of gender assignment. For example, Rockwell points out the following pertinent facts in his book *Giving Voice to Bear* (Rockwell 1991) where he discusses different aspects of New World Bear Ceremonialism. Among the Ojibwa, in order to become "bears", i.e., adults, young women went through a different initiation process from young men who also become "bears". Their initiation was indicated by the onset of menstruation and young women who were about to start their period were called *wemukowe* —"going to be a bear". It was this bodily event that triggered the lengthy initiation ceremonies leading to the young woman's full conversion into an adult and, hence, into bearhood. When the ceremonies were completed the woman was called *mukowe* meaning "she is a bear". Quite obviously, when the prototype of human nature is that of a bear, one must be very careful when mapping cognitively from one belief system to the other.

16. A caveat should be expressed at this stage with respect to this discussion of the European materials. Although in this paper I refer to the European False Faces, the bear trainers and other ritual curers, in the masculine, there is evidence that in Europe the healers themselves were often women. In fact, terms such as *belharegile* and *belharegin*, "plant worker, healer, shaman" (Iribarren 1984, 83) as well as the hero/heroine's name *Hartzkume* "Little Bear", in and of themselves, have no overt gender identity in Euskera (Basque). Moreover, in the cycle of European tales the Spirit Animal Guardians appear as females, examples being the Grateful Eagle, the Grey Mare and the Black Wolf. That they are quite capable of taking on male characteristics from one moment to the next is demonstrated in reports of visionary experiences among the Basques as well as in actual ritual performance. There is additional evidence for a female-oriented interpretation of the European materials, but given the complexity of the arguments required to explain that interpretation of the data, for the purposes of economy I have chosen to refer to the figure of the Bear Shaman and, hence, the Bear Son, primarily in the masculine. Furthermore, traditional Basque image schemata reflect metaphorical understandings associated with animals that differ radically from those found in the mechanistic instrumental model characterizing Modernity. In analyzing Basque folk beliefs we discover that when humans trace their ancestry back to bears, there is no place in the resulting genealogical myth of origins for high anthropomorphic (male) sky gods (cf. Frank and Susperregi 2000, 2001; Hartsuaga 1987).

17. Among a related tribal group, the Delaware who reside in Oklahoma, the colours utilized in the masks are black and red rather than black and white, although the ceremonies themselves are quite similar (Time-Life Books 1992, 164).

18. In the case of the Basque data there is reason to suspect that in these "good luck visits" women acting as *belhargile* or *belhargin* were involved and that their role was linked to that of the so-called *serora* whose duties placed her at the centre of many ritual traditions where she acted, essentially, as "the mistress of ceremonies" coordinating the actions of the other women. Furthermore, there is evidence pointing to the incorporation of and, hence, perpetuation of the role of the *belhargin* within the Catholic Church (Frank 1977).

19. In Europe during the Twelve Days of the Winter Carnival period, those miming the role of the bear healer in such ritual visits, such as the *Pelznickels*, *Pelzmärten*, and Han Trapp, often leave behind a piece of coal or charcoal (see Frank n.d.c). Specifically, pieces of charcoal from the Yule Log were highly valued for their prophylactic characteristics as were the log's ashes that were carefully collected and utilized for a variety of healing purposes. In the case of the *Christpuppe* and *Knecht Ruprecht*, ashes also play a major role. For example, in Mechlenbrug, where he is called *rû Klas* (rough Nicholas), he sometimes wears bells and carries a staff with a bag of ashes at the end. Hence, he is occasionally given the name

Aschenklas. One theory connects this aspect of him with the *Polaznik* "first footer" visitor of the Slavs. On Christmas Day in Crivoscian farms he goes to the hearth, takes up the ashes of the Yule log and dashes them against the cauldron-hook above so that sparks fly (Miles 1912, 231, 252). For other cases of the European belief in "good luck" being conferred by ashes, blackening one's face with them and black creatures in general, see Alford 1930, 277 ff.; Barandiaran 1974 II, 375; Creighton 1950, 20–1.

20. The Sioux equivalents of the False Face healers are known as *heyoka*. Unquestionably these healers, "contraries" or sacred clowns, are the strangest of all Native American medicine men. These were individuals who had been condemned by the nature of their vision to act in a way that ran counter to normal practice. Among the Sioux the ranks of the *heyoka* were made up of men who had dreams of thunderstorms. "*Heyokas* swam in icy pools in winter complaining of the heat, pretended to shiver with cold on the hottest days of summer and faced backwards when riding horses. They carried crooked bows and bent arrows, or used bows that were so ridiculously long that they were impossible to shoot. Most spectacular of all, they conducted ceremonies that climaxed with them plunging their arms into cauldrons of boiling water—an ordeal that they prepared for by secretly smearing their arms with chewed leaves of the mallow plant" (Time-Life Books 1992, 142). "In many communities, the solemnity of the ceremonies has been relieved traditionally by the antics of the sacred clown, who mock the shamans, lampoon the dancers, and interrupt the proceedings by shouting gibberish. Among the Zuni, the clowns even parrot the most holy prayers, substituting obscene phrases for the originals. Navajo clowns make fun of the sleight-of-hand tricks practiced by the shamans, clumsily revealing their secrets. Besides providing comic relief, the foolery supplies an important counterweight to the seriousness of the rest of the ritual—an essential aspect in the Indian world, where all things must be in balance" (*ibid*., 149). The masked Koyemshi clowns tramp through Zuni Pueblo. "Teaching by bad example, these contraries exaggerate vice and other antisocial practices, mocking all that is held sacred and lampooning greed and gluttony by stuffing themselves during rituals" (*ibid*., 147).

21. In spite of their clownish behaviour, the False Faces were frequently consulted as healers. They treated toothaches, nose-bleeds and ear-aches, as well as ailments of the head, shoulders and joints (Time-Life Books 1992, 143).

22. From one point of view the genre, in terms of some of its exterior narrative elements, mimics those found in canonical Christian liturgical drama. However, at the same time other components of the genre find their meaning and symbolic grounding in the earlier cosmovision. In this sense the elements must be read using two different symbolic codes and the result is a transculturated cognitive artifact. It speaks simultaneously to two audiences or readers: the first (e.g., the French-speaking authorities) is capable of reading only the Christian symbolism, while the second is bicultural and, as such, is able to read a text that is two-pronged, parodic and often even self-mocking in its nature.

23. In contrast to English, the Basque colour spectrum of *beltza* moves from black, cobalt-blue or dark-blue, to a deep blue-red: thus red wine is called *beltza* in Euskera. Similarly, *gorri* has a range from yellow-orangish red to bright red: so that, for example, an egg yolk is called *gorringo*.

24. Based on Barandiaran's (1974, II, 375) research at the beginning of this century, there is little question that the image schemata in question, e.g. the positive qualities of the colour black, hearken back to the framework found in the earlier cosmovision (see also Frank n.d.c). In contrast, *gorri* is often used to refer to a negative "pole of being" constituted by lack, pain, and barrenness as well as to a general notion of being out of control and, hence, operating primarily under the rule of one's emotions. The two ontological poles can be paraphrased by means of two contrasting sets of qualities. The Beltzak represent the parodic, burlesque, spontaneous, and humble; they are filled with vitality, wholeness, plenitude, fecundity, playfulness, and mischief. They are seen as flexible, adaptive; disruptive of (excessive) order, anti-authoritarian, and "dialogic" in a Bakhtinian sense (cf. Bakhtin 1990). The

Gorriak, in contrast, can be characterized as serious, single-minded; mechanical, and full of pride. They are linked to the embodied notions mentioned previously, e.g., illness, fever, misery, pain, and barrenness. They tend to be portrayed as irascible, unbending, inflexible, rigid, orderly, authoritarian, and "monologic", again in the Bakhtinian sense (cf. Frank and Susperregi, 2000; 2001).

25. Although the topic requires separate treatment, we should note the dancers' participation in a final apocalyptic "war dance", which constitutes not only a ritual closure reconciling the colour-coded, opposing, yet complementary "poles of being", but also the perfect theatrical counterpart to the tremendous battle that brings the Hartzkume tales themselves to a close.

26. Today, however, only the Gorriak have a puppet on the tall pole above their entrance. There is a hint that the Beltzak's entrance was formerly equipped with its own pole and puppet, also. Certainly in the popular imagination each group is equipped with its own dancing puppet. A recent Basque television talk show for young people involved a debate between two opposing groups. The stage was organized so that the two groups faced each other, while above each group was the perennial dancing puppet. The creature would leap about each time that its strings were pulled which signalled that its team was taking part in the performance.

27. As Alaiza (1992, 362–6) has suggested, the structural components of the Maskaradak and Pastoralak performances need to be studied in more detail in order to determine whether the commonalities encountered might be best explained by the fact that previously the Maskaradak performances were more complex in nature and integrated a popular theatrical piece similar to the Pastoralak. At the same time the ritualized nature of the dance interludes in the Pastoralak as well as the continuing intervention of a bear and live sheep on stage recall Chaho's discussion of the bear's earlier role in the Maskaradak and the fact that the actor playing that role was said to be "un remarquable danseur", another indication of the former importance assigned to this animal (cf. Alaiza 1992, 282–6, 296; Chaho 1865, 63, 96, 109; Hérelle 1914–17, 373–4). In short, these structural similarities as well as the curious inversion of colour-coding in the two performances, reveal that at some point the indigenous symbol system was altered to some extent. In the case of the Maskaradak, the dancers who are viewed as the "outsiders" are played by the Beltzak, whereas in the Pastoralak the colour-coding conforms more closely to the indigenous image schemata where the Beltzak are postively-coded and the Gorriak are viewed as the "outsiders" (cf. Frank and Susperregi 2000, 2001).

28. It would seem that the expression *hamalautxo*, "little fourteen", reappears in Spanish as *mamarracho* (*hamalautxo* > **mamalaucho* > *mamarracho*). In Spanish-speaking zones of Euskal Herria, folk belief speaks of a diminutive magical creature called a *mamarro* that is reminiscent of an elf or leprechaun. The latter appears to spring from a similar phonological prevarication: *hamalau* > **mamarau* > *mamarro*. Phonological variants of the Bear Shaman's name are also encountered in Basque-speaking zones of Euskal Herria. For example, there is the character found in the carnival of Mundaca called *marrau* < *hamalau,* while in Lesaka we encounter the *azaku-zaharrak* < *hamalauzaku* (cf. Azkue 1969, I, 3), derived perhaps from **hamalau-zain-go zaharrak,* along with another set of curious figures. Then there are Hamalau's helpers, sacred clowns called *(h)amairu* < *hamahiru* which in Euskera means "thirteen", a term that appears to have its phonological variant in *amarru*, e.g., in expressions such as *amarrudun* and *amarru gaitzeko gizona* "a sage, a man of great sagacity" (Azkue 1969, I, 37). For a discussion of New World counterparts of these sacred clowns, see the chapter called "Clowning and Chiasm" in Farrer 1992, 101–27.

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12

Birth and celestial bodies in Lithuanian and Latvian tradition

Jonas Vaiškūnas

Abstract

This article deals with Lithuanian and Latvian ethnographic data disclosing people's attitude towards celestial bodies and their influence on a live organism during its birth. The available sources show that various qualities of a person are seen to be determined by the phase of the moon in the most important moments of his or her life, including appearance, health, character, wealth, and happiness. A person's appearance is determined quite directly: the waxing moon is usually linked with a pleasant and youthful appearance, and the waning moon, conversely, brings about a uncomely and aged appearance.

The analysed sources give us reason to suppose that the influences of the sun and the moon on people are very similar. The waxing and the waning periods of the moon correspond respectively in general terms to the morning (day) and evening (night) sun.

Although folk knowledge about the phases of the moon dominates in the analysed sources, there is also some information about stars. This demonstrates that in the Lithuanian and Latvian tradition there existed a belief that stars are connected with human fate and the most important moments of life: birth and death.

This synthesis of folk traditions concerning the influence of celestial bodies on an organism that is coming to life shows that of some of the main principles of modern astrology were familiar in the ancient culture of the Balts.

Introduction

In scientific discussions of the ways in which celestial phenomena were perceived and understood in Lithuanian and Latvian traditional cultures, a somewhat categorical opinion prevails that astrological beliefs were not characteristic of these cultures. As the ethnographic evidence relevant to this question was missing from such discussions—not even summarized—one gains the impression that this opinion is based not so much on the real facts but stems from a negative attitude towards astrology as pseudo-science. This paper aims to redress the balance by using ethnographic evidence as the basis for a discussion of the influence of celestial bodies on new-born babies in Lithuanian and Latvian tradition. By synthesising and analysing the scattered fragments of evidence available from empirical ethnography, we hope to find traces of some of the main astrological principles in traditional Baltic culture, which determined the influences that particular celestial bodies were believed to have upon the health, character, and fate of a new-born human being.

Stars

Both in Lithuanian and Latvian traditional culture there exists the idea that a star shines in the sky for every man living on the Earth. When a man is born a star starts shining and when he dies that star falls down. Within rural communities there exists a strong opinion that there are as many stars in the sky as people on the Earth. The brightness of a star corresponds to the status of a man: bright stars belong to good, wealthy and noble people; dimmer stars to the poor, sinners, etc. (Vaiškūnas 1996, 139; Straubergs 1944, 42–4). Lithuanian historian T. Narbut mentions a myth that the goddess of fate, Werpeja ("spinner"), starts spinning the thread of life of a new-born man and there is a star at the end of that thread (Narbut 1835, 71–2). The Latvians, like the Lithuanians, believed that "the Latvian goddess of fate Vērpēja put a thread into the hand of a new-born baby and there was a star tied at the end of that thread. When a man dies the star breaks off and falls down" (Straubergs 1944, 42). This myth has the straightforward implication that peoples' fates are reflected in the sky, that is in the stars. If that was so, then it was possible to make predictions about people's fate by referring to the same stars. We do not have direct data about the immediate influence of stars and planets on birth. But a widespread saying "born under a lucky [or unlucky] star" suggests that the position of other celestial bodies at the moment of birth could have been observed and perceived as significant. However, we have very little evidence of this kind. One exception comes from the surroundings of Pandėlys (Rokiškis region): when a mare had a colt, people made predictions about its swiftness and strength according to the position of Ursa Major in the sky (Vaiškūnas 1996, 145). The Latvians prognosticated about the increase of sheep in a similar way: "If Greizie rati (Ursa Major) is over the cow-shed then the sheep will have lambs" (Straubergs 1944, 262). Generally, a clear starry sky forebodes a large family (many children and grandchildren) for the one who is being born (Straubergs 1944, 265).

Planets and zodiacal constellations

Ethnographer A. Vitauskas provides interesting information from the pre-war Šiauliai district, though this information is not directly connected with birth. According to him, constellations are "objects of astrological observations for the present and future. Especially *Aušrinė* ('Morning star'), *Derliaus* ('harvest star'), and *Šeimynykštis* ('retainer, servant')". Vitauskas maintains that "different positions of these three stars have different meanings; similarly, the different position of each star in the unstable structure of this star group". According to the position of these stars, predictions were made about the coming season of the year, if it was going to be good or bad with regard to "standard of living or harvest" (Vitauskas 1937, 138–9). Such observation of the location of planets proves the existence of a fairly complex astrological system.

On the other hand, the question remains open of whether a set of constellations forming the circle of the Zodiac were used for astrological prognoses. This is despite the fact that we can find historical evidence that the circle of the Zodiac was familiar to the Lithuanians: the recent researches of specialists in folklore and ethnography demonstrate that there certainly was knowledge of a distinctive circle of Zodiacal constellations.

The moon

There is a good deal of evidence demonstrating the existence of a traditional belief that the phases of the moon predetermine the character, appearance and health of a new baby. Researchers into the Lithuanian ethnic culture such as J. Balys (Balys 1951, 13), P. Dundulienė (Dundulienė 1975, 258; 1988, 38–9), and A.J. Greimas (Greimas 1990, 171–3) also paid attention to the influence of the moon on a living individual.

The influence of the moon on a baby before its birth

There existed beliefs that events happening well before the time of birth had an influence upon the nature of a baby. This is clear from a variety of items of evidence. First, the phase of the moon on the parents' wedding day is of great importance. If the wedding takes place when there is the waxing crescent in the sky, then the children of the couple will be "pretty; not tall; the first baby will be a girl" (SBK). If it takes place at full moon then "the family will be large and healthy"

(SBK; Šliavas 1993, 130). The Latvians consider that a woman married during the waxing moon "gets pregnant soon" (Straubergs 1944, 285).

The phase of the moon at the moment of sexual contact is also important. In the Latvian tradition we find evidence that the gender of a baby depends on the phase of the moon of that particular moment: "[people say] if the sexual contact is in the waxing moon so a boy is born, and a girl is born if the contact is in the waning moon" (Šmits 1940, no. 14781).

Another important factor is the parents' behaviour before sexual contact. It is prohibited for a man to urinate in front of the moon, because he can lose his potency. And if he has sexual contact immediately after that, an abnormal child or even "a devil might be born" (SBK; LTA 790/21/; LKAR 2/156/; LKAR 2/388/; LKAR 2/447/). The same is said concerning a woman (SBK). People believed that the moonlight could have an impact on the health of a baby. "If the moonlight falls on a sleeping pregnant woman then her baby might be born a sleepwalker or even anaemic" (SBK).

The influence of the moon on a baby at the moment of its birth

It is supposed that the nature and health of a man are determined by the phase of the moon at the time of his or her birth. Ethnographic data indicate the characteristics of a man born at a certain phase of the moon, and these are summarised in the tables that follow. Positive qualities are italicised. The figure next to each characteristic feature shows the number of places where it is mentioned. The sources used are listed after each table.

Children born during the waxing of the moon:

look young	22	are angry	2
are afraid of eyes	12	*are clever*	2
are timid	9	*are happy*	2
are joyful and grow up well	8	*eat a lot*	2
are nice	7	*are of good nature*	2
are weak	6	*have teeth that grow faster and more easily*	2
cry at night	4	do not live to a venerable age	1
are resistant to illness	4	*are tall*	1
are frivolous	3	are lazy	1
are strong	2	*are energetic*	1

(Sources: SBK; EAA 9310; LTR 4232/61/; LTA 1252/73/; EAA 8808; EAA 8901; Šliavas 1993, 118.)

Children born during the waning of the moon:

get old soon	20	*are quiet*	2
are angry	5	*are not afraid of eyes*	2
are strong	5	*are clever*	2
are slow and not nimble	4	*are brave*	2
are sad / gloomy	3	*are practical*	1
are not nice	3	*live long*	1
are thin	3	*are serious*	1
are unhappy	2	are lazy	1
are unhealthy / fall ill often	2	are hypocrites	1
do not live long	2	grow bad	1

(Sources: SBK; EAA 9310; EAA11.)

Children born at full moon:

are nice and plump	4
are very strong and healthy	3
are wealthy, happy and live well	3
are very clever	1
are lazy	1

(Sources: SBK; LTR 4232/55/; LTR 4232/61/; EAA 9310; EAA 8901; Šliavas 1993, 118.)

Children born at the waning crescent:

live badly	2

(Source: EAA 89010.)

Children born at new moon (emptiness):

are greedy	1

(Source: EAA 9310.)

The Latvians have retained quite a lot of information about the influence of the moon on a new-born baby. The Latvians suppose that the children born during the waxing of the moon:

look young for a long time, do not turn grey	(LTT 2417, 2418, 2419, 2420, 2422)
are healthy	(LTT 6856)
are nimble and joyful until their old age	(LTT 2417)
are happy	(LTT 2421, 2483)

The ones who are born during the waning of the moon:

turn grey and get old soon	(LTT 6856, 2424, 6847)
lose their teeth early	(LTT 6856)
are not nice	(LTT 2484, 2423)
are gloomy	(LTT 2417)
die more often	(Straubergs 1944, 263)
[boys] usually remain bachelors / [girls] become old maids	(LTT 6856, 6848, 19831)

People born at full moon:

are the wealthiest	(Straubergs 1944, 263)

The influence of the moon after birth

The cycle of lunar phases continues to influence the life of children after their birth. Certain things should be done at the appropriate phase of the moon. For instance, a child baptized during the waxing moon has the following qualities when he or she grows up:

remains young for a long time	8
is healthy	1
is honest, happy, and wealthy	1
is joyful	1
is nice	1

A child baptized at the waning crescent:

is unhealthy	1
is strong	1

A child baptized at full moon:

is very strong	1

(Source in each case: SBK.)

The phase of the moon was also important when weaning a baby from the breast. According to P. Višinskis (Vishinskij 1935, 151), the Samogitians weaned a girl on the third day of the waxing crescent so that she would "not get old and remain young for a long time". A boy was weaned in the first quarter or at full moon in order that he would be "healthy and full like the moon". And some mothers weaned their boys in the last quarter of the moon wishing their sons "not to be adventurers in love". If a boy was weaned from the breast in the waxing moon, then "he would run after girls even when he was old" (EAA 94010). (Latvian traditions contain the same belief (Straubergs 1944, 263).) Girls were also weaned at full moon in the expectation that they would be "full and nice" (EAA 94010). The author of the report noted that if a married Samogitian woman had a girl and she wanted her second child to be a boy then she had to wean her daughter from the breast on the third or fourth day of the waning phase, when the moon is gibbous. If she did so in the waxing phase then she would have another girl.

The behaviour of a grown man in relation to the lunar phase cycle continues to influence the fulfilment of his fate. The phase of the moon is important, for example, when matchmaking, getting married, or even building a house. This means that it is possible to influence fate by choosing a certain time for a given action. However, it was also supposed that the lot of an adult depended on his parents, this dependence finally taking its effect at the time of their death. It was believed that dying parents could take away the good fortune of their children, since the phase of the moon on the day of death determines the children's future. For instance, if father or mother dies at full moon then they "leave happiness to their children"; children "live happily and they do not lack anything, their homes do not grow poor"; and sons "get rich" after their father's death. If a father dies in the waxing phase of the moon, they say that "the family gets richer", or "a son gains riches" until he grows up. The same happens to daughters if their mother dies in the waxing moon. If a parent dies while the moon is waning, then their children become unhappy: "they start living hard, their riches keep vanishing, their homes get empty, and they can die early" (Balys 1981, 43). The same belief is confirmed in Latvian traditions (Straubergs 1944, 291–2).

The sun

Lithuanian ethnographic sources do not contain much information about the influence of the sun at the time of birth, and one gets the impression that there was little interest in this. Nonetheless, the data that have survived show that people believed that the position of the sun above the horizon did have an influence upon the nature of a baby.

The influence of the sun on a baby before its birth

The time of a wedding was thought to determine the sex of any future babies. It was believed that people who get married before midday can expect many sons (Straubergs 1944, 285). In the surroundings of Pakruojis it was prohibited for a pregnant woman to look at the sun or moon through dark glass during an eclipse. If a woman did so then she might have black children (EAA 94010).

The influence of the sun at the moment of birth

The Lithuanians of Gervečiai (Belarus) supposed that babies born in the evening die whereas those born in the morning grow, i.e. live (LTR 4232/55/, /706/). They also maintained that children born in the daytime are happier (EAA 1). More information on this point has been found in Latvian sources, which is as follows.

It is supposed that children born in the daytime (with the sun) are happier, are fair of face; have a better nature; have a pleasant disposition and smile like the Sun; are clever; and have an easier life.

Those born at night are angry, stupid, and dark of face. However, there are some statements quite contrary to this: for example, children born at night are the liveliest and healthiest.

Children born early in the morning when the sun is rising, are said to be wise, sensible, and unusual; they marry early but they die early too; and their life is happy, but they are anxious.

Finally, children born in the evening and afternoon are slow, angry, and unhappy; girls do not stay married long and live only until middle age. However, there is also an opinion that children born in the evening live until old age (Straubergs 1944, 264–65).

The influence of the sun on a baby after its birth

There is a widespread opinion among Lithuanian people that a mother can harm the fate of her baby if she weans him away from the breast and then, after some period, starts nursing again. When such a baby grows up he has very "evil eyes" and he is called *atžinda*s (Patackas and Žarskus 1990, 77–80). In Lithuania Minor (Prussian Lithuania) it was believed that a baby is like this if he is not nursed for one and a half days. A further opinion from Lithuania Minor is that a baby becomes *atžindas* if his mother does not return home until sunset and nurses her baby later (Balys 1937, 17).

We may assume, then, that the position of the sun above the horizon was of no less importance to the nature of a newborn baby than the phase of the Moon.

Discussion

Having examined the available sources, it is possible to assert that the following qualities of a person are determined by the phase of the moon in the most important moments of his or her life:

(1) appearance (in 37% of sources);
(2) health (27%);
(3) character (26%);
(4) wealth (0·05%);
(5) happiness (0·04%);
(6) other (0·01%)

1. A person's appearance is determined quite directly: the waxing moon is usually linked with a pleasant and youthful appearance, and the waning moon, conversely, brings about an uncomely and aged appearance. It is interesting that the name of the waxing and the waning phases of the moon correspond to the main periods of person's life in Lithuanian and Latvian languages. The waxing phase of the moon is called *jaunas* and *jauns* respectively in

Lithuanian and Latvian, both of which mean "young". The waning phase is called *senas* and *vecs*, which mean "old".

2. The statements concerning the influence of the waxing moon on a person's health are rather contradictory. On the one hand it is said that those who are born during the waxing phase of the moon are "afraid of eyes" (12 sources), weak (6), and cry at night (4), but on the other hand they are resistant to illnesses (4) and strong (2). It seems that the weakness of those who are born when the moon is waxing manifests itself not in poor health, but in their lack of resistance to other people's negative influences. In other words, those ones who are born during the waxing moon are weak because they might be easily affected by other people's "evil eyes". It is supposed that children cry at night for the same reason. Babies who are born during the waning moon are strong (5 sources) and not afraid of "evil eyes" (2), but they are not healthy and are often ill (2).

3. The characters of people born during the waxing and waning moon are clearly differentiated. Joyful (8), energetic (1), and good natured (2), though timid (9) and frivolous (3), people are born during the waxing moon; whereas sad and gloomy (3), and angry (5), though brave (2), serious (1) and practical (1), people are born during the waning moon.

On the whole, babies who are born during the waxing moon have more positive qualities, with the ratio of positive to negative characteristics being 12:8. For the waning moon this is reversed: 8:12. Positive qualities linked with the full moon exceed negative ones by 4:1, although very few examples are recorded.

We can see that the changing phase of the moon is believed to modulate processes in the natural world and, as a result, there are favourable or unfavourable times for various of these processes. Yet the fate of a man, a plant or an animal is not considered to be fatalistic or finally fixed at the moment of birth. A man born in one or another period can influence his fate by carrying out the most significant activities of his life at a particular time. This can happen whether the timing was intentional or not. If, for example, a baby has been born at an unfavourable time, it is possible to give him the desired qualities by baptizing or weaning him from the breast at a certain time. For this reason, people who wanted to preserve a child's beauty and youth tried to baptize him during the waxing moon if he had been born during the waning moon (Dundulienė 1975, 258). Likewise, if it was desired to increase a baby's weight he would be weighed during the waxing moon (SBK).

The analysed sources give us reason to suppose that the influences of the sun and the moon on people are very similar. In general terms, the waxing and the waning periods of the moon correspond respectively to the morning ("day") and evening ("night") sun. As the material concerning the influence of the sun on people is scanty, it is necessary to use wider information in order to draw meaningful conclusions. It is possible that this can be found in sources concerning the sun and farm labour, which could be a topic for another article.

Although folk knowledge about the phases of the moon dominates in the analysed sources, there is also some information about stars. This demonstrates that in the Lithuanian and Latvian tradition there existed a belief that stars are connected with human fate and the most important moments of life: birth and death.

One reason for the diversity of the perceived relationships and the discrepancies between different sources might be extensive degradation of ethnic knowledge concerning the celestial bodies. The fragments of ethnic knowledge that survive are, more often than not, based on data from individual informants. If we seek to recreate elements of the system of knowledge about the influence of celestial bodies on a newborn baby or another other organism, it is necessary to analyse the information that has survived in the context of all Lithuanian ethnoastronomical knowledge.

Conclusion

The survey presented in this paper suggests that we can find traces of certain general principles underlying astrological beliefs in Lithuanian and Latvian traditional cultures. In essence, these are as follows:

1. The celestial bodies have a predetermined influence on vital processes in the natural world as a whole.
2. The influence of the celestial bodies upon a living entity is greatest at the moment of birth. At that moment, natural characteristics are determined which have an influence on the entire development of the person, animal, or plant.
3. In spite of (2), it is possible to influence and adjust the characteristics of a living entity at certain times in its process of development, by timing actions with respect to the position of celestial bodies in the firmament.

A particular consequence of (3) is that by observing the moon, sun and stars, and by developing a suitable knowledge of their influences, it becomes possible to time certain key actions relating to a human life (such as the weaning or baptism of a baby) in order to neutralize any negative characteristics acquired as an inevitable consequence of the moment of birth.

The similarities between the Lithuanian and Latvian data give us reason to believe that astronomical/astrological beliefs that have survived in modern folk tradition might be remnants of a more complex system of knowledge which existed in the times of the community of the Baltic tribes.

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List of abbreviations and unpublished sources

EAA: Personal ethnoastronomy archives by J. Vaiškūnas in Kulionys village, Őiulėnai district, Molėtai region, Lithuania. This materials were recorded during the period between 1988 and 1998.

SBK: The “Synopsis of Beliefs” compiled by Jonas Balys from LTA (see below). This manuscript now belongs to The Department of Ethnology of the Institute of History at the Lithuanian Academy of Sciences, Vilnius.

LKAR: Archives of people’s art at the Lithuanian Folk Culture Centre, Vilnius.

LTA: Archives of Lithuanian folklore. The materials in this archive now belong to LTR (see below). LTA and LTR are distinguished in the article in order to help the reader separate older information (LTA information was recorded between 1935 and 1940) from more recent data (LTR information has been recorded since 1940).

LTR: Archives of manuscripts of Lithuanian Folklore in the Institute of Literature and Folklore at the Lithuanian Academy of Sciences, Vilnius.

LTT: Šmits 1940.

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13

The beliefs and mythology of the early Irish, with special reference to the cosmos

Fergus Kelly

The beliefs of the pre-Celtic inhabitants of Ireland are shrouded in mystery. The archaeological evidence indicates that the earliest arrivals were Mesolithic hunter-gatherers who came about 7000 BC. They left no monuments which could give us an insight into their religious beliefs. Neolithic farmers came about 4000 BC, and by 3000 BC their society was sufficiently well-organized to construct the massive passage-graves of the Boyne valley. The chamber at Newgrange is aligned so that the rising sun illuminates it at the winter solstice. Clearly, the designers of this monument had accurate knowledge of the sun's course, and it is a fair guess that a midwinter rite was celebrated annually at this place. Similarly, it is likely that the large trumpets which have survived from the Late Bronze Age had a ritual function—the association of music with religious practice is of course worldwide and of high antiquity (MacWhite 1945).

With the arrival of Celtic-speaking peoples about 700–600 BC we find firmer evidence with regard to religious belief and practice in Ireland. A good deal is known about the culture of these people from early inscriptions and artefacts on the continent of Europe, and from the writings of Classical authors. Both the Greeks and Romans had dealings—often hostile—with the Celts: in 390 BC a Celtic army sacked Rome, and in 279 BC it is recorded that a group of Celts invaded Greece and plundered the shrine at Delphi. In Strabo's History there are references to the Celts of Galatia, who met in assembly at a place called *drunemeton*, which may mean "oak-sanctuary, sacred oak-grove". Julius Caesar's account of his campaign against the Gauls (58–52 BC) is also very important as it provides first-hand information on their customs and beliefs. He comments on the knowledge of the stars and their movements possessed by the druids (*druides*) and summarizes the religious beliefs of the Gauls in blunt Graeco-Roman terms:

> of the gods they worship Mercury most of all. He has the greatest number of images: they hold that he is the inventor of all the arts and a guide on the roads and on journeys, and they believe him the most influential for money-making and commerce. After him they honour Apollo, Mars, Jupiter and Minerva. Of these deities they have almost the same idea as other peoples: Apollo drives away diseases, Minerva teaches the first principles of the arts and crafts, Jupiter rules the heavens and Mars controls the issue of war.

Writing in the first century AD, the historian Tacitus provides a good deal of information on the Celts of Britain, and gives an account—no doubt somewhat dramatized for literary effect—of the destruction by Suetonius of the druids and their sacred groves on the island of Anglesea in about AD 61 (Chadwick 1966, 38).

The Celts' own writings are of course of even greater significance than the inevitably biased accounts of their adversaries. Many inscriptions have survived in various parts of the Celtic world, mainly France, Germany, Britain, Spain and northern Italy. The most extensive is a bronze panel from the first century BC which was found at Botorrita in northern Spain. It is in a dialect called Celtiberian, and is written in a script of Phoenician origin. The text is difficult to interpret but it is thought by some scholars to regulate the upkeep of a local shrine. Another Celtiberian inscription (at Peñalba) is easier to interpret and refers to a ceremonial procession in honour of deities called the Mountain-dweller, the Horse-god and Lugus. They may indeed be merely three aspects of a single deity: the Celtic pantheon tends to be diffuse and shifting.

Especially after Gaul and Britain came under Roman domination, the custom arose among the Celts of representing their gods in the form of stone-carvings. For example, a relief found near

Württemberg shows the horse-goddess Epona seated among seven horses (Mac Cana 1970, 136). Often these monuments show both Celtic and Graeco-Roman features: a relief dug up in Paris contains representations of Jove (Jupiter) as well as the Celtic divine bull Tarvos Tricaranus accompanied by three long-legged birds, possibly sacred cranes of the Otherworld (Mac Cana 1970, 30–3).

From the astronomer's point of view, undoubtedly the most interesting Celtic inscription is the Calendar of Coligny, dug up near Bourg (Ain) in France in 1897 (E. MacNeill 1926). It dates from about the time of Christ and uses Roman letters and numeration. It is however totally independent of the Roman calendar, and gives a five-year synchronization of lunation with the solar year. Some periods of days are marked MAT ("good"), and others ANM[AT] ("not good")—evidently this refers to whether the days are auspicious or not.

Leaving the Continent, we move back to Iron-Age Ireland. The archaeological evidence from this period is sparse, and there is little to provide us with insight into religious practice. From about the second century BC we have the Turoe Stone in Co. Galway, beautifully carved in the La Tène style. This was clearly an object of religious significance, and may have been associated with fertility.

Our earliest account of Irish pagan beliefs comes from the disapproving pen of the fifth-century missionary, Saint Patrick, who refers in his *Confessio* to the "idols and abominations" worshipped by the Irish. The Church founded by him flourished, and it is clear that by the sixth century Irish paganism was on the retreat. In a Hiberno-Latin penitential of this period, members of the Church are instructed not to make an oath before a druid (*magus*) in the pagan manner nor to practice or believe in pagan magic. By the seventh century the Church had clearly won, and the literature which survives from this period is thoroughly christianized.

Nonetheless, the New Order did not entirely supplant the Old, and echoes of paganism are widespread. For example, an eighth-century medico-legal text limits the entitlements of a *druí* (druid, sorcerer) but does not outlaw him altogether (Kelly 1988, 60). Another law-text credits the druid with being able to bring victory in battle to the weaker side. In the annals there is mention of a druidical fence (*airbe ndruad*) which caused the death of any enemy who leaped over it. Druids clearly dealt in fortune-telling and love-potions, and there are a number of references to a form of black magic which goes by the mysterious name of *corrguinecht* ("heron-killing"). Apparently, the perpetrator caused death or injury to his victim by reciting satirical verse standing on one leg, with one arm raised and one eye shut in imitation of a heron's stance (Kelly 1997, 128).

In some texts the druid is presented in a quite a favourable light. In the eighth-century life of Saint Brigit, it is a druid who first detects the sanctity of the infant Brigit. One night he was watching the stars when he saw a fiery column rising out of the house where the baby was: this convinced him of her future greatness (Ó hAodha 1978, 1–3). In passing it should be noted that the consensus among scholars is that Saint Brigit never actually existed, and was in fact a local goddess whose cult was too deep-rooted to suppress: the Church consequently provided a place for her among the ranks of the saints. One can compare the way in which the pilgrimage to Croaghpatrick in Co. Mayo—originally a celebration of the festival of the god Lug at the beginning of harvest—was assimilated into the Church's year (M. MacNeill 1962, 26–42).

Our most important source of information on pre-Christian beliefs is the mythological cycle of tales, mainly from the eighth and ninth centuries AD. These texts were no doubt primarily for entertainment, and describe the activities of various gods, semi-gods, monsters and fairies and their relationship with the world of humankind (O'Rahilly 1946). Many of the deities of the Celts of Britain and the Continent can be recognized among the dramatis personae of the Old Irish mythological tales. For example, the god Lugus—whose name survives in place-names such as Lyon (originally Lugudunom)—is the ubiquitous Lug of Irish mythology. The Irish god Ogmae obviously corresponds to the Gaulish Ogmios, and Nuadu is to be identified with Nodons, to whom there is a dedication in a Romano-British temple in Gloucester. As in the pantheon described by Caesar, some of the early Irish deities had particular areas of responsibility: Día n Cécht was the god of healing, Goibniu was the god of iron-work, Crédine was the god of bronze-work, and the raven-goddess Bodb was concerned with fomenting war and bloodshed. The paramount god seems to have been Dagdae "the good god", though in some texts he is presented as a rather ridiculous figure.

Many supernatural figures in early Irish texts have connections with animals. The semi-divine king Conaire of Tara was fathered by a bird on a mortal woman and it was taboo (*geis*) for him to kill birds. When he broke this and other injunctions, his reign collapsed and he was killed. The great hero Cú Chulainn had the dog as his totem-animal, and he too met his end after being tricked by his enemies into eating dog-flesh. Some early Irish deities were associated with particular localities. Not surprisingly, the massive Neolithic passage-graves of the Boyne valley attracted the attention of later peoples, and are represented in the mythological tales as being entrances to the Otherworld.

The tradition of the four main seasonal festivals of the pre-Christian year is widely preserved in early Irish texts (Kelly 1997, 459–61). *Imbolc* at the beginning of February celebrates the start of growth and lactation, and is to this day associated with the goddess/saint Brigit. *Beltaine* at the beginning of May celebrates the coming of summer and fertility of livestock and people. At the beginning of August, Lugnasad—the festival of the god Lug—celebrates the start of fruiting and harvest. The festival of *Samain* at the beginning of November marks the coming of winter. *Samain* is especially prominent in the mythological literature, as it is the time when the barriers between the natural world and the Otherworld are at their weakest: encounters between mortals and fairies often take place on the night of *Samain*. Some of the traditions associated with this festival live on in the modern Hallowe'en.

The close connection between mythology and astronomy is of course well documented, and in many civilizations the brighter celestial objects—sun, moon, planets, major constellations—were seen as manifestations of the divine. Greek mythology, for example, is particularly rich in traditions relating to the Heavens, and there are numerous tales explaining the origins of the various constellations. There is no doubt that the early Irish likewise saw the supernatural in the sky: the mythical seer Cormac mac Airt is represented as having in his youth been "a listener in the woods and a gazer at the stars" (Meyer 1909, 16 §7). There is a native term *mathmarc* ("astrologer, augur") of uncertain etymology; it is attested in a text of the ninth century, but may be much earlier. Another Irish word for astrologer is *néllatóir*, a derivative of *néll* ("cloud"). Presumably, the shapes of the clouds suggested images from which the future could be foretold. In general, however, the surviving texts indicate that for the early Irish the world of the supernatural was a place to be entered through a fairy mound or by passing through a fairy mist. Most frequently, it was represented as an island or group of islands in the Western Ocean. Consequently, we do not find an extensive vocabulary in the Irish language relating to celestial objects. To my knowledge, no native words are attested for the planets or constellations in any early Irish text, though in the later language we find expressions such as *Bóthar na Bó Finne* ("the road of the white cow") for the Milky Way.

The study of Classical astronomy was clearly well established in the Irish monastic schools, and a good deal of material is found in Old Irish texts and glosses of the eighth to tenth centuries, especially on the calendar and the movement of the sun, moon and planets. The vocabulary is almost entirely derivative, e.g. Old Irish *Satuirn* (Latin *Saturnus*), *ecenocht* (Latin *aequinoctium*). An Irish monk named Dícuil, who was born about the middle of the eighth century, wrote two treatises in Latin which show a fair degree of scientific expertise. He is thought to have studied at the monastery of Iona before moving to the Carolingian court. In AD 816 he completed his treatise *De Astronomia* ("on astronomy"), which was dedicated to the Emperor Louis the Pious (Esposito 1907). It contains material on such matters as the lunar and solar year, the distance between the planets, and the revolution of the planets. Not having been edited since 1907, this text is urgently in need of re-edition. In 825 Dícuil completed his *Liber de Mensura Orbis Terrae* ("Book on the Measurement of the Earth's Globe"), which also contains astronomical data (Tierney 1967). In this context, mention should be made of a tenth-century metrical version of the Bible entitled *Saltair na Rann* ("The Psalter of the Quatrains") (Stokes 1883). In the account of the Creation in this poem, the seven heavenly bodies are listed as Saturn, Jupiter, Mercury, Mars, the Sun, Venus and the Moon. The distance from the Earth to the Moon is given as 126 miles, and from the Moon to the Sun as 252 miles. The Earth is said to be six times larger than the Moon, and the Sun sixteen times larger than the Earth. The poet lists the twelve constellations (Aquarius, Pisces, Aries, Taurus, Gemini, Cancer, Leo, Virgo, Libra, Scorpio, Sagittarius and Capricorn) and describes how the sun stays in each of these constellations for a month i.e. thirty days and ten and a half hours. In lines

273–6 he speaks of the beauty of the part of the sky which is not visible in northern latitudes: “Though we think fair the half of the firmament with its many constellations which is turned to us, the other side is no uglier, if we were to see it”.

In a recent article on “Astronomical observations in the Irish annals and their motivation”, Daniel McCarthy and Aidan Breen (1997) have shown that “from the seventh to the eleventh centuries careful and sustained observation and recording of astronomical phenomena was conducted in some Irish monasteries”. They concluded that the underlying motive for this work was to detect the first signs of the end of time as foretold by the book of Revelation. There are a number of references to comets, some of which can be confirmed from the records of other civilizations. For example, in 1066 the Annals of Tigernach record that “a hairy star (*rétla mongach*), strange, enormous, was seen in the air on the Tuesday after Little Easter … such was its size and brilliance that men said it was a moon. And to the end of four days it remained thus”. This is an accurate description of the appearance of Halley’s Comet, and can be confirmed from the Bayeux tapestry and Chinese annals of the same year.

Eclipses of the moon are quite often recorded. The annalists sometimes describe the phenomenon as “the moon turning to blood” and viewed it with foreboding. The *aurora borealis* was also recorded on a few occasions, and was likewise regarded as a bad omen. For example, it is recorded in the Fragmentary Annals that in the year 700 “three shields were seen as if fighting in the sky, from east to west, like tossing waves, on the tranquil night of the Ascension of the Lord. The first was snowy, the second fiery, the third bloody, which it is thought prefigured three evils to follow: for in the same year herds of cattle throughout Ireland were almost destroyed, not only in Ireland, but indeed throughout Europe. In the next year there was a human plague for three consecutive years. Afterwards came the greatest famine, in which men were reduced to unmentionable foods [i.e. cannibalism]”. Sometimes the *aurora borealis* was imaginatively interpreted as the movement of dragons: the Annals of Ulster record that in the year 746 “dragons were seen in the sky”. Other entries are more mysterious; in the year 748 the same annals note that “ships with their crews were seen in the air above Clonmacnoise”.

After the twelfth century it seems that less significance was attached to the study of the heavens in Irish monasteries, and the annals record no further astronomical observations. With the revival of learning in the secular schools of the fourteenth and fifteenth centuries, there was a renewal of interest in continental medicine, philosophy and astronomy. Many works were translated into Irish at this period. Of particular interest in the present context is the translation of a Latin version of an Arabic treatise written about 800 by Messahalah, a Jewish astronomer of Alexandria. This text was edited in 1914 by Maura Power under the title *An Irish Astronomical Tract* (Power 1914).

Astrology was closely linked with medieval medicine, as various surgical and therapeutic procedures had to be carried out under the correct astrological sign. Consequently, there is astrological material in many Irish medical manuscripts of this period. Some of these manuscripts have examples of a volvelle or rotula, i.e. a circular piece of vellum pinned to the folio which can be turned by a tab so as to ascertain in which sign and degree of the zodiac the sun and moon are on any particular day of the year. There are also fine illustrations of the signs of the zodiac. By kind permission of the Trustees of the National Library of Scotland, I reproduce in Fig. 13.1 the signs of Libra, Scorpius (Scorpio), Sagittarius and Capricorn from a text on the constellations (*ranna an aeir*) in a sixteenth-century Irish manuscript in this collection (Anderson 1909).

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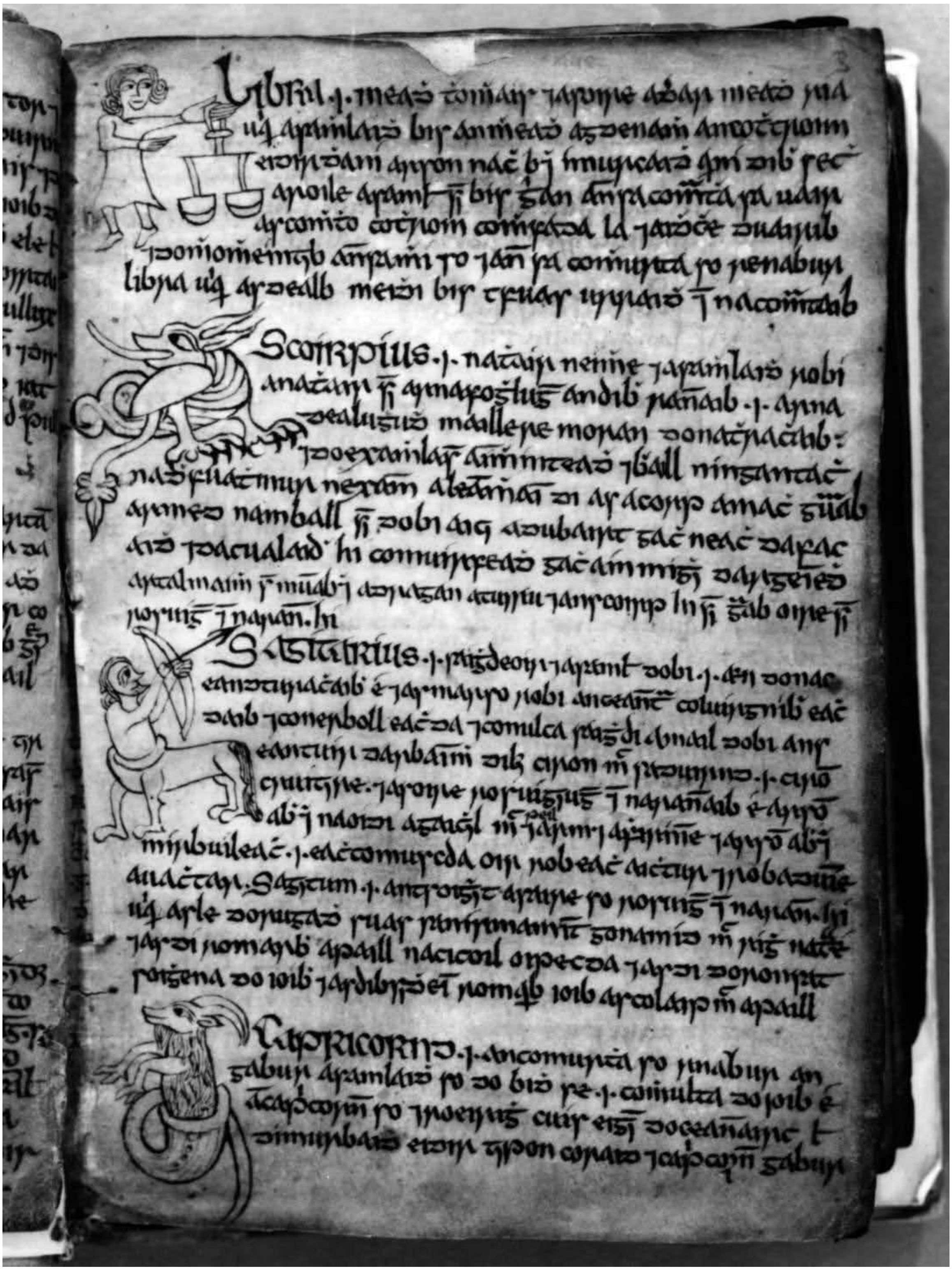

Fig. 13.1. Four of the signs of the zodiac from a sixteenth-century Irish manuscript, Advocates 72.1.2 folio 3 r (reproduced by kind permission of the Trustees of the National Library of Scotland).

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14

Jonathan Swift's astronomical prophecies

Irakli Simonia

It was in 1877, the year of the great opposition of Mars, that Asaph Hall of Washington Naval Observatory discovered two satellites of Mars using a 65 cm refractor. Since that time Phobos and Deimos have been a subject of study for many astronomers. This paper, however, concerns a most amazing fact. The great English satirist Jonathan Swift, whose novel *Gulliver's Travels* recounts Gulliver's many different adventures, describes his visit to the Laputan astronomers, and mentions two satellites of Mars. Yet *Gulliver's Travels* was published in 1726, long before Hall's discovery. A few suggestions have been made to explain this fact, the following three of which are worth citing:

(a) It is a result of the writer's imagination, which was boundless.

(b) Swift believed in the harmony of numbers: one satellite for the Earth, two for Mars and so on.

(c) Swift used earlier sources—books, manuscripts, and letters.

Each of these hypotheses can be supported by certain reasoning and all three are equally valid. On the other hand, one should not forget that Swift was a satirist and aimed his criticism at the vices of contemporary society; therefore many, if not all, of his plots and characters reflected reality, even though they had been altered by the writer using artistic licence. The underlying substance remained realistic. The story about the Laputan Observatory might have been a result of certain reminiscences. Describing the cave in which the Observatory was placed, Swift named several sextants, quadrants, telescopes, astrolabes and other astronomical instruments. He described the life of those astronomers devoted to the observation of celestial bodies. Their telescopes were of exceedingly high quality, the largest of them being 3 ft long but much stronger than the 100 ft-long telescopes existing in Swift's time. The Laputan scientists could make discoveries that no European astronomers could even dream of. They compiled a catalogue of 2000 stationary stars, while the existing European catalogues listed only one third of that number. They discovered two small stars or satellites going around Mars. One of them moved at a distance from its centre equal to three of its diameters, while the other one moved at a distance equal to five of its diameters.

The Laputans told Gulliver that they had studied ninety-three comets and precisely established the times of their periodic returns. Swift remarked that those research results ought to become known to the public.

The passage describing the Laputan Observatory and another speaking of their scientific achievements suggest that the writer had visited astronomical observatories, knew some astronomers and had some knowledge of this branch of science. Gulliver's remark concerning the quality of the Laputan telescopes, which he thought to be better than those in his own country, suggests that Swift might have visited at least two observatories. He describes a 3 ft telescope in comparison with a 100 ft one, thus confirming that he had seen both short-focus reflectors (described as 3 ft ones) and long-focus refractors (described as 100 ft ones).

And then comes another curious remark—that the achievements of the Laputan astronomers should become known to the public! Could this be sheer fantasy or a hint that not all discoveries were being made known to the public in Great Britain in Swift's times?

These things, and also the fact that Swift had certain relations with the British Royal Society, suggest another hypothesis: namely, that a contemporary astronomer had discovered the satellites of Mars but did not let anyone know about the discovery. Swift might have witnessed that discovery and told about it in his book which has thus become a kind of a link between the discoverer and us.

But some further questions then arise: who was that astronomer, and why didn't he officially announce his discovery? These questions are likely to be answerable by examining sources found in archives, libraries or museums, but whichever of these is being pursued, one point must be kept in mind: such a discovery could be made only with the help of a reflecting telescope. Any other telescope of that time (such as those of Hevelius, Huygens and Flamsteed) suffered from different aberrations although their objectives were of quite big diameters and it was altogether possible to observe the satellites of Mars through those telescopes. Moreover, in the late 17th and early 18th centuries the mathematician, physicist and philosopher Tschirnhaus made large concave mirrors and lenses; and in 1722 the astronomer Hadley made one of the first reflectors with a main mirror diameter of 15 cm (Newton and Hook had built smaller reflectors earlier).

One further relevant fact remains. In 1752, the great French writer Voltaire also mentions two satellites of Mars in his *Micromegas*. The same questions arise as with Swift: was this Voltaire's imagination, or did he believe in the harmony of numbers, or did he use earlier written sources? There is currently no definite answer to these questions, but for the present two things are clear. The first is that Hall should rightly be remembered as the discoverer of the satellites, in that it was he who brought information about them into the public domain in 1877. The other is that both Swift and Voltaire have left remarkable traces in the science of astronomy: two craters of Deimos bear their names.

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15

Orientation for archaeoastronomy — a geodetic perspective

Frank T. Prendergast

Introduction

The Irish landscape possesses a rich and diverse range of prehistoric sites and monuments, which are comprehensively listed and described in a variety of databases and publications. They range from specialist journal reports on site excavations, to the broader but less detailed Sites and Monuments Record (SMR), and the archaeological inventories compiled on a county basis (e.g. Power 1992). The SMR database and county inventories are the result of a national conservation programme initiated in the early 1980s for the protection of archaeological remains throughout the State. They provide primary descriptive information in the form of monument classification (tomb, circle, row, etc.), geographic position, and patterns of density and distribution on the Irish landscape. In general, these cater for the broader needs of the specialist and the high level of public interest in heritage sites. For the archaeoastronomer, however, such publications do not contain the specific types of data required to discover meaningful evidence of astronomical practice during the Neolithic and Bronze Age (c. 3700BC – c. 500 BC).

To undertake such investigations, field and analytical techniques have been developed, based on well-researched and tested methodologies. These include the determination of monument orientations, horizon profiling, horizon categorisation, stone morphology, monument decoration, statistical methods (Ruggles 1994; 1996; 1999; Ruggles and Prendergast 1996), and computer simulation (Prendergast 1991). As a result of correlation of data collected at many sites in Europe and elsewhere, convincing evidence linking astronomical practice with cultural development in arcane societies is evident. In some cases, these findings have made a significant contribution to our understanding of prehistoric culture and the concept of a "ritual landscape". That understanding is partly based upon reliable field data. Such data will often include the azimuth (true bearing) of a monument's axis, or the azimuth of points of interest on the horizon associated with the alignment of the axis.

In the above context, this paper examines four techniques to determine azimuth. They are:

- astronomical azimuth,
- gyroscopic azimuth,
- azimuth derived from projection (or map) coordinates, and
- azimuth derived from magnetic bearing.

The topic is examined and discussed, with reference to the use of modern surveying instrumentation and geodetic positioning concepts. It will have global application for those involved in fieldwork.

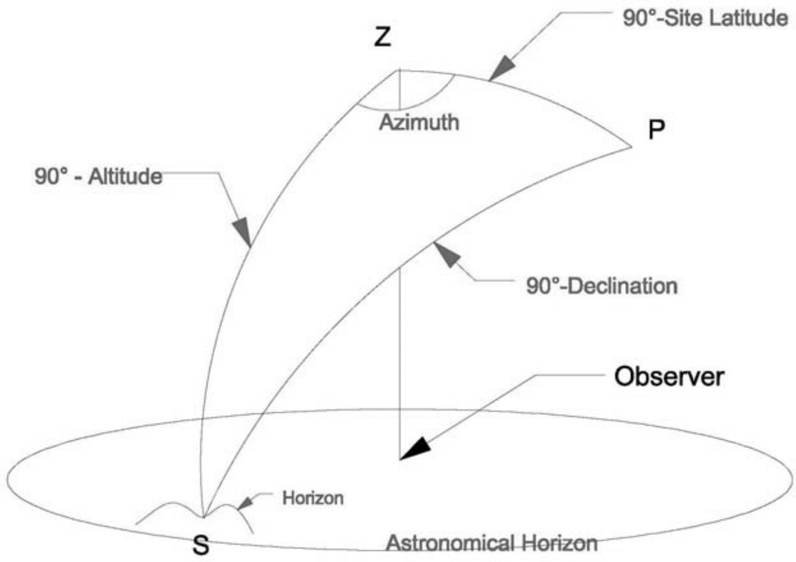


FIG. 15.1. The celestial sphere and the Astronomical Triangle (PZS).

Orientation by astronomical methods

An understanding of the geometry of the celestial sphere and the various solutions of the spherical triangle is an essential prerequisite for those undertaking surveys at archaeological sites with astronomical alignment potential. The ancient concept of the heavens was of a collection of stars whose relative positions were constant and attached to the inside of a sphere centred on the earth—the "celestial sphere". The concept was based on the perceived apparent motion of celestial bodies about the observer. That model still proves convenient today for the purpose of azimuth and declination determination.

In such a model, the daily rotation of the earth from west to east translates into an apparent reverse rotation of the sky from east to west about the polar axis of the earth. This axis will intersect the "celestial sphere" at the north and south celestial poles when extended. For the terrestrial observer positioned at an archaeological site, the upward extension of the vertical (defined by a plumb line) intersects the celestial sphere at the observer's zenith point (Fig. 15.1).

By joining the zenith point (*Z*), the celestial pole (*P*), and any point of interest on the horizon (*S*) with the arcs of great circles, a spherical triangle (*PZS*) is generated. Azimuth, declination or other unknowns can then be solved using various combinations of the sine, cosine or tangent rules for spherical triangles. Point *S* may for example, be a point on the horizon at which a celestial object will rise or set, and coincide with the alignment of the axis of a prehistoric monument.

Equations [1] and [2] are of particular use in the investigation process in order to compute either azimuth from astronomical observations, or astronomical declination from values of azimuth, latitude and horizon altitude:

$$\tan A = \frac{\sin t}{\tan\delta \ \cos\phi \ - \sin\phi \ \cos t} \qquad \ldots [1]$$

$$\sin\delta = \sin h \sin\phi + \cos h \cos\phi \ \cos A \qquad \ldots [2]$$

In Equations [1] and [2], A = azimuth, δ = declination, ϕ = latitude, h = altitude, and t is a function of the local hour angle of the celestial object. The angle h is the observed altitude of point S on the horizon, in the direction (A) of the alignment. Altitude must be corrected for atmospheric refraction, parallax (solar or lunar), and the altitude of the skyline above the astronomical horizon (Hawkins 1968). Thus h, for example, may equate to the first flash of the sun's disc, or to when the disc is fully tangential on the horizon.

Equation [1] is the so-called "azimuth by hour-angle" method and is used to determine astronomical azimuth (A) from the time-dependent variable t, δ, and the latitude of the monument (ϕ). This enables the orientation of the horizontal circle of a theodolite to be established for subsequent profiling of the horizon. The fieldwork phase of the astronomical work first involves sighting a terrestrial reference point, followed by the celestial object (the sun or Polaris) and

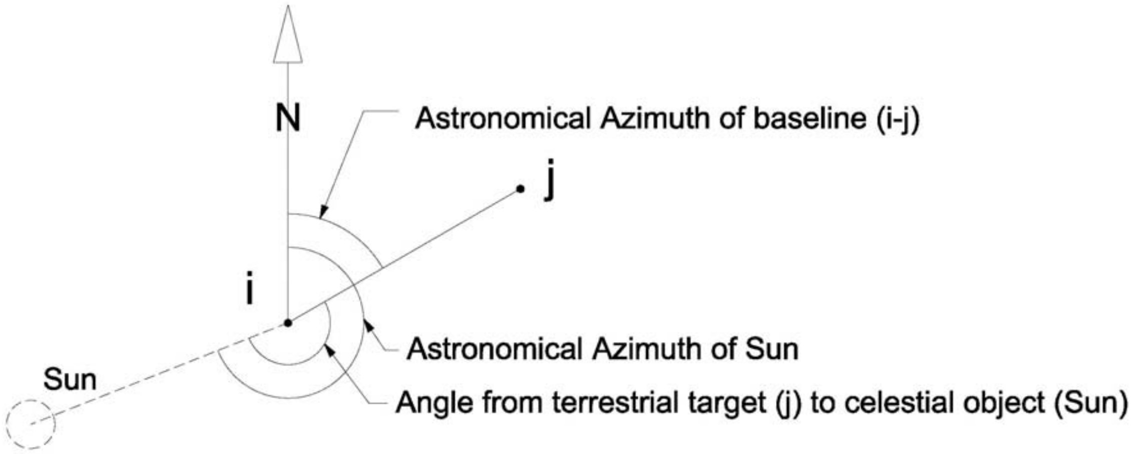


Fig. 15.2. Angular relationships between sun, baseline and north (example).

recording the horizontal directions of both objects. The Coordinated Universal Time (UTC) at the instant of reading the horizontal direction of the astronomical object is also recorded, to provide the local hour angle of the celestial body. For the highest accuracy in solar azimuth determination (better than ±15″), the UTC time should be corrected by the DUT1 correction to obtain UT_1, which is the mean solar time of the meridian of Greenwich. The DUT1 correction varies between 0 seconds and ±0·9 seconds and its value is encoded on the broadcast UTC signal. Observations and computations for azimuth are undertaken according to a prescribed and rigorous methodology such as that described in Buckner (1985) and illustrated in Fig. 15.2. Accuracy typically ranges from <1″ (Polaris method) to between ±5″ and ±20″ (solar method), and also depends upon the geometry of *PZS*, instrumentation, and skill of the observer.

In Equation [2], astronomical declination (δ) is determined from site-specific values of the variables h, ϕ and A. This can be used to investigate the alignment of a monument or a horizon profile for astronomically interesting values of δ, either in line with or close to the direction of the alignment (Fig. 15.3). In addition, the study of calendar dates derived from such values of δ can assist in our understanding of the purpose of such monuments, especially when combined with other relevant evidence, such as position on the landscape or proximity to prominent hills or mountains (Ruggles 1999).

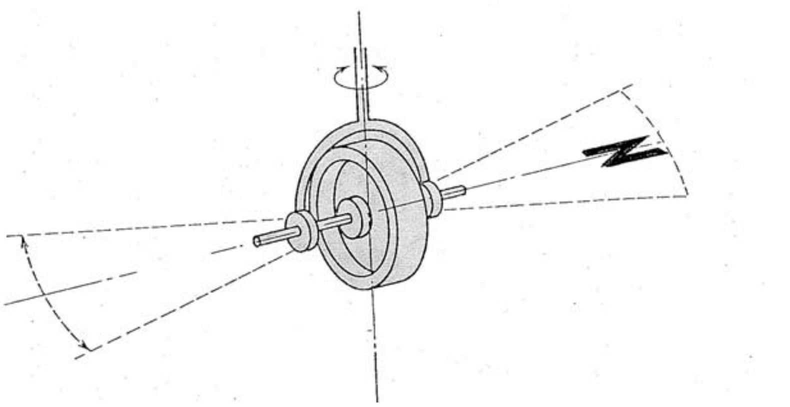
Fig. 15.3. Knockaunbaun Stone Row, County Galway, Ireland (quartz stone pair).

Orientation by non-astronomical methods

The gyroscopic method

Gyro-theodolites provide a means of azimuth determination without the need to sight an astronomical body. They are primarily designed to provide orientation in mines and tunnels. Although expensive, they can be a practical alternative in archaeoastronomy where astronomical expertise is lacking or where views of the sky are impossible, such as inside a chamber or tomb.

The modern gyro-theodolite consists of a digital theodolite with either a detachable or integrated gyroscope, depending on the model specification (Fig. 15.4). At the heart of all gyroscopes is a suspended rotor. Gravity and earth rotation act on the rapidly spinning rotor (>20,000 rpm) to produce a north-driving force. This causes the spin axis of the rotor to precess in the horizontal plane towards the meridian. Ultimately, the rotor will oscillate with damped simple harmonic motion about true north. The corrected direction of the mean centre of this oscillation is therefore equivalent to the direction of true north (Fig. 15.4). The azimuth of the baseline is obtained from data derived by tracking the precession of the rotor, and horizontal angle data observed with the theodolite. Reduction of the data from the gyro-theodolite relates the direction of true north with the direction of a reference object (RO) at the other end of a baseline. Recent technological advances in gyroscopic instrumentation have made geodetic levels of accuracy possible, *i.e.* $\pm 3''$ accuracy, after only ten minutes of observation time. Gyro-theodolites require frequent calibration and must be handled with extreme care, but can provide accurate azimuths between latitudes *c*.75° north or south of the equator. Because precessional torque decreases as a function of $\cos \phi$, gyroscopes become increasingly dysfunctional and unreliable in high latitudes and are inoperable at the poles (e.g. all azimuths at the north pole are 180°).



GPS Method

The Global Positioning System (GPS) is a satellite-based navigation, positioning and timing service provided by the US Department of Defence. Two levels of broadcast service are available to the GPS user: the Standard Positioning Service (SPS) and the Precise Positioning Service (PPS). Both services enable navigation and positioning in 3D. Access to PPS is restricted to the US military and other authorised users, and is denied to the general public.

The space segment of GPS consists of 24 satellites, in orbit at 22,200km above the earth in precisely known and predictable trajectories (Fig. 15.5). They are grouped into six different orbital planes, distributed along the plane of the celestial equator at intervals of 60°. The orbital period is 12 sidereal hours. This configuration ensures that a minimum of 4 satellites will be visible above a distant horizon, anywhere on earth. Reception of the microwave signals and their associated codes and messages enable the user to navigate and fix position with an accuracy which depends upon the type of receiver, the method of observation and the processing technique. GPS therefore offers considerable potential for archaeoastronomy, both for positioning, timing and orientation determination. Orientation determination by GPS has the potential for very high absolute accuracy (Schwarz 1998).

Numerous factors affect the final GPS positional accuracy. In summary, they are:

- the type of receiver used (code/carrier-phase or code-only),
- differential (Δ) or non-differential (autonomous) methods,
- carrier-phase measurement or *C*-code measurement,
- static or kinematic operational method.

Satellite geometry, atmospheric factors, and data processing techniques also affect the final positional accuracy. Most significantly of all, until its removal on 1 May 2000, Selective Availability (S/A) induced errors of up to 100 m in 95 % of measurements. S/A was a technique employed by the US Government to downgrade the accuracy of the GPS service to those using receivers in autonomous mode (non-ΔGPS).

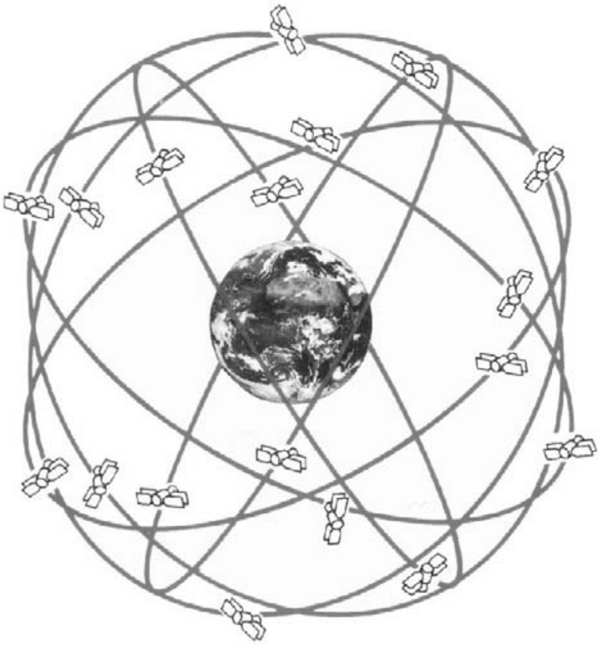


Fig. 15.5. GPS constellation and hand-held code receiver (Garmin GPS48).

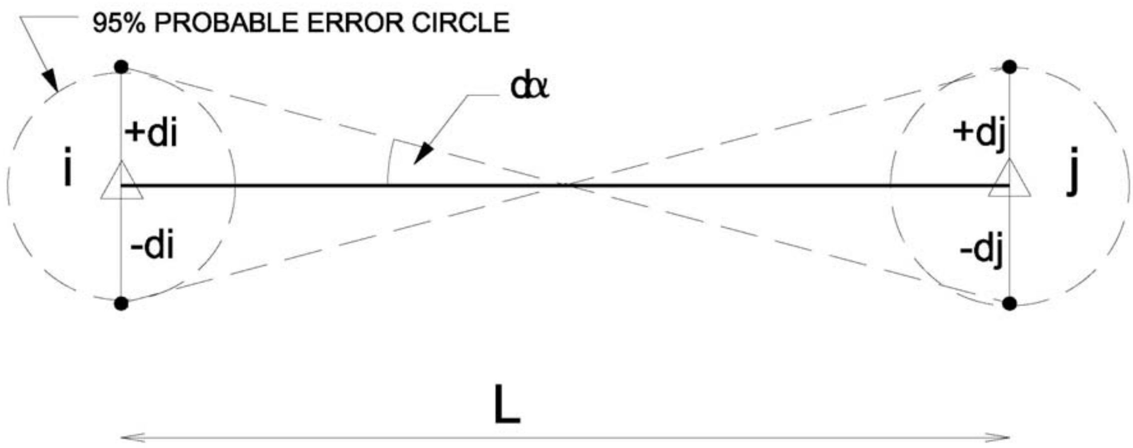


Fig. 15.6. GPS baseline and orientation error.

GPS methods can be used to obtain baseline azimuths by computation, using the coordinate data obtained from the GPS receivers. These azimuths can then be used to obtain the orientation of monuments and observed horizon features at sites of archaeological interest. The significance of positional errors on such azimuths should be fully understood, however, in order to assess not only the accuracy of the final result, but also its effect on archaeological conclusions based on such data.

Consider two points (i, j) at either end of a GPS baseline (Fig. 15.6). Where the probable error circle in each of the baseline stations is a maximum, the worst-case scenario for azimuth computed from such coordinates is when the unknown errors di and dj are normal to, and on opposite sides of, the baseline. Both di and dj are assumed to equate to 2·4σ at the 95% probability level, *i.e.* the maximum probable error, and to be equal in magnitude. The resulting maximum probable error in azimuth $d\alpha$ over any distance L is given by:

$$d\alpha\ ^\circ = \tan^{-1}\frac{2di}{L} \qquad \ldots [3]$$

The error ranges associated with the five commonly used GPS positioning methods are shown in Fig. 15.7. Calculation of the angle subtended by these plan errors over increasing baseline lengths, using equation [3], gives the resulting error in baseline orientation. For the more precise GPS methods (differential static and differential kinematic) and the less precise methods (differential code and code with/without S/A), the orientation errors are shown in Figs 15.8a and 15.8b. It is apparent that the GPS receiver type, observation method, and the length of the baseline can have a profound effect on the accuracy of azimuths derived by computation from GPS coordinates. Orientation errors are inversely proportional to the length of the baseline. In Fig. 15.8a, azimuth accuracy is seen to improve in a hyperbolic manner as a function of increased baseline length. Provided baselines are kept longer than about 600m, the ΔGPS method used in either static or kinematic mode should keep orientation errors <30″. The potential accuracy typical of astronomical and gyroscopic techniques is included in Fig. 15.8a for comparison with GPS methods. The accuracy of astronomical or gyroscopic methods is unrelated to baseline length and is therefore a constant as a function of baseline length. In Fig. 15.8b, for the less precise GPS methods shown in Fig. 15.7, all are significantly worse than those shown in Fig. 15.8a. The typical accuracy obtainable from azimuth derived from a magnetic bearing (equivalent to about one solar diameter) is included in Fig. 15.8b to emphasize the significance and scale of these results. Over short baselines, the orientation derived from differential code receivers equates to the accuracy obtained with a compass, at best. In conclusion, baseline lengths should always be selected with due regard to the likely effect on baseline azimuth arising from the expected GPS positioning errors.

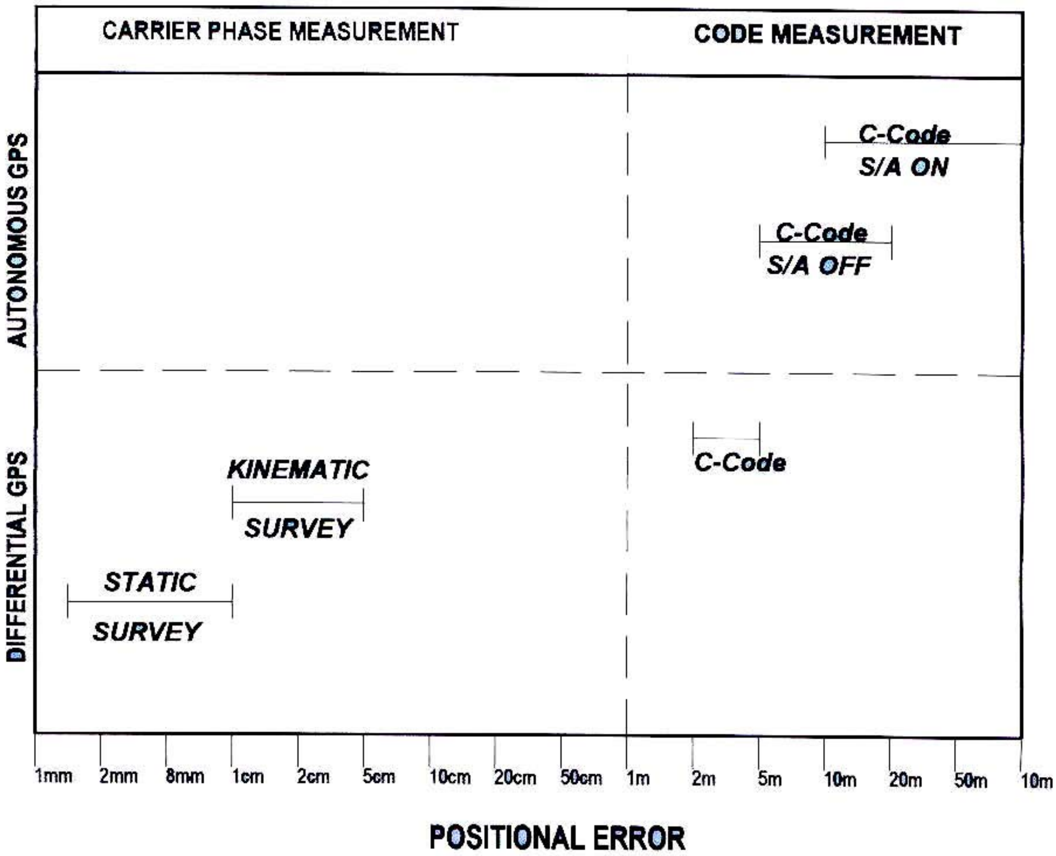


Fig. 15.7. GPS methods and accuracy—summary.

Projection Coordinates Method

Astronomical azimuth can be computed from projection coordinates. Projection (or map grid) coordinates will often be available for pillars or ground bolts in close proximity to the project site. If these can not be obtained, several surveying techniques are available to tie any new on-site control points into the national network such as GPS methods, networks, traversing, intersection, resection etc. Projection coordinates can also be scaled from a map. These can eliminate the need for fieldwork, and astronomical, gyroscopic or GPS methods of orientation. If such a method of orientation is contemplated however, it is imperative to have a basic appreciation of map projections and coordinate systems.

Terrestrial positions can be expressed in three ways:

- astronomical latitude and longitude (ϕ_A, λ_A) defined with respect to the local direction of gravity;
- geodetic latitude and longitude (ϕ_G, λ_G) defined with respect to the normal to a specified ellipsoid (as used for GPS geodetic coordinates); and
- grid easting and northing (E, N) defined with respect to the origin of a plane grid, tangential with the ellipsoid, *i.e.* the map projection plane.

Astronomical position is not the same as geodetic position, and astronomical north is not the same as geodetic north. Different reference surfaces are used in their definition (geoid and ellipsoid). The differences are small, however (<10″). For archaeoastronomical surveys, therefore, astronomical azimuth and geodetic azimuth can be regarded as equal and the term “azimuth” is therefore used to mean either type. The same does not hold true for the relationship between grid north (on the projection) and astronomical/geodetic north.

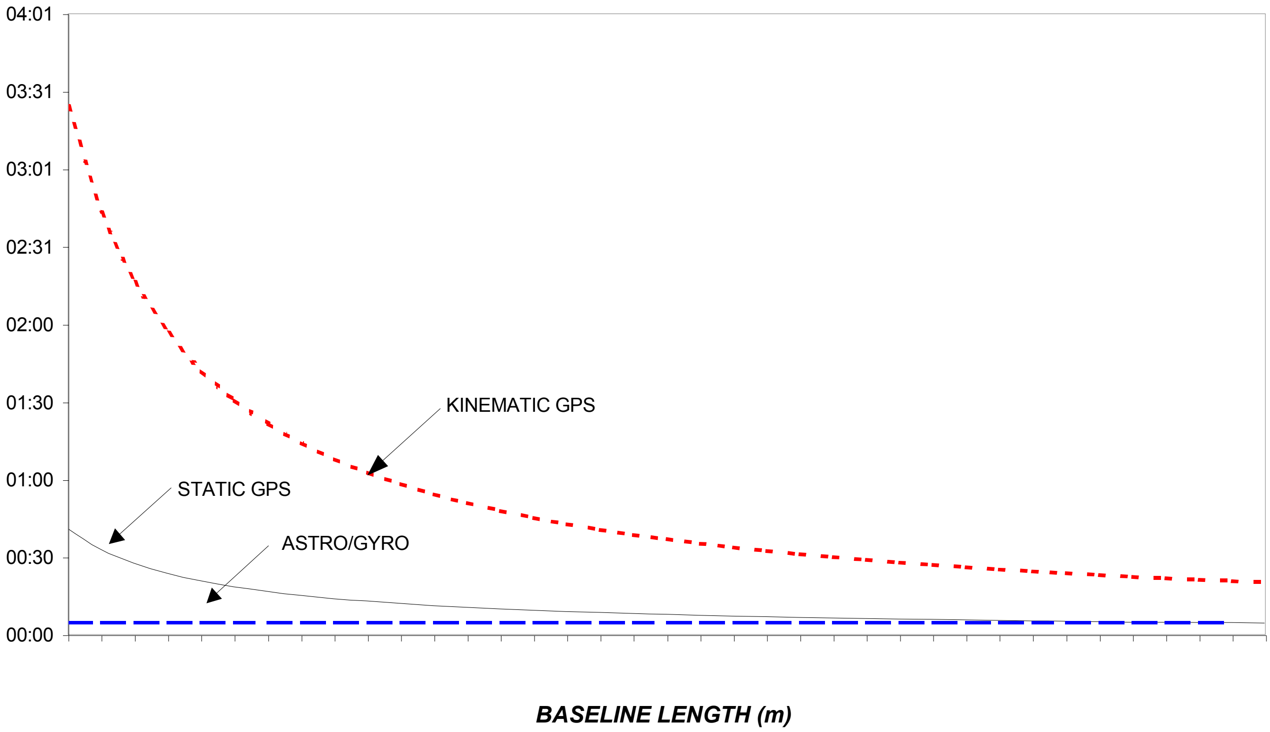


Fig. 15.8a. Azimuth errors from static and kinematic GPS and astronomical/gyroscopic methods.

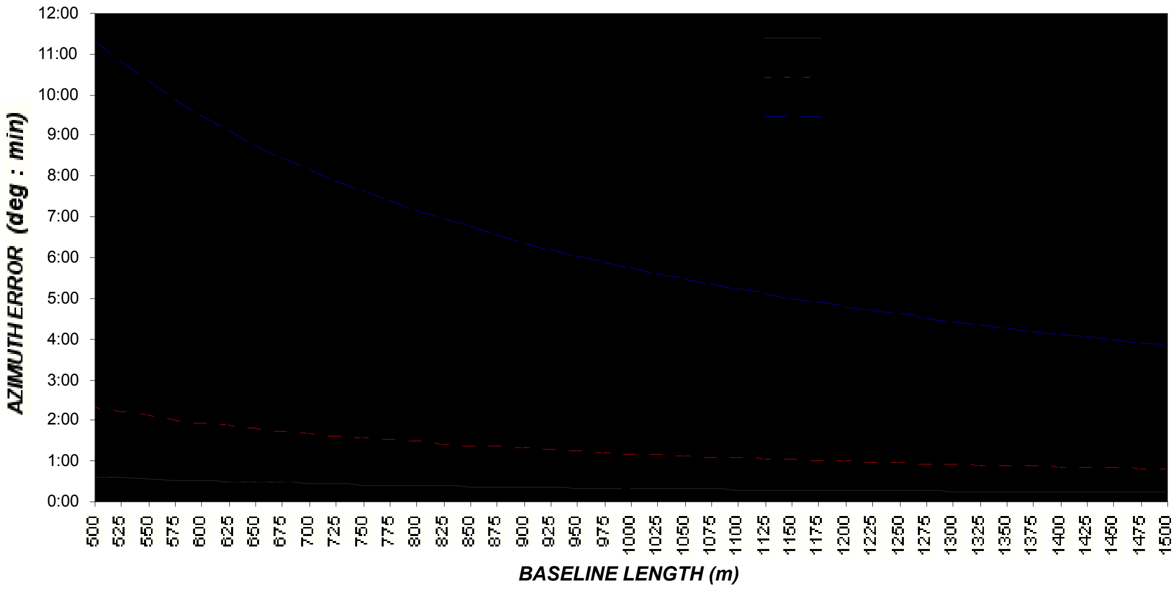


Fig. 15.8b. Azimuth errors from C-code GPS (with/without SA) and magnetic methods.

West of CM	***At CM***	***East of CM***
Grid Bearing > Azimuth	*Grid North ≈ Astronomical North ≈ Geodetic North*	*Azimuth > Grid Bearing*

Fig. 15.9. North relationships on the TM projection (arcs indicate bearings).

The purpose of a map projection is to enable the curved topographic surface of the earth and its features to be represented on a plane surface (the map) with minimal and acceptable levels of distortion. The two most commonly used map projections are the cylindrical Transverse Mercator projection (TM) and the conical Lambert projection. The Universal TM projection (UTM) is a world-wide system of TM projections. The Lambert projection is used to map areas that have a large east-west extent and a small north-south extent. The TM projection caters for the opposite case. The TM projection is used in Ireland and the UK, for example. In the USA, where states may vary considerably in both shape and size, both projections can be found.

The angular difference between grid bearing (β) and azimuth (α) varies according to position in relation to the Central Meridian (CM) of the projection (in some mapping zones, there may be more than one CM). This difference is known as Meridian Convergence (C). At the central meridian, the direction of grid north and azimuth coincide. East or west of that line, the angle C will increase with increasing longitudinal distance ($\Delta\lambda$) from the central meridian and increasing latitude and give the relationships and sign conventions in Fig. 15.9.

The angle C may be calculated with sufficient accuracy from either

$$C = \Delta\lambda \times \sin\phi \qquad \text{... [4]}$$

or

$$C'' = \frac{206265 d \times \tan\phi}{R} \qquad \text{... [5],}$$

where d = distance of point (i) from CM,
i.e. Easting of point (i) – Easting of true origin of projection,
R = radius of curvature of the earth ($6{\cdot}38 \times 10^6 m$), and
ϕ = latitude (astronomical or geodetic).

The process of converting a grid bearing into an astronomic azimuth is illustrated below using two examples located east and west of the CM on the Irish TM projection. This method can be applied to any zone in either the TM or the Lambert conical projections with an accuracy of a few arc seconds.

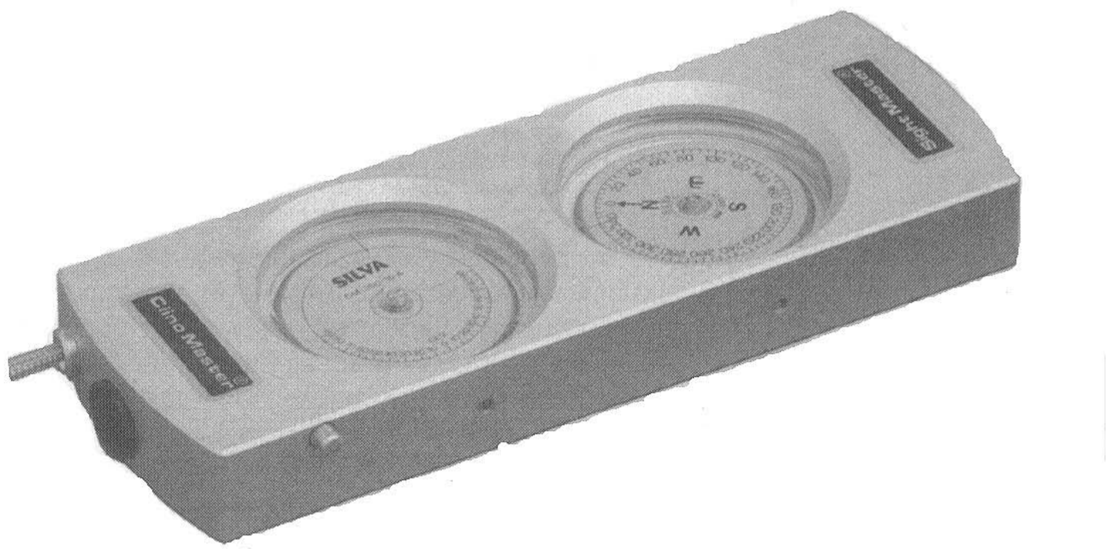


FIG. 15.10. Silva Survey Master—compass and clinometer.

The projection parameters necessary to compute the given examples are:

Ellipsoid name:	*Airy Modified*
True Origin of the projection:	*Latitude 53° 30′ 00″ N*
	Longitude 08° 00′ 00″ W
Easting coordinate of the True Origin:	*200 000m*

Given the projection coordinates of two points (i, j) for each of two baselines that are east and west of the CM (Fig. 15.9), the grid bearing on the projection (β) is first computed using the differences in easting and northing coordinates of the points (ΔX_{i-j}, ΔY_{i-j}), from the relationship:

$$\beta^\circ = \tan^{-1} \frac{\Delta X_{i-j}}{\Delta Y_{i-j}} \qquad \ldots [6].$$

Meridian convergence (C) is then computed (equation [4]) and applied to β, to obtain the azimuth of the baseline (α). The following examples use coordinate data on the Ireland 1965 Datum.

Example 1 — Baseline West of CM	
Easting of i	*188 152·70 m*
Northing of i	*237 617·19 m*
Easting of j	*188 585·71 m*
Northing of j	*237 867·19 m*
Latitude of i	*53° 23′ 19″ N*
Longitude of i	*08° 10′ 41″ W*
d	*11 847·30 m*
Grid Bearing (β)	*60° 00′ 00″*
C	*00° 00′ 09″*
Azimuth (α)	*59° 59′ 51″*

Example 2 — Baseline East of CM	
Easting of i	*328 546·34 m*
Northing of i	*237 617·19 m*
Easting of j	*328 979·35 m*
Northing of j	*237 867·19 m*
Latitude of i	*53° 22′ 23″ N*
Longitude of i	*06° 04′ 06″ W*
d	*128 546·34 m*
Grid Bearing (β)	*60° 00′ 00″*
C	*01° 33′ 00″*
Azimuth (α)	*61° 33′ 00″*

Magnetic Method

Azimuth can be derived from observed magnetic bearings. The difference between astronomical/geodetic north and magnetic north is termed Magnetic Declination (D). Absolute measurements of D together with Magnetic Inclination (I) and Total Force (F) are made on a regular basis by Met Eireann (The Irish Meteorological Service), for example. These data give variation in the individual magnetic elements Horizontal Force (H), Vertical Force (Z) and D. Surveys of D, I, F, H and Z at different stations throughout Ireland enable lines of equal magnetic declination (isogons) to be determined for any given moment in time (epoch), together with the annual variation. All national maps give information on the relationship between magnetic north and true north or grid north, thus allowing a magnetic bearing to be converted into azimuth. The relationship between magnetic north and other types of north is illustrated in Fig. 15.9.

The following simple example demonstrates this process:

Observed Magnetic Bearing (*i–j*)	110° 30′
Date of Survey	May 1999
Magnetic North west of Grid North (Epoch 1990)	08° 04′
Annual decrease per annum	00° 9·8′
Correction to Magnetic Bearing	–01° 28′
Adjusted Magnetic North	06° 36′
Grid Bearing (*i–j*)	103° 54′

The grid bearing (*i–j*) is then corrected for meridian convergence (*C*) as previously described to obtain the azimuth.

Owing to the limitations of reading the graduations on the compass and the many unpredictable or unknown variations/errors that can locally attract the direction of the compass needle, caution must be taken. Even wristwatches, rings and steel-framed spectacles can exert a significant local attraction up to 1·5 m away. Magnetic bearings should, where possible, be observed reciprocally, and only where other forms of azimuth determination are unsuitable or unnecessary, such as on a reconnaissance survey. A particularly useful and convenient instrument for such a task, and used by the author, is illustrated in Fig. 15.10. The Silva Survey Master is a combined compass and inclinometer and enables the horizon to be profiled with a potential precision of ±0°·5. When used in combination with a handheld GPS receiver, this instrument provides a low-cost and lightweight measurement solution for some field tasks in archaeoastronomy.

Conclusions

The measurement of orientation is just one of several investigative methods used by archaeoastronomers to enhance the understanding of prehistoric monuments and their relationship with the landscape. The choice of method is commonly determined in the first instance by site accessibility, available instrumentation and expertise, rather than by rigorous measurement specifications or guidelines. More significantly, ambiguity in the determination of the structural axis of some monuments will often dictate the most appropriate survey method and the required precision. In that context, the following quotation from O'Riordain (1979) seems apt. He wrote:

> There is no doubt that orientation was considered important by prehistoric man not only in stone circles but in some megalithic tombs; its importance has been obscured by the extravagant claims made by its protagonists who have sometimes argued about orientation as if primitive man used precision instruments (*ibid*., 93).

It is incumbent on those working in archaeoastronomy to adopt a careful and self-checking approach to fieldwork nonetheless, and to ensure an appropriate level of ground truth in the collected data. If such data is then allowed to "speak for itself", the resulting findings can make a significant and worthwhile contribution to mainstream archaeology, and to the corpus of knowledge on a period of prehistory which still harbours many unsolved mysteries.

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