Astronomy in the Upper Palaeolithic?

Brian Hayden and Suzanne Villeneuve

Beginning with Alexander Marshack's interpretation of engraved lines as lunar calendrical notations, a number of highly controversial claims have been made concerning the possible astronomical significance of Upper Palaeolithic images. These claims range from lunar notations, to solstice observances in caves, to constellation representations. Given the rare nature of artefacts and images that lend themselves to such interpretations, these claims are generally difficult to evaluate on the basis of archaeological data alone. However, comparative ethnology can provide at least a way of assessing the plausibility of such astronomical claims. If the premise is accepted that at least some of the Upper Palaeolithic groups were complex hunter-gatherers, then astronomical observances, or the lack of them, among ethnographic complex hunter-gatherers can help indicate whether astronomical observations were likely to have taken place among Upper Palaeolithic complex hunter-gatherers. A survey of the literature shows that detailed solstice observances were common among complex hunter-gatherers, often associated with the keeping of calendars and the scheduling of major ceremonies. Moreover, aggrandizers in complex hunter-gatherer societies often form 'secret societies' in which esoteric astronomical knowledge is developed. The existence of calendrical notations and secluded meeting places for secret-society members are suggested to be at least plausible interpretations for a number of Upper Palaeolithic caves and images.

Over the past three decades, there have been a number of controversial studies arguing that complex astronomy and calendars developed in some Upper Palaeolithic societies of western Europe (Marshack 1972; 2001; Jeguès-Wolkiewiez 2000; Rappenglueck 2001; Aujoulat 2004). While some of these claims have been pushed to extremes and are viewed with skepticism, many archaeologists accept a number of the more fundamental forms of these interpretations, or are at least willing to consider them as possible meanings associated with various examples of Upper Palaeolithic art. The aim of this discussion is to examine a number of these basic claims using ethnographic data to see if they are reasonable and to propose a broader theoretical context in which such prehistoric developments might be understood.

Until now, the major thrust of scientific effort has been directed to establishing claims that astronomical or calendrical monitoring actually took place in the Upper Palaeolithic. There has been little attempt to understand why such developments might be expected to occur or what factors could have motivated people to undertake elaborate monitoring of celestial objects. At best, there seems to have been a tacit assumption that sophisticated astronomy (as well as art, calendars, complex language and other abilities) was part of the package of modern cognition brought to Europe by anatomically modern humans (Wynn & Coolidge 2007; 2010). This idea, so prevalent in the 1990s, does not seem tenable in view of the lack of such developments among many technologically simple modern hunter-gatherers who are anatomically (and neurologically) modern. Nor do 'natural emergence' explanations make good sense given the time, effort and training required to establish some of these bodies of knowledge. Rather, the time and effort required to establish and pass on complex calendrical and astronomical conceptual systems indicate that there were strong positive pressures behind their development.

Cambridge Archaeological Journal 21:3, 331–55 © 2011 McDonald Institute for Archaeological Research
doi:10.1017/S0959774311000400 Received 20 Sep 2010; Accepted 13 Jan 2011; Revised 10 Aug 2011

https://doi.org/10.1017/S0959774311000400 Published online by Cambridge University Press

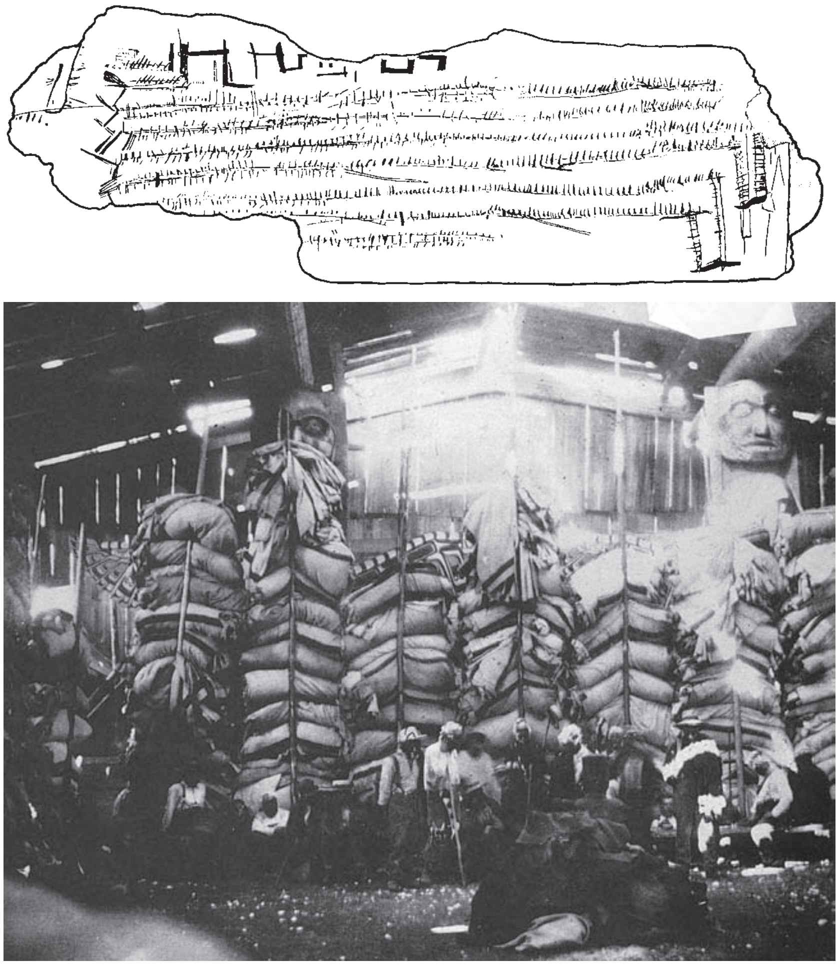


Figure 1. *Engraved markings on the Taï plaque from the French Upper Palaeolithic that Alexander Marshack interpreted as notations made for calendrical record-keeping. While calendrical notations may be represented on some artefacts, alternative purposes seem more plausible for some other notational artefacts in the Upper Palaeolithic such as these tally-type notations. Tallies could have been kept, for instance, for feasting gifts and debts considering the large numbers of objects that were given away at major feasts such as the potlatch blanket gifts depicted here (from Marshack 1992; Jonaitis 1991, 109, image #22861, American Museum of Natural History Library).*

We propose that, irrespective of neurological modernity, these developments cannot be understood outside of their economic, social and political contexts. We will argue that almost all hunter-gatherers make some astronomical observations, however the more elaborate types of observations first appear among complex hunter-gatherers (as defined below). We will also argue that sophisticated astronomical record-keeping makes theoretical sense primarily as part of the sociopolitical dynamics of inequality in complex hunter-gatherer societies. A key issue in understanding these occurrences is what motivated people to develop complex astronomical systems. In the following sections, we will examine the evidence for astronomical systems among hunter-gatherers and we will then discuss what insights can be obtained on motivations for creating and maintaining such systems. However, before entering these discussions, it will be useful to briefly review some of the claims that have been made for astronomical systems in the Upper Palaeolithic.

Astronomy in the Upper Palaeolithic?

Solstice monitoring and calendars

Alexander Marshack (1972; 1985; 1991a,b; 2001) was one of the first to propose that calendrical reckoning was represented in some portable-art pieces of the Upper Palaeolithic and that solstices or equinoxes may have been important time-markers in those societies. He expanded this notion to argue that Palaeolithic art displayed 'time-factoring', a rather nebulous concept involving the ritual tracking of seasonal changes and activities (Marshack 1985; 1991a; 2001). While a few engraved artefacts do seem to show sequences of counts that plausibly could have been related to day counts of lunar cycles, other examples (e.g. the Taï and Okuzini engravings: Fig. 1) involve so many line counts that it is difficult to imagine that they constituted calendars or day counts, although they may well be notational counts of something else.

Building on Marshack's research, Chantal Jegues-Wolkiewiez (2000; 2007; 2008; n.d.) subsequently argued that a number of painted Palaeolithic caves and rock shelters were chosen because the sun shone into their entrances at astronomically significant times of the year. She made observations showing that some caves such as Lascaux and Bernifal were illuminated at the summer solstice sunset (and only then) by the sun's rays penetrating directly into the entrance chambers. Other rock shelters, such as Abri Castanet and Bison are illuminated at the winter solstice sunset,

https://doi.org/10.1017/S0959774311000400 Published online by Cambridge University Press

a

b

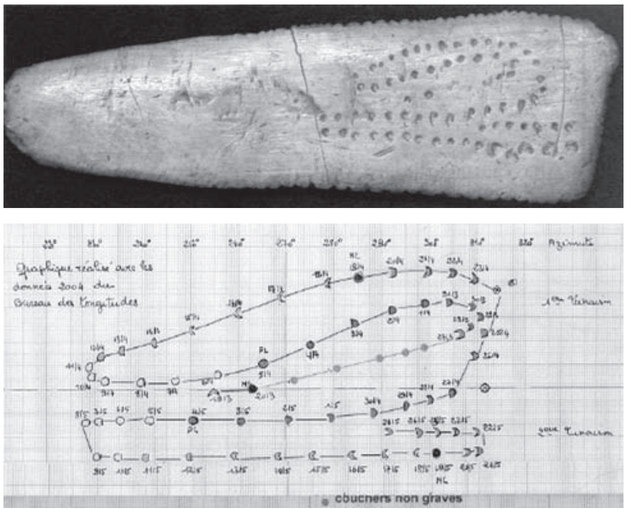


Figure 2. *(a) The Blanchard plaque (from Jègues-Wolkiewiez 2005) showing the ellipse pattern of incisions which is interpreted (b) as mimicking the analemma movements of successive zeniths of the moon. The notches along the edge of the bone may represent corresponding azimuth intervals as illustrated by Jègues-Wolkiewiez.*

while still others such as Blanchard and Combarelles Cave-I, are illuminated at the equinoxes (Jeguès-Wolkiewiez n.d.). Among a number of ethnographic complex hunter-gatherers these were solar events that were important for shamanic displays (Hudson & Underhay 1978; Broughton & Buckskin 1992, 185).

Jeguès-Wolkiewiez (2005) also used the same engraved bone from Abri Blanchard that Marshack had analysed to argue for a remarkably detailed monitoring of lunar-setting positions at the Vernal Equinox. The bone appears to record not only lunar changes in azimuth (rising and setting positions along the horizon), but also changes in nightly lunar zeniths (maximum altitude) above the horizon (Fig. 2). Such changes create an elipsoid pattern known as an analemma, similar in shape to the infinity sign (Fig. 3). Jeguès-Wolkiewiez argued that this pattern is probably represented on the Blanchard bone. She thinks that the shape and direction of the elipsoid is specific to seasonal lunar positions and may be identified with new moon occurring at the vernal equinox, something which would only reoccur every 19 years together with a potential solar eclipse.

Constellations

There is ample scope for scholars to interpret rock-art images in terms of potential star patterns or constellations and there have been a number of claims in this regard concerning the Upper Palaeolithic. For

Figure 3. *An analemma of the sun's successive zenith points taken over the course of a year at the temple of Delphi in Greece (kind courtesy of Anthony Ayiomamitis). The sun, the moon, and all planets form analemmas over the course of their transit cycles. The elliptical form of the analemma may reflect the lunar position recordings on the Blanchard plaque (see Fig. 2), as suggested by Jègues-Wolkiewiez.*

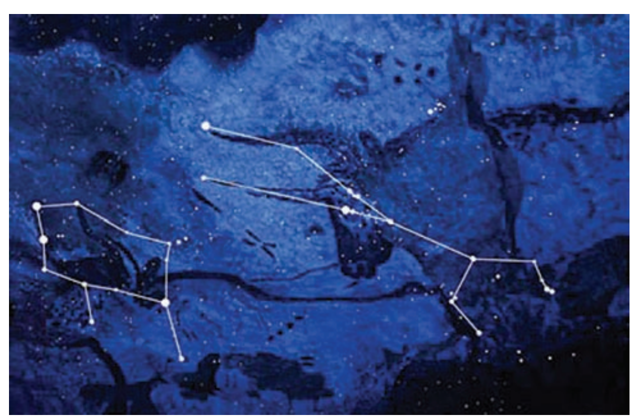


Figure 4. *The cluster of black dots near this bull's head bears a similar spatial relationship to the Pleiades star cluster in relation to the constellation Taurus, which a number of scholars have remarked upon (image courtesy of Jègues-Wolkiewiez).*

https://doi.org/10.1017/S0959774311000400 Published online by Cambridge University Press

instance, Jeguès-Wolkiewiez and others have suggested that the seven dots above one of the main bulls in the Hall of the Bulls in Lascaux resemble the Pleiades and Taurus (Fig. 4). She extended this approach to the major art panels in the Hall of the Bulls which she claimed formed star maps. Rappenglueck (1997; 2001) has also claimed that paintings in Lascaux and other caves represent constellations, arguing in addition that series of black dots represent days in lunar cycles.

More recently, Aujoulat (2004, 264–5), who has studied the art of Lascaux in more detail than any other person, has argued for the astronomical importance of the art in Lascaux, but not in terms of the constellations advocated by Jègues-Wolkiewiez or others. He suggests, instead, that the cave roofs were viewed in terms of sky vaults but that the images painted on these vaults were more figurative visions of events taking place in the skies rather than specific constellations. The events in the skies are postulated to have been viewed as reflecting important seasonal terrestrial events in animal behaviour such as the mating seasons of horses (spring), aurochs (summer) and red deer stags (autumn). He postulates that cave rituals were connected to the re-creation of life taking place in the Palaeolithic world which in turn mirrored the cycles of the stars in the sky.

Discussion

Many of the interpretations concerning constellations, calendars and solar-lunar monitoring in the Palaeolithic are highly speculative. Nevertheless, there is considerable support for the notion that, at least in some locations, as Aujoulat (2004, 264–5) has argued, celestial phenomena potentially played an important role in Upper Palaeolithic art and ritual. Given the varied nature, and the very limited number of elaborately decorated cave-art sites, it is difficult to assess most of the published claims in terms of testable hypotheses. On the other hand, some idea of the probability or plausibility of these claims may be obtained by examining astronomical systems cross-culturally.

While ethnographic analogy can be a powerful tool in theory-building, many of the examples that have been used in the past were inappropriate. For example, in his initial arguments concerning lunar calendars in the Upper Palaeolithic, Alexander Marshack drew on a wide range of societies to support his interpretations. He included many horticultural and agricultural groups like the Winnebago, Hopi and Highland Maya to demonstrate that complex day-count, lunar-cycle and seasonal calendars could be, and were, kept by non-literate societies with relatively simple sociopolitical organizations.

Jeguès-Wolkiewiez (2000) used even more complex cultures such as the Egyptian, Assyrian and Greek astronomical systems to support her contentions about pre-industrial solstice observations and the associations of given constellations with various animals. Use of Jeguès-Wolkiewiez's and Marshack's ethnographic examples might be criticized on the grounds that agricultural communities had greater needs for keeping calendars in order to time their planting and other agricultural activities or on the grounds that complex calendars and astronomical systems may have required writing or arithmetical specialists and therefore were only developed by far more complex state-level cultures.

For the purpose of evaluating the plausibility of claims about astronomical systems in the Upper Palaeolithic, we propose a more focused use of ethnographic analogy (analogy by principle or synthetic cultural analogy: Hayden 1993, 127–9) which limits examples to hunter-gatherers and further distinguishes between simple hunter-gatherers and complex hunter-gatherers. If detailed solar or astronomical observations were common occurrences among some types of hunter-gatherers, such as complex hunter-gatherers, and if it can be demonstrated that at least some art-producing Upper Palaeolithic societies were complex hunter-gatherers, then there would be a reasonable probability that astronomical interpretations of some Upper Palaeolithic materials might have some merit, at least at a basic level. This probability would be increased even further if grounded causal arguments could be advanced to show why such astronomical elements should begin to appear in specific types of cultures like complex hunter-gatherers. On the other hand, if no, or few, ethnographic hunter-gatherers made detailed astronomical observations, then any astronomical interpretations of Upper Palaeolithic materials would be considerably weakened.

Were there complex hunter-gatherers in the Upper Palaeolithic?

Before examining this question in detail, it is important to distinguish simple from complex hunter-gatherers and to examine these in the context of the Upper Palaeolithic Europe. As described by Hayden (2001a; 2003; 2007), ethnographic complex hunter-gatherers can be generally characterized by a number of important traits, including:

- relatively high population densities (0.2–10.0 people per square kilometre);
- seasonal or full sedentism;
- individual or family control of products and some productive resource areas (private ownership);

https://doi.org/10.1017/S0959774311000400 Published online by Cambridge University Press

- storage (controlled by individuals or families);
- significant socioeconomic differences within communities (often reflected in burials);
- trade and the creation of prestige objects based on surpluses;
- competitive displays and elaborate feasting activities based on surpluses;
- bride prices or dowries together with enhancement of the value of individual children;
- attempts by elites to control access to the supernatural;
- hierarchical and heterarchical sociopolitical organizations based on economic production;
- complex counting systems that extend into the hundreds or thousands.

These features distinguish complex hunter-gatherers from simpler, more egalitarian hunter-gatherers who exhibit lower population densities, obligatory sharing, communally owned resources, simple counting systems limited to 10–20 numbers, minimal socioeconomic inequalities or prestige objects and negligible economically-based competition or feasting or marriage payments. There are a number of good ethnographic accounts of complex hunter-gatherers, particularly from California, the Northwest Coast and Plateau of North America, as well as some parts of Alaska, Siberia and Japan. It is these cultures that may be most usefully examined for indications of the roles (if any) that calendars, astronomy and solar movements have the potential to play in complex hunter-gatherer societies.

We assume that material expressions of the above traits in the Upper Palaeolithic are indications that complex hunter-gatherers also existed in some European areas at that time. François Bordes (Bordes & de Sonneville-Bordes 1970, 64) suggested that Upper Palaeolithic societies in the Périgord may have been like Northwest Coast societies. Hayden has elaborated this interpretation and argued that the Upper Palaeolithic communities located *in the most productive Eurasian environments* were complex hunter-gatherers perhaps more similar to ethnographically complex groups on the Northwest Plateau (Hayden 1981, 527; 1990; 1993; 2001a; 2003; 2007; 2008; Owens & Hayden 1997). Briefly, some of the reasons for this interpretation are that Upper Palaeolithic groups in Europe were able to establish seasonal or even fully sedentary communities lasting several years in favourable locations (Klima 1962, 201; Klein 1969, 222; Soffer 1985, 328, 411, 416). They also stored considerable amounts of food (Soffer 1989; 1990, 240; Grønnow 1985, 158; Hayden 2008). They exhibited relatively high population densities and had enough surplus resources and time to create many prestige items and trade for shells, amber or other exotic items from locations hundreds of kilometres away (de Beaune 1995, 117, 175–9, 185, 247–8, 264, although simple hunter-gatherers also do some of these things on rare occasions). The surpluses that they produced appear to have underwritten socioeconomic inequalities between families, with certain individuals being lavishly buried, as exemplified by the children buried at Sungir with thousands of ivory beads and other similar burials. Competitive, or display, feasting also seems to be represented by prestige types of eating utensils such as antler and ivory spoons, intentional destruction of prestige objects (de Beaune 1995, 53, 81, 125, 132, 212), and remarkably thick concentrations of animal bones inside some caves (e.g. at Enlène, La Garma and El Juyo: Bégouën & Clottes 1981, 37–9; Ontañón Peredo 1999, 19, 34–5, 39–40; Conkey 1980). Images made deep inside caves also appear to reflect exclusive or controlled access by a privileged minority to the ritual experiences associated with them (Lewis-Williams 1994; 1995). While simple hunter-gatherers sometimes also make images and create special objects, the images are almost never in deep parts of caves and the special objects are rare, group-owned and secretly cached ritual items rather than the more numerous prestige objects used by complex hunter-gatherers to display personal status in public or residential contexts.

If we accept these instances as indicative of complex hunter-gatherers, then the critical question is whether complex hunter-gatherers developed relatively precise and complex astronomical systems requiring significant time and effort investments; and, if so, what factors could have motivated some groups or individuals to do so. To answer these questions, we turn to cross-cultural analysis and the ethnographies of complex hunter-gatherers.

The ethnographic approach

One of the problems with the ethnoarchaeological approach is that we cannot be sure that all ethnographers collected information pertinent to any given issue. Some ethnographers may not have thought that calendars, constellations or solstices were of much consequence; knowledge may have been lost by the time ethnographic records were made; or ethnographers may never have been in a position to become aware of the more esoteric facets of the cultures they studied. Thus, in any ethnographic survey, there may be some cases that appear to be non-conforming. Despite these constraints, and because arguments of plausibility and probability depend on the prevalence of sophisticated calendrical and astronomical systems among hunter-gatherers, we conducted a broad survey of ethnographic cases to see how much insight could be gained from such research.

https://doi.org/10.1017/S0959774311000400 Published online by Cambridge University Press

We collected information on 82 hunter-gatherer cultures including seven simple and 75 complex hunter-gatherers (Table 1). Our data were obtained from the Human Relation Area Files (World Cultures), published ethnographies and observations compiled by Hudson *et al.* (1979) and Marshack (1985; 1991c). These resources were consulted for information regarding:

1. the degree to which various groups monitored solar or lunar movements and key positions, how monitoring was done and why; information on the social context surrounding solstices was also noted where possible;
2. whether various groups had calendars, the organization of their calendars and how they were determined (what celestial monitoring was involved);
3. whether various groups recognized constellations and what stars these involved.

This is only a preliminary survey, conducted for the purpose of identifying any general patterns in the data, as well as assessing the potential use of ethnographies for dealing with issues related to astronomy. We therefore did not intend to examine all possible complex hunter-gatherers nor all research documented for individual groups. Nonetheless, based on our initial survey, some useful information and patterns emerged which we suspect would only be strengthened if the sample were expanded.

Because of the nature of this type of ethnographic data, the presence and amount of information in each category varied. We summarize the information obtained in Table 2 which focuses on solstice monitoring and calendars and in a summary graph of the most frequently recognized constellations recognized (Fig. 6).

Results

Solstice monitoring and calendars

From the outset, it can be observed that almost all hunter-gatherers have some kind of astronomical system (e.g. Johnson 1998; MacDonald 1998; Williamson 1984). Simple foraging groups are aware of the extremes of solar movements in general terms, but usually do not go to the trouble of precisely determining specific days of solstices or equinoxes and frequently do not hold any special ceremonies to celebrate the solstices. They may also recognize different lunar cycles that coincide with seasonal events such as the appearance of mosquitoes, berries or first frosts. This is particularly true of groups lacking contact with agriculturalists such as the desert Aborigines in Australia (Marshack 1985, 28), the Inuit (MacDonald 1998, 130), the Andaman Islanders (Radcliffe-Brown 1922, 141), and some of the San Bushmen who lack any form of calendar (Schapera 1930, 413–18; Marshall 1976, 53; Marshack 1985, 28).

In our survey of *complex* ethnographic hunter-gatherer groups, 80 per cent of the groups (63 of 79) exhibited some solstice observation or monitoring and/or calendars (most often lunar). The other groups lacked information on solstice observations, but there were no groups that explicitly lacked solstice observances. In all of the 63 groups, it was the winter solstice that appeared to have played an important role in terms of celestial observations, in commencing the year, rituals, dances and feasts, or in some cases food restrictions (e.g. among the Yokuts: Gayton 1948, 118). The summer solstice was noted as important in about one third (23) of the groups. This included 20 groups in California summarized in Hudson *et al.* (1979), all of whom also observed the winter solstice, the Tlingit of the Northwest Coast whose calendar commenced at the summer solstice (de Laguna 1972), the Bella Coola who monitored the winter and summer solstices in the same way (Olson 1936) and the Evenki of Siberia who held elaborate rituals at this time (Grøn & Kosko 2007). In terms of the equinoxes, with one possible exception, there was no indication in any of the literature surveyed that these were important or monitored solar events. Hudson *et al.* (1979, 44–5) and Cope (1919, 121) note the same pattern specifically for groups in the United States and Canada although they mention that the Nootka, Nomlaki, and probably the Chumash were at least aware of the equinoxes and may have calculated their occurrence.

It should be emphasized that in our ethnographic sample, as well as in Hudson *et al.*'s and in Marshack's examples, the mention of 'solstice observances' generally involved careful and accurate monitoring of solar rising/setting positions by specialists using tree, post, or rock alignments viewed from special locations. In the Quinault, for example, Olson (1936, 176–7) documented that the winter and summer solstice were monitored using the same techniques.

> At several of the villages were 'seats' (a stump or stone) where the old men watched both sunrise and sunset. Usually they sighted from the seat to a pole placed in the ground, or to a designated tree … sighting was done by marking on a stick placed horizontally the spot where the shadow of a certain tree fell at the moment of sunrise. One such mark indicated 15 days until the solstice … [and] it was believed that at the summer solstice the sun set four or five times at the exact same place.

Such precision solstice observations occur over a very diverse geographical and cultural spectrum (Table 2) encompassing over 10 language phyla and 26 lan-

https://doi.org/10.1017/S0959774311000400 Published online by Cambridge University Press

Table 1. *List of groups surveyed from the Human Relation Area Files (World Cultures), published ethnographies, and research on ethnographies of hunter-gatherer societies. Where references are not provided HRAF files were used for data sources.*

Region	Sub-region	Culture
Africa	East	Mbuti*
	South-central	San*
Asia	East	Ainu
	Southeast	Andamans*, Semang*
	Northern (Siberia and nearby)	Chuckchee, Koryaks, Yakut Evenki (Grøn & Kosko 2007) Kamchatka (Marshack 1985) Ostiak-Hante (Marshack 1985) Various other Siberian arctic and subarctic groups (Marshack 1985)
Australia	Central	Aranda*
	Northern (Islands)	Tiwi
Europe	Northeastern	Saami
North America	Eastern	Innu
	California	Klamath, Yokuts 50 groups examined by Hudson *et al.* (1979) including: Achumawi, Atsugewi, Cahto (Kato), Cahuilla, Chemehuevi, Chilula, Chimariko, Chumash, Coast, Miwok, Costanoan, Cupeño, Hupa, Ipai, Kamia, Karok, Kawaiisu, Kiliwa, Kitanemuk, Klamath, Konkow, Koso (Panamint), Luiseño, Maidu, Miwok, Modoc, Monache (Western Mon), Nevada Shoshone, Nisenan, Nomlaki, Nongatl, Northern Paiute, Owen's Valley Paiute, Pomo, Salinan, Serrano, Shasta, Sinkyone, Southern Paiute, Surprise Valley Paiute, Tipai (Kuneyaay), Tolowa, Tübatulabal, Wappo, Wintu, Wiyot, Yokuts, Yuki, Yuma, Yurok
	Central	Assiniboine, Chipewyans, Ojibwa
	Northern	Aleut, Alutiiq, Copper Inuit North American Eskimos (Marshack 1985; MacDonald 1998)
	Northwest Coast	Bella Coola (McIlwraith 1948) Quinault, Tlingit Tsimshian (Miller 1992)
	Northwest Interior	Thompson (Teit 1900) Shuswap (Teit 1909) Sahaptin (Stern 1998)
South America	Tierra del Fuego	Ona*, Yahgan*
	Southern	Tehuelche

* Groups we considered to represent simple hunter-gatherers. The Innu include both complex and simple hunter-gatherers.

guage families, some of which were far removed from any possible influence from more complex cultures. It thus seems highly probable that they would have also occurred among many other ethnographic complex hunter-gatherer societies but may simply never have been recorded by ethnographers, especially given the often secret nature of this knowledge as discussed below.

Of particular interest as well is the specialist role that is commonly involved in solstice monitoring. These roles are often held by a shaman or ritual specialist, a 'sun priest' (Hudson *et al.* 1979), 'old men' (Gusinde & Schütze 1937, 1386; Olson 1936, 177), 'wise old men' or 'calendar experts' (McIlwraith 1948, 27), 'calendar keepers' (Marshack 1985), or 'official elders' (Jochelson 1905–8, 87, 88, 98). Although many individuals can make observations, the careful monitoring and accurate keeping of a calendar was undertaken by a specialist. More important, and something that is also seen in more complex societies, is that this often did not go without political repercussions and factional disputes.

The individual who monitored solstices, the calendar specialist, was responsible for selecting the date when ceremonies, rituals, feasting and dances would begin. Setting the correct date was of utmost importance due to the competitive arena of feasting and ritual hosting both in terms of creating allies and in terms of displaying power (both profane and supernatural) and thus maintaining leadership. The Bella Coola provide a clear example of this at the complex hunter-gatherer level, where 'bitter disputes' would often result from differences in opinion on the proper date for starting the winter ceremonials (McIlwraith 1948, 50). Each big house had its own calendar specialist, who presumably competed in calendar knowledge and accuracy and hence monitoring methods. McIlwraith notes that many of the old men admitted that errors were common sometimes involving four or more days (McIlwraith 1948). The importance and

https://doi.org/10.1017/S0959774311000400 Published online by Cambridge University Press

Table 2. *List of cultures by region and sub-region for which there is information on solstice monitoring and calendars.*

Region	Sub-region	Culture	Solstices and 'calendars'
Africa	South-central	San	Use the 'stellar calendar for timing of the male initiation school'. When Sirius appears in spring it signals the time for the second phase of the school to begin (Silberbauer 1981, 109–10).
Asia	Northern, Siberia	Chuckchee	Accurate solstice monitoring. 12-month lunar calendar starting at the winter solstice and with the appearance of their constellation Pehi'ttin (Altair and Tarared). Winter solstice sacrifices, ceremonial fires and ritual dances (Bogoras 1904–9, 51–2, 307, 376; Zhornitskaya 1996, 5).
		Evenki	Elaborate summer solstice circular pole structures and rituals oriented to the position of the rising summer solstice sun (Grøn & Kosko 2007).
		Kamchatka	10 months of 30 days (Marshack 1985, 47).
		Koryak	Accurate solstice monitoring. 12-month lunar calendar starting at the winter solstice. Sacrifices at the winter solstice to welcome the sun, a dog sacrifice is made to the sun soon after the winter solstice by the 'official elder', and reindeer feasts are held by 'rich men' after the winter solstice (Jochelson 1905–8, 87, 88, 98).
		Yakut	Ivory calendar sticks (Marshack 1991b,c, 218).
		Ostiak-Hante	30-day named lunar months (Marshack 1985, 47).
		Various groups	Named lunar months, lunar and solar observations and keepers of 'calendars' (Marshack 1985, 28, 44).
Europe	Northeastern	Saami	Celestial movements are known in 'precise detail' on every day of the year. They know the position and paths of the stars 'so exactly that one glance at the sky suffices to tell how late it is' (Bernatzik & Ogilvie 1938, 48). During the day, time is monitored through both the position of the sun, but also observation of where sunlight reaches a particular point on a mountain, stone or elsewhere. At night, time is told through the position of the stars, especially Ursa Major, the Pleiades and morning and evening stars (Itkonen 1984, 957).
North America	California	Chumash	Detailed solstice observations (Marshack 1985, 28, 44; see also Hudson *et al.* 1979 summaries below).
		Yokuts	The solstice was noted and recognized as the turning point for the length of days (Gayton 1948). 'Soon after the winter solstice a winatum would go through the village saying that all those who wished or intended to participate in the next ceremony must cease to eat meat … only acorn dishes and clover were eaten until twelve days after the tire had taken place — roughly speaking, a period of three months' (Gayton 1948, 118).
		Various groups (see Table 1)	21 groups observed the winter solstice, and 20 groups observed both the winter and summer solstice (see discussion of Hudson *et al.* 1979 in text).
	Central	Ojibwa	Solstice monitoring and feasting at the winter solstice (Ross 1992, 96).
	Northern	Alutiiq (Koniags)	12-month calendar, starting with the arrival of Pleiades (August) followed by Orion (September). Stars were used to estimate the days of the month, but 'this required special knowledge which did not belong to everybody'. After the winter solstice tops were spun to hasten the return of the sun (Birket-Smith 1953, 103, 115).
		Copper Inuit	Their constellation Aagyuuk (which involves two stars in the Eagle constellation of lesser magnitude in the northern sky) signals the return of the sun in the winter months, and it is also therefore a time of celebration (Pryde 1972, 80).

prominent role of the calendar specialists in these cultures is also reflected in mythical accounts in both the celestial (constellation) realm and in ceremonial performances.

> Supernatural beings experience the same difficulty as mortals in reckoning the passage of time. A number of calendrical experts live in the land above, whose duty is to record both months and years. They have been seen occasionally, and are shown, as masked figures, at *sisaok* but not at *kusiut* dances. Two of these beings always appear, and they argue about their observations after the fashion of humans (McIlwraith 1948, 44).

As part of the competition between rival factions, and in tandem with their competitive elaboration of feasting and rituals, it seems likely that such disputes over dates led to more sophisticated developments in astronomical monitoring and specialized knowledge.

Probably the most detailed and insightful documentation available for astronomical systems among complex hunter-gatherers anywhere in the world has been assembled by Travis Hudson and Ernest Underhay (1978) for the Chumash in southern California. While this example may represent an extreme development of a complex astronomical

https://doi.org/10.1017/S0959774311000400 Published online by Cambridge University Press

Table 2. *(cont.)*

Region	Sub-region	Culture	Solstices and 'calendars'
North America *(cont.)*	Northwest Coast	Bella Coola	Each big house had a calendar expert. 'The making of calendrical observations is a lost art.' Formerly, 'wise old men' would keep count of time, yet 'differences of opinion were the rule rather than the exception, a condition which often led to bitter disputes concerning the proper date for starting the winter ceremonials' (McIlwraith 1948, 27). 'The chief difficulty … in computing time rests on the fact that each month is judged by the moon, whereas the main periods of the year depend upon the solstices. One old man … states that trouble always came at the winter solstice when the month was divided into two sections' (McIlwraith 1948, 28). 'If the calendrical experts have been successful in their reckonings, the November moon will first be visible on the night of this day. Several of the older men admitted that errors were common, and that sometimes four days more had to elapse' (McIlwraith 1948, 50).
		Tlingit	Solstice monitoring. 12-month calendar starting with the summer solstice (de Laguna 1972, 799).
		Quinault	Solstice observations and lunar months (Miller 1992). Accurate solstice monitoring by 'old men' who watched both sunrise and sunset, using a pole placed in the ground or a designated tree and marking observations on a stick (see discussion below). Dances of the *klokwalle* (secret society) held for three months following (Olson 1936, 177).
		Tsimshian	Solstice observations and lunar months (Miller 1992).
	Northwest Interior	Thompson and Shuswap	Precise solstice observations and named lunar months (Teit 1900, 239; 1909, 604, 610).
		Sahaptin	Solstice observations (Stern 1998, 407).
South America	Tierra del Fuego	Ona*	The phases of the moon divide the year into months. When Orion (*Kwányip)* reaches his most distant position and turns back, they know that winter will slowly disappear and the days will become longer (Gusinde 1931, 1586). They 'know the stars well' and 'medicine men' are often approached for advice concerning celestial events (Gusinde 1931, 1580, 1583).
		Yahgan*	'Some of the older men watch the lengthening days with particular attention. They pass on their observations, and their assurances awaken loud expressions of joy. However, they do not occupy themselves nearly as much or as thoroughly with the heavenly bodies as do the Selk'nam (Gusinde & Schütze 1937, 1386).

system among complex hunter-gatherers, it nevertheless demonstrates some of the motivations that can lie behind the creation of such systems.

Specifically, Hudson and Underhay (1978) show that the most powerful elites were trained as specialist astronomers who putatively acquired their supernatural power, knowledge and paraphernalia from celestial beings in vision quests to the upper world. These astronomical specialists formed a secret society (the 'antap) with detailed astronomical knowledge about celestial movements as the core of their esoterica. This knowledge was never shared with commoners and often proved difficult for anthropologists to learn about (Hudson & Underhay 1978, 100; Conway 1992, 236–7; Loeb 1926, 229). The astronomers claimed that they were the only ones that could understand (and ritually influence) the celestial system upon which Chumash life depended according to elite ideology. The highest-ranking position in the 'antap was the Sun Priest who was also the master astronomer. These astronomer priests maintained careful observations of the sun's positions and used solstice points to adjust their elaborate calendar. Hudson and Underhay (1978, 141, 144) conclude that the Chumash elite possessed an astronomical system far more sophisticated than generally assumed for any hunter-gatherers by Western scholars.

Of special relevance for the following discussions are the facts that the 'antap priests went to the mountains for solstice rituals and that these sometimes took place in caves into which the sun penetrated with special visual alignments at solstice sunrises. These caves contained rock art including solar and celestial images made by the elite astronomers associated with vision quests. Also of interest is the fact that the 'antap astronomer priests stored their ritual paraphernalia in caves.

Edwin Krupp (1993) has added the identification of other painted caves for solstice ceremonies to Hudson and Underhay's list. On the basis of the archaeological occurrence of ritual paraphernalia used in the 'antap, Corbett (2004, 70) has argued that the 'antap, or something very similar to it, goes back to at least AD 900–1150 in regional prehistory. In a similar type of example, Drucker (1941, 209, 222) recorded that caves were used to obtain rites from spirits and as seclusion

https://doi.org/10.1017/S0959774311000400 Published online by Cambridge University Press

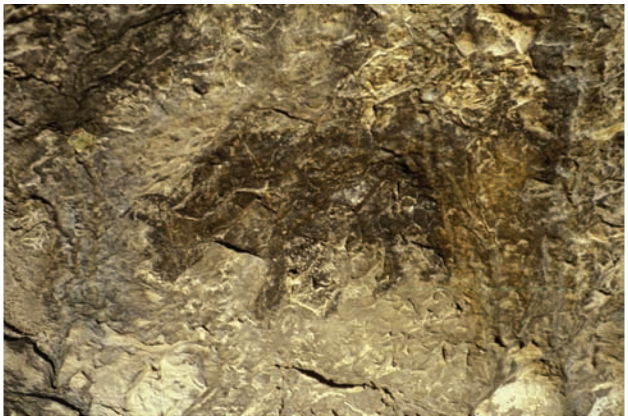


Figure 5. *Painting of a bison in Teton Jack Cave, Wyoming. The back of this image is lit up for a few minutes at the winter solstice, a time when Crow natives began their prayers for the coming bison hunts (information and photo courtesy of Jean Clottes and Larry Loendorf).*

locations for secret-society initiates on the Northwest Coast. Farther inland, the Crow Indians of Montana placed the image of a bison in a cave such that its back was lit up at the winter solstice which was also the day when they began their prayers for the upcoming bison hunts (Fig. 5; Jean Clottes pers. comm.).

The remarkable study by Hudson and Underhay (1978) demonstrates the depth of knowledge and type of sociopolitical context that may lie behind the much more superficial descriptions of 'solstice observations' alluded to in passing by other ethnographers of complex hunter-gatherers. Similarly, among the Pomo in northern California, Edwin Loeb (1926, 229) documented astronomical esoteric knowledge that was 'in the hands of the head of the secret society' who watched the heavens. And Boscana (1933, 41, 43, 65–6, 88), an early nineteenth-century Spanish observer of the Luiseño group, in southern California, reported that an astronomer specialist set the dates for feasts with a lunar and solstice calendar known *only* to chiefly elites. This included a zodiac that marked the months.

What emerges from these observations and those in Table 2 is a pattern among complex hunter-gatherers of solstice-monitoring systems together with varying developments of calendrical systems based on lunar cycles and days leading up to key solar events such as solstices. As previously observed, no such systems appear to occur among generalized hunter-gatherers. Thus, we may ask ourselves what it is about complex hunting and gathering societies that made it important to spend considerable time and effort to monitor detailed solar movements and to pass this training and information on to subsequent generations. The Aurignacian person(s) who appears to have chronicled lunar zenith positions on a bone plaque at Abri Blanchard for over two months (as interpreted by Marshack and Jegues-Wolkiewiez) would have embarked on a project that required staying awake for two months to varying hours of the night or morning and making systematic detailed observations comparable to those we might associate with modern scientific astronomical observations or experiments. This is very unlikely to have been the product of idle curiosity. It makes far more sense as a highly focused activity undertaken by a specialist who was motivated by a specific purpose.

Moreover, the instances of solstice monitoring that we have noted were not simply unique events produced by prehistoric geniuses. Like writing systems, complex astronomical knowledge needed effort to be maintained. It needed to serve some function in prehistoric societies and required the efforts of specialists across a wide spectrum of complex hunter-gatherer societies lasting for many generations. What kinds of purposes might engender such determination and effort investment? Before exploring the theoretical domain of the social contexts related to solstice monitoring in more depth, we first turn to examining ethnographic information on constellations among complex hunter-gatherers to help address one further claim about astronomical knowledge in the Upper Palaeolithic.

Constellations

An awareness of the stars and their use in myths, night navigation and as indicators of seasons of the year is a general pattern observed in all groups examined including simple hunter-gatherers (Johnson 1998; MacDonald 1998; Marshack 1985, 28; Williamson 1984). However, there is considerably more variability in more complex astronomical observations. In regard to claims about Upper Palaeolithic art (e.g. Jegues-Wolkiewiez 2000), one major issue involving more complex astronomical concepts is whether constellations along the ecliptic (the shared trajectory of the sun, moon and planets through the sky) were observed by hunter-gatherers to the extent that they formed a zodiac that was represented by animals in some of the cave art. Recognition of the ecliptic and the construction of a zodiac to monitor solar, lunar and planetary movements entails fairly sophisticated astronomical concepts and has often been considered the hallmark of complex literate societies. Proposing the existence of such a system in the Palaeolithic is therefore of some import. Of somewhat less theoretical importance, but interesting from an historical perspective, is the issue

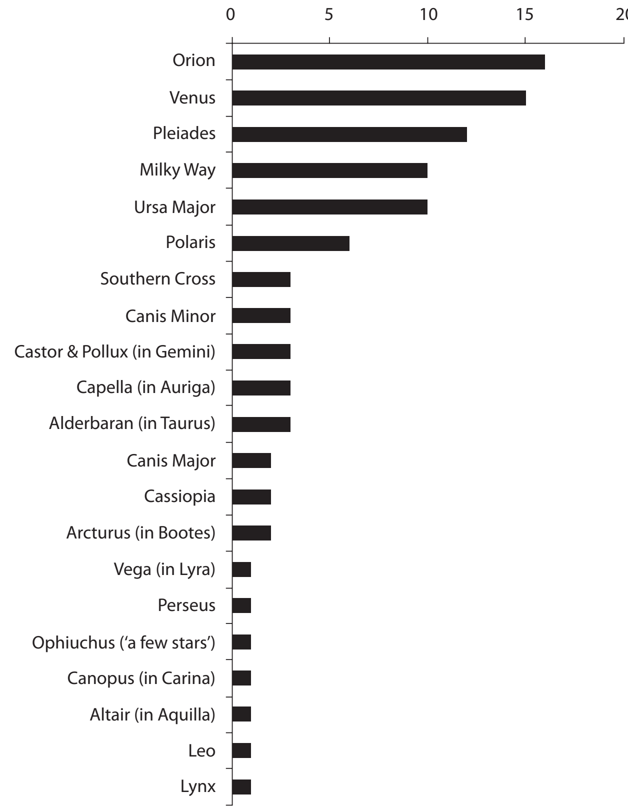
https://doi.org/10.1017/S0959774311000400 Published online by Cambridge University Press

of whether any star clusters comprising constellations in historical Western cultures could have been recognized in a similar way by Palaeolithic groups and hence reproduced in their art.

We included 26 hunting and gathering cultures from the Human Relation Area Files in our survey on constellations. The literature on hunter-gatherer star lore is considerable, thus our current survey only reflects a fraction of the information that is available on this topic. Nonetheless, some patterns emerged that were relatively strong.

In total, 18 different constellations were mentioned in our sample of ethnographies. However, 78 per cent of the cases consisted of either single stars (such as Capella in Auriga or Alderbaran in Taurus) or only small portions of the constellation (see Fig. 6). Only three of the constellations along the ecliptic are mentioned including one group (Chuckchi) recognizing Leo, three groups (Chuckchi, Yahgan, Andaman) recognizing Alderbaran (in Taurus) and three groups (Chuckchi, Klamath, Saami) recognizing Castor and Pollox (in Gemini). Although our survey of the topic was only exploratory, these preliminary findings nevertheless strongly suggest that individual stars or constellations along the ecliptic were not of particular importance for most complex hunter-gatherers. Boscana (1933), describing the Luiseño, appears to be the only person to claim that any group possessed a zodiac, but he does not mention any specific constellations in this respect.

Jeguès-Wolkiewiez's (2000) arguments to the effect that some animals in the Salle des Taureaux at Lascaux represent constellations *below the horizon* at the time of the major solstice rituals in the cave thus seem highly conjectural. Logically, it would seem that star clusters situated along the ecliptic would constitute important reference points for monitoring seasonal changes as well as solar and lunar progress through their respective cycles. The Western zodiac and the Chinese zodiac are two such systems and many other variations exist. Yet, some of the constellations proposed for Lascaux would not have been visible at the time the cave was supposed to have been used and their existence would imply a conceptual framework far more sophisticated than can be supported by the current ethnographic evidence. Her suggestions about the position of the horizon markers among the paintings seem arbitrary, as do interpretations of animal confrontations representing solar movements, the precession of equinoxes and other complex astronomical phenomena. Some of these interpretations may eventually be shown to have more merit, but at present they appear overly speculative.



Note:

Constellation	Counts also include
Orion	Belt ($N = 7$), Betelgeuse ($N = 1$), Rigel ($N = 1$)
Ursa Major	'2 stars' ($N = 1$), Handle ($N = 1$), Bowl ($N = 1$)
Southern Cross	Alpha and Gamma Crucis ($N = 1$)
Canis Minor	Procyon ($N = 2$)
Canis Major	Sirius ($N = 2$)

Figure 6. *List of, and frequency of occurrence (presence/absence) of, constellations and stars in our sample of 26 hunter-gatherer societies.*

Furthermore, ethnographically identified clusters of stars generally represent multiple players in events (e.g. MacDonald 1998). Individual stars or the individual stars in a configuration tend to represent individual animals or people or features. Thus, hunter-gatherer constellations are quite different as a rule from historic Western constellations and this fact does not lead us to expect many individual cave images of animals to represent star configurations. That being said, some star configurations could conceivably represent herds of animals and/or groups of humans as is the case with the stars in the Pleiades (the Seven Sisters). These tendencies in hunter-gatherer concepts lend support to Aujoulat's (2004) contention that most cave painting may not have represented constellations in the modern sense of star patterns depicting full images of animals or humans, but only their general

https://doi.org/10.1017/S0959774311000400 Published online by Cambridge University Press

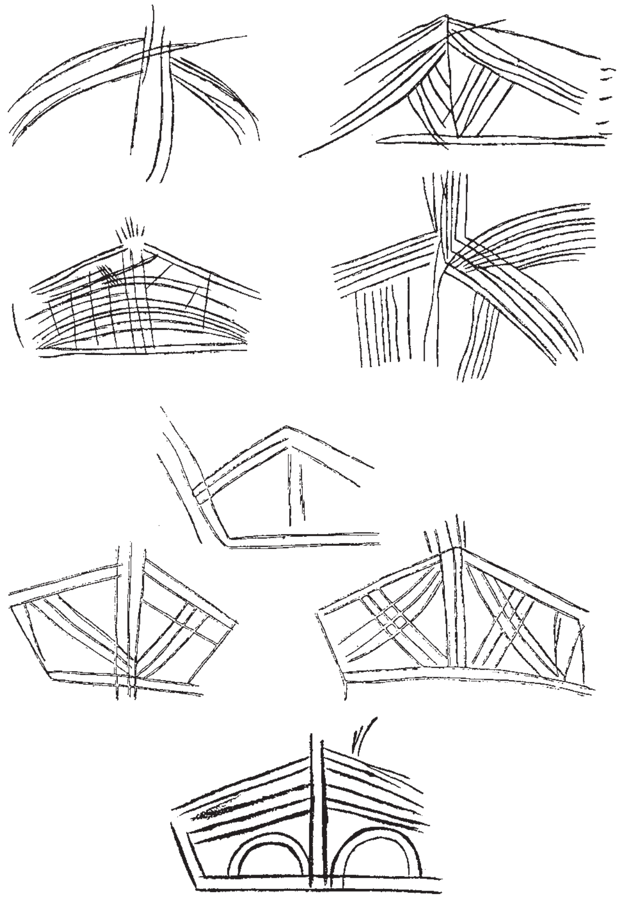


Figure 7. *Tectiform shapes occur in a number of Upper Palaeolithic caves in southwestern France. One possible meaning of them is that they may represent special tents constructed for shamanic flights to the stars or upper realms as documented in the text (in contrast to residential conical or hemispherical structures). The constellation of Auriga, at the tip of the horns of Taurus, also bears a strong resemblance to these tectiforms and may also have been considered a shamanic star portal, similar to the nearby constellation of the Pleiades used by Ojibway shamans when they entered their 'Shaking Tents' to travel to the Sky World. The examples illustrated are from Font-de-Gaume in the Dordogne (Capitan* et al. *1916, 228–9, 231). Of special interest are the lines that emanate from the peak or roofs of many of these figures. These may be attempts to portray trance journeys to the sky. On the other hand, some of them may simply represent decorative features on structures or protruding structural elements similar to those in Figure 8.*

existence (e.g. one star representing one animal, or a cluster of stars representing a herd of animals with no exact correspondences). Nevertheless, there are a few ethnographic instances where configurations of stars do represent single animals, structures, hide stretchers, bones or even supports for stone lamps (MacDonald 1998, 62, 66, 82, 87; Chamberlain 1992, 227) and some of these full-image types of constellations may conceivably be reflected in a few cave-art images. Yet, these are problematic ideas to test.

On the other hand, the Pleiades are almost always viewed as a group of individuals and are one of the most frequently mentioned star clusters. They are recognized as a special constellation by a surprisingly wide range of hunting-gathering and agricultural societies throughout the world (Fig. 6) from Australia (Johnson 1998, 54–5), to California (Kroeber 1953, 682), to the Algonkians and Seneca (Conway 1992; Ceci 1978, 301), to the Indo-European steppes, to Near Eastern, Greek, Mesoamerican and other cultures. In many of these cases, the Pleiades are viewed as a group of women, sometimes chased by another star or cluster representing a man or men; in many other groups they are viewed as children. Their importance cross-culturally strongly suggests that they would have been similarly notable in the past. Our findings also show that single stars or planets such as Venus (the morning or evening star) and Polaris are also frequently noted.

Several other more speculative but intriguing possibilities may be considered in the future. The identification of the Taurus constellation (the Hyades) with a bull may have considerable antiquity. This specific star association stretches back at least 4000 years to Assyrian times. The early written records place the Hyades:bull association at a third of the age of the end of the Palaeolithic — making a historical origin back in the Palaeolithic seem at least possible. The relatively accurate juxtaposition of dots resembling the Pleiades with a bull in the proper spatial relationship for the Taurus constellation in Lascaux seems like an extraordinary coincidence if it was not intentional.

Arguments for another possible Upper Palaeolithic constellation association are based more on ethnographic observations. These consist of the unusually widespread identification of the stars in Ursa Major with bears or bear myths (Gibbon 1964). This occurs among the Plains Indians of North America, the Inuit, Siberian groups, Central Asians, as well as Indo-Europeans such as the Greeks. This implies either an unusually rapid diffusion of ideas about Ursa Major (between three continents) or a very substantial time depth extending back to Mesolithic or earlier times. However, as Aujoulat (2004) argues, there may be no specific representation of any bear constellation in cave art, only a general depiction of bears in some caves indicating an awareness of a bear myth or of the general presence of the bear spirit in the sky during a particular season.

https://doi.org/10.1017/S0959774311000400 Published online by Cambridge University Press

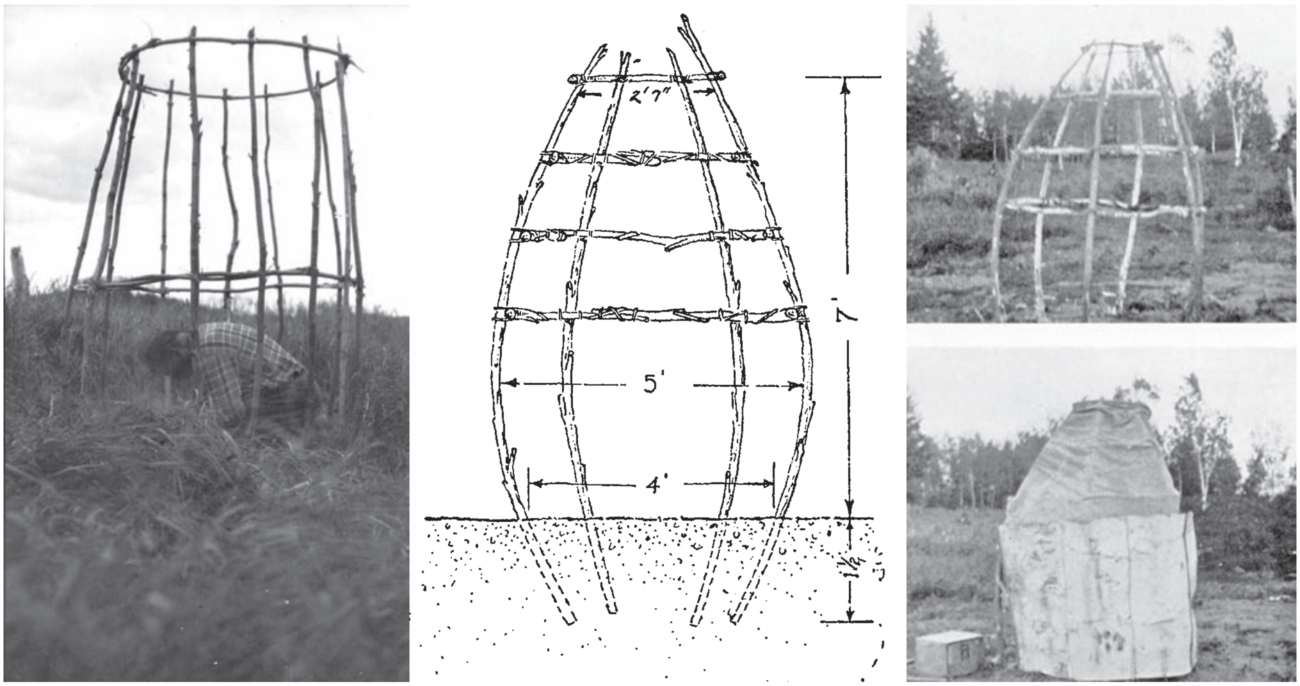


Figure 8. *One of the 'shaking tents' used by Ojibwa and Algonkian shamans for travelling up to the 'Hole in the Sky' represented by the Pleiades (Conway 1992, 256: Conjuring tent uncovered, Canadian Museum of Civilization, J. MacPherson 1930, neg. 74140). Irving Hallowell in his* Role of Conjuring in Saulteaux Society *(1942, 36–3) recorded similar tents as illustrated here (reprinted with permission of the University of Pennsylvania Press). In fact, when the bottom of these structures were covered with vertical sheets of bark, they take on a slightly elongated pentagonal shape.*

Finally, perhaps the most interesting, is the significance of the tectiform images recorded in a number of caves. These pentagram-shaped images (Fig. 7) are often tentatively identified as 'tents', but they also bear a striking resemblance to the constellation at the tip of Taurus's horns: Auriga. Based on star position programs used at the Vancouver Planetarium, it can be established that the basic form of Taurus and Auriga have not changed in the past 19,000 years. We would suggest that a number of ethnographic ritual practices may provide further insights into the significance of these tectiform images. For instance, Conway (1992) reports that shamans among the Ojibwa and Algonkian hunter-gatherers around the North American Great Lakes erect a special 'shaking tent' that they enter in order to go into their trances, some of which are even a bit pentagonal (Fig. 8). The shaman's journey then takes him to the 'Hole in the Sky' which is identified by the Ojibwa as the constellation of the Pleiades. Such shaking tents were also prominent features of shamanic seances among the Cree of Quebec (Tanner 1979). Siberian groups, too, constructed special tents for shamanic flights to the upper realms (Oakes & Riewe 1998). The idea of contacting the spirits of the Upper World by journeying to a specific constellation or star as an entry point is a widespread concept among hunter-gatherers and may well have been a feature of Upper Palaeolithic shamanism. Among the Inuit, stars were considered to be holes in the sky through which shamans could pass to reach the Sky World (especially Polaris, as also among the Koyrak and Chukchi) and the stars were a major source of shamanic power (MacDonald 1998, 33, 40). These observations lead us to speculate that similar concepts may have been more widespread among northern hunter-gatherers in the past, or perhaps developed independently among a number of northern groups.

Use of caves and cave art have been interpreted as shamanistic in nature by a number of authors (Clottes 2001; 2004; Clottes & Lewis-Williams 2001; Lewis-Williams 2002; Lewis-Williams & Dowson 1988; Whitley 2000). To help assess such claims, Villeneuve (2008; Villeneuve & Hayden 2007) developed analytical methods for cave art and contexts that can help identify images created by trained specialists such as shamans (see also Sauvet *et al.* 2009). Even if shamans were not the principal users of caves, they

https://doi.org/10.1017/S0959774311000400 Published online by Cambridge University Press

may well have been key figures in ritual groups that used caves, such as secret societies. As leading figures, their cosmological concepts (including power animals and special structures used to access the Underworld and the Sky World with its constellations or star portals) may well have suffused the symbolism used to decorate some caves.

There could be other constellation concepts, besides those noted above, that exhibit some historical continuity between the later Upper Palaeolithic and Indo-European constellation concepts, such as large felines, goats, serpents, fish, or even upside-down horses (such as the 'falling horse' images in Lascaux, Niaux, La Garma and Le Portel which may constitute homologues to the upside-down image of the Pegasus constellation). However, there seems to be no current way to assess such speculative possibilities.

What we can tentatively conclude from this initial review of constellations is that hunter-gatherer constellation concepts tend to be quite different from historical Western concepts, as many other researchers have pointed out. Individual stars most commonly represent individual people or animals or things in a mythological story, while clusters of stars tend to represent groups of animals or people. Moreover, there are remarkably few stars or configurations of recognized importance along the ecliptic, indicating that concepts involving the ecliptic or a zodiac are unlikely to be represented in Palaeolithic art. On the other hand, some stars and configurations are commonly and prominently featured, especially Polaris, Venus, the Pleiades, portions of Ursa Major and Orion, together with the Milky Way. These are the most likely candidates to occur in rock art, although it must be recognized that there is considerable variability in constellation concepts among hunter-gatherers.

Sociopolitical models versus traditional archaeological thinking

In our earlier discussion of solstice reckoning among ethnographic hunter-gatherers, we emphasized how important relatively precise determinations of solar events — as well as calendrical reckonings in general — were for many groups. We would now like to elaborate on the sociopolitical contexts of such preoccupations with calendars, and we shall explore some possible reasons for these developments. Traditionally, calendars have been viewed as a means by which elites held sway due to their ability to tell farmers when to plant and harvest — views expressed by Robert Heizer and Bruce Smith (Chedd 1981; UCECMIL 1963). However, others have challenged the practical farming function of calendars, such as Lewis-Williams and Pearce (2005, 232) who noted for the European megaliths:

> It is unlikely that Neolithic people were so naive as to accept that the round of seasons was entirely in the hands of their ritual specialists. They are more likely to have seen that the cycle of the seasons was inevitable, a simple fact of life. Nor did Neolithic people need massive 'celestial calendars' to tell them when the seasons were about to change. Throughout the world, people in small-scale societies detect the subtle signs of nature and thus know when summer is just around the corner. In fact, the winter solstice does not tell farmers who may observe it anything useful.

David Friedel makes this same point even more forcibly in the film, *Maya Lords of the Jungle* (Public Broadcasting Associates 1981): 'Any Mayan farmer worth his salt knows when to plant and harvest. He doesn't need someone dressed up in fancy J's to tell him when to do that.' Given yearly variations in weather, determining the time for planting or other agricultural activities by reliance on precise calendrical dates would have been maladaptive for producing good harvests, if not sometimes catastrophic. In contrast to the ideas expressed by Smith, Heizer and others, it makes poor sense to develop calendars for scheduling agricultural or other subsistence activities, although once developed, calendars undoubtedly could help in the overall planning of these activities.

In contrast to traditional archaeological explanations for the development of calendars, there is a more sociopolitical feature that emerges from ethnographic accounts of complex hunter-gatherers that plays an important role in keeping track of time. That is, setting the dates of feasts together with the rituals and ceremonies that accompany them. From our modern industrial perspective, setting the date of a feast may seem like a relatively trivial detail. However, when one becomes more acquainted with the internal dynamics of large traditional feasts, it is clear that this is anything but a trivial consideration. There have been significant theoretical advances in the past two decades in understanding the dynamics of traditional feasting (Hayden & Villeneuve 2011); and these developments now enable us to place phenomena such as calendars in more comprehensible sociopolitical contexts.

Scheduling feasting and ritual ceremonies

Large feasts in particular, such as the type that would often occur during winter ceremonial seasons, take a great deal of planning. Preparations often required a year or more and even up to five to ten years for larger feasts such as major potlatches or *moka*'s (Teit 1900, 299, 334–5; Romanoff 1992; Perodie 2001, 207).

https://doi.org/10.1017/S0959774311000400 Published online by Cambridge University Press

The annual and larger feasts were not simply a matter of food preparation. They also involved a complex web of debts and social relationships that were often imbued with competitive elements (Hayden & Villeneuve 2010).

During the preparation time, numerous investments had to be made by giving away (loaning) surpluses with the understanding that equivalent amounts, or more, would be repaid within an agreed-upon time period. It was not possible for one household to simply produce, amass and store the huge amounts of food necessary for large feasts. Spoilage alone would reduce the produce to insignificance. Rather, it was the *orchestration of investments, labour and debts* that was essential for holding large feasts. The ability to call in debts all together (or at least to the extent possible) at a specific time, for a given event, was critical for the giving of large feasts. And this was far from a simple matter since allied families generally had their own debts, investments, commitments or feasts that frequently conflicted with the feasts that a particular host was planning.

Thus, in order for large feasts to be possible, it was necessary to have some means of planning for them in a detailed fashion, some way to establish how many years, how many months or lunations, and which specific day all debts would be called in so that the required provisions would be delivered on time at a given location. Given this practical feasting concern with timing, we suggest that it is primarily for *this* purpose that considerable time, effort and training were devoted to establishing calendars, the monitoring of solstices and the tracking of lunations in complex hunter-gatherer societies — a possibility previously only alluded to by Hayden (2003, 139–40). It should be recalled that simple hunter-gatherers do not appear to have feasts, or at least not the lavish competitive types of feasts that tend to characterize complex hunter-gatherers (Hayden 2001a).

The critical role of setting dates for major feasts is graphically documented by Andrew Strathern in the film *Ongka's Big Moka* where rival big men vied with each other to establish the feast date for the *moka*. In this instance, the competitive manoeuvring to set the feast date resulted in economic chaos and nearly provoked a war. The previously discussed example from McIlwraith dealing with the Bella Coola provides a similar emphasis on the 'bitter disputes' that could occur when setting dates for the commencement of feasting (and accompanying ritual ceremonies). Thus, we are led to expect some sort of calendrical system with yearly-event markers to emerge in the context of complex hunter-gatherers where aggrandizers promote, display and/or sponsor competitive feasting. The solstice was probably the most obvious and predictable of annual celestial events that could be easily monitored. In support of this view, a number of ethnographic observers explicitly state that the major use of calendars among complex hunter-gatherers was not for practical purposes such as scheduling hunts. Rather, the use of calendars was for setting ritual and feasting events. In addition to the examples in Table 2, Boscana (1933, 43, 65–6) explicitly states this for the Luiseño of California as does Blackburn (1976, 236) for the Chumash. In more general terms, Williamson (1984, 317–18) observes that California hunter-gatherers used celestial calendars to serve ritual interests and that counting was rarely used except to establish the time of rituals within the ceremonial year. Similarly, among the Pawnee (although they practised horticulture) and Koniags, the Pleiades were key elements in the calendar and were used to determine the appropriate times to begin ceremonials (Birket-Smith 1953; Chamberlain 1992, 230). The Sahaptins in the northwest also kept knot records of days to determine when the solstice ceremonies would occur (Stern 1998, 407).

In general, solar positions such as solstices, have been frequently favoured for the most important feasting events, or at least for use as the main reference point to calculate major feasting events. Examples range from the White Deerskin Feast of the Hupa (Goldschmidt & Driver 1943, 124), the major festivals of other California groups (Hudson *et al.* 1979, 39), the winter feasts of the Northwest Coast (de Laguna 1972; Olson 1936; McIlwraith 1948), the Interior Salish (Teit 1900; 1909), and the solstice feasts and celebrations in numerous other groups such as the Chuckchi, Evenki, Koryak, Ojibwa and Copper Inuit (see Table 2). There may also have been an elite ideological component involved in the choice of solstices for major feasts since elites in many complex hunter-gatherer societies promoted the importance of the sun as the most powerful deity, and they (as well as elites in more complex societies) often identified themselves with it, as in the Chumash case of the 'antap sun priest (see also Blackburn 1976, 235–6; Hayden 2003, 242–7). George Hunt (Boas's main Kwakiutl informant) also declared: 'The Sun is the chief of the upper world ... Their god is the Sun' (Odyssey 1980).

Thus, among complex hunter-gatherers and also horticulturalists, there are good reasons to view calendars as developed for practical sociopolitical reasons, to wit: establishing the dates of large feasts and important ritual ceremonies in conjunction with ideologically imbued celestial events. As we have seen, astronomical and calendrical knowledge, at least at the level of detailed solstice monitoring, was a recurring feature in many complex hunter-gatherer

https://doi.org/10.1017/S0959774311000400 Published online by Cambridge University Press

groups and continued to be a major feature in more complex societies from the dawn of agriculture to the first high civilizations.[1] This type of knowledge, especially related to the sun, sometimes also constituted secret-society esoteric knowledge and was used to schedule secret-society rituals, initiations and feasts. We found examples of this in some of the complex hunter-gatherers included in our survey. The Chumash 'antap society and Luiseño equivalent (Boscana 1933, 41) once again provide some of the most typical and insightful examples of the operation of secret societies among complex hunter-gatherers.

Membership in the 'antap was only open to elites, it was internally ranked, it developed esoteric knowledge and ideology (based largely on astronomy, solar movements and the associated rituals) that was supposed to ward off catastrophes and ensure the continuing productivity of the Chumash world. All this was used by elite members to justify and enhance their corporal power. The secret society was the dominant political institution and the most important rituals revolved around the esoteric worship of the sun (Blackburn 1976, 235–6; Hudson & Underhay 1978). Far to the north in California, the *Kuksu* secret society of the Pomo operated in an identical fashion (Loeb 1926, 227–9, 354ff.), and comparable examples can be found along the Northwest Coast (de Laguna 1972; McIlwraith 1948; Olson 1936; Drucker 1941) and Interior (Teit 1900; 1909) cultures.

Like competitive feasting, secret societies seem to first emerge among complex hunter-gatherers. They appear to be absent among simple foragers but common among the more complex hunter-gatherers. As the Chumash example illustrates, secret societies are essentially voluntary associations whose membership is restricted by wealth and social connections. There is always an internal hierarchy, successive levels of which require greater and greater initiation fees. These fees together with levies on lower-ranking members create the wealth of the secret society which is used to obtain expensive cult paraphernalia, subsidize secret rituals, hold exclusive feasts as well as impressive public feasts, exercise power and establish beneficial links with other groups. Members of these societies frequently appropriate major aspects of already existing ideologies while claiming to have acquired yet deeper (secret) meanings and to have accessed more powerful supernatural connections due to their secret knowledge and rituals (Owens & Hayden 1997; Johansen 2004; Hayden 2003, 142–7).

We suggest that it was emerging elite aggrandizers who, in the context of creating feasting and ritual sodalities (like secret societies) for the purpose of increasing their political control, developed or supervised the development of accurate astronomical systems and calendars especially for the purpose of setting dates for feasting and creating ritual esoterica.

Aggrandizers are individuals who systematically seek to promote their own self-interests above those of other community members and they typically employ a variety of subterfuges or strategies in order to achieve these ends (see Hayden & Villeneuve 2010, 99–103). Owing to the stringent constraints of survival in unproductive environments, simple hunter-gatherers tolerate neither self-promoting aggrandizers nor their many schemes for gaining social and political dominance (Woodburn 1982; Cashdan 1980). Simple hunter-gatherers also lack the surpluses that are required for the impressive social, political or economic competitions among ambitious complex hunter-gatherers. In contrast, the prominence of aggrandizers and their various schemes (including marriage payments, production of prestige objects, wealth exchanges, feasts and claims to costly, exclusive supernatural knowledge: Hayden 2001a; 2008) appear to regularly occur among ethnographic complex hunter-gatherer and other complex societies as reflected in the material remains associated with the various strategies like feasting and prestige objects (Hayden 2001a; 2003; 2007). This perspective on the origin of calendars and elaborate astronomical knowledge among hunter-gatherers is based on an archaeological version of political ecology, the goal of which is to understand how the production of surpluses in traditional societies was used (via a number of strategies) to increase the practical benefits to various community members (Hayden &Villeneuve 2010, 96).

Material patterning

Some aspects of material patterning that can be considered in relation to detecting possible secret societies in the Upper Palaeolithic involve imagery, location, individuals and artefacts. As mentioned previously, secret societies frequently appropriate parts of pre-existing ideologies but add new esoteric elements which normally form the 'secrets' known only to secret-society members. This relationship may be represented in cave art and in the portable art found outside caves. Most Upper Palaeolithic images of animals in caves are similar in content and style to the motifs found outside caves at residential sites. However, inside the caves, additional types of images occur without external equivalents (ghosts, mythic animals, therianthropes, speared humans, tectiforms and other geometric forms). The distinctive images found only in caves could correspond to the more esoteric ideological aspects developed by secret societies.

https://doi.org/10.1017/S0959774311000400 Published online by Cambridge University Press

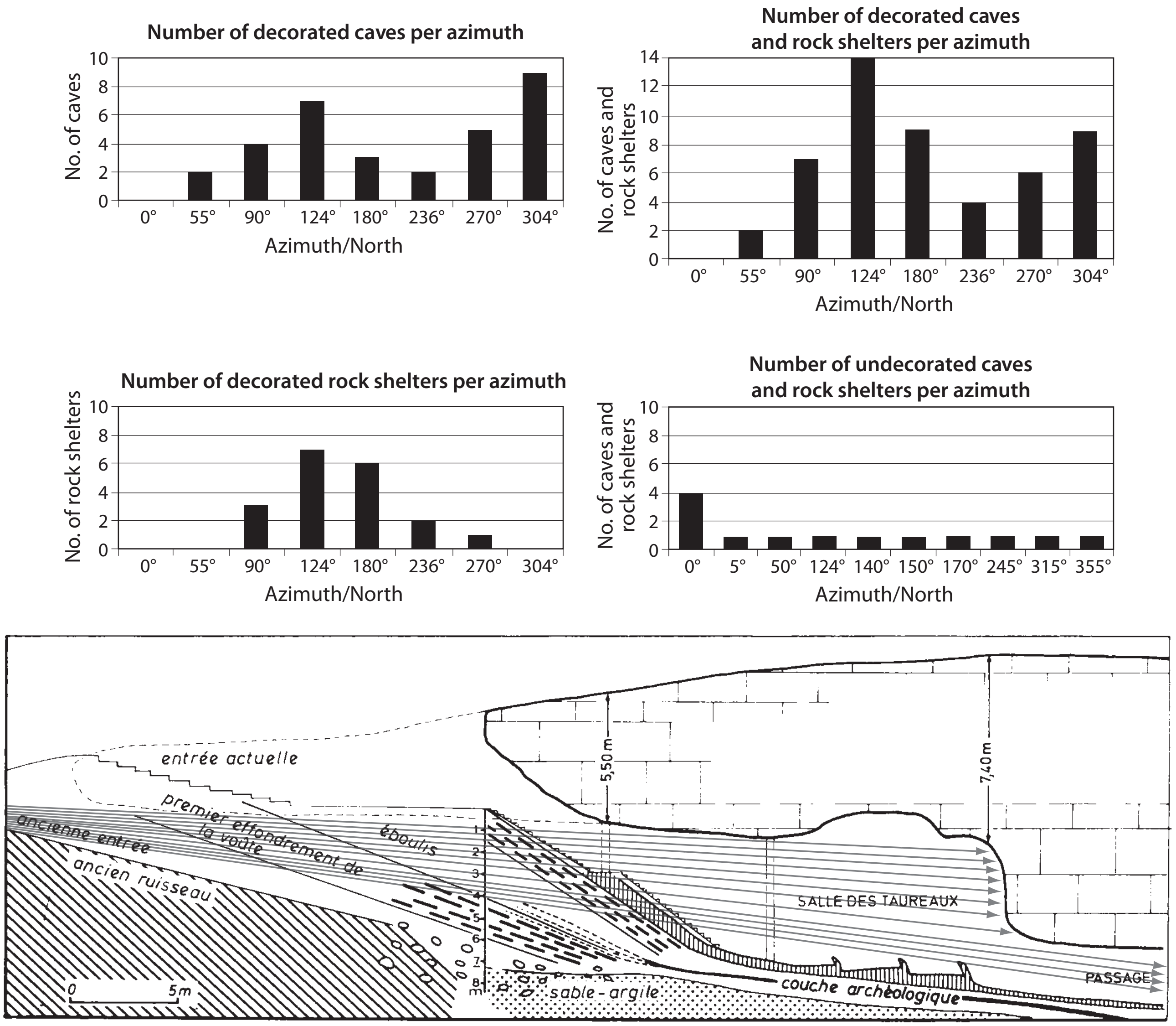


Figure 9. *Data obtained by Jègues-Wolkiewiez indicate that the entrance orientations of decorated caves and rock shelters in the Les Eyzies-de-Tayac region strongly cluster towards the rising or setting positions of the sun at solstices (56, 124, 236, and 304 degrees azimuth), and to a lesser degree at equinoxes (90 and 270 degrees azimuth). In contrast, the entrance orientations of undecorated caves and rock shelters exhibit random orientations (histograms redrawn from Jègues-Wolkiewiez n.d.; Lascaux lateral section drawing from Leroi-Gourhan 1979, fig. 24, with redrawn additions of the setting sun's rays at the summer solstice based on Jègues-Wolkiewiez 2000).*

In terms of location, we have mentioned the use of some caves in California by secret societies for solstice rituals. Thus, it is significant that Jeguès-Wolkiewiez has reported a strong preferential orientation of decorated caves and rock shelters towards key solstice and equinox rising and setting positions of the sun on the horizon (Fig. 9). However, secret-society rituals featuring solstice observances were probably not only restricted to caves. They could also be conducted on mountain tops or at stone or tree alignments (as documented in California by Hedges 1981), or at other landscape features with natural alignments, or even at locations where poles were set up.

In terms of individuals, we know that elite *children* were initiated into the Chumash and Pomo secret societies generally in remote areas like hills or woods. Children were also initiated into secret societies on the Northwest Coast and elsewhere such as among the Luiseño (Boscana 1933, 45), or at least they obtained guardian spirits, plausibly as an aspect

https://doi.org/10.1017/S0959774311000400 Published online by Cambridge University Press

Figure 10. *One of the most intriguing aspects of decorated Upper Palaeolithic caves is the high proportion of hand stencils and footprints that appear to belong to children. Owens and Hayden (1997) argued that the most decorated caves may have served as sanctuaries for secret-society rituals, including the initiation of elite children into these societies. On the Northwest Coast of North America, secret societies were powerful organizations with membership restricted to the elites. Here, a proud chief poses with his wealth and his young son who has been initiated into the Hamatsa secret society whose members wore cedar-bark rings such as he has around his neck (de Laguna 1991, 63; photograph courtesy of the Alaska State Library, Winter & Pond Photograph Collection, #P87-0010).*

of secret-society membership (Owens & Hayden 1997). This is graphically illustrated in some early photographs of elite families including young children being initiated into the societies or wearing Cannibal secret-society paraphernalia (Fig. 10). The presence of numerous children's handprints and footprints in the highly decorated Upper Palaeolithic cave sanctuaries may suggest the involvement of elite children in secret-society group rituals or of more solitary vision quests possibly related to initiations into such societies (Owens & Hayden 1997; Hayden 2003). As a side note of interest, unusual numbers of raptor wings and talons sometimes occur in Upper Palaeolithic caves (Bouchud 1953; Solecki & McGovern 1980; Laroulandie 2003), and these may reflect the use of caves for storage of ritual paraphernalia, if not the performance of rituals, as in the Chumash case noted earlier.

If secret-society knowledge encompassed sophisticated solar, lunar and other celestial observations and knowledge, we might expect the highest-ranking members of secret societies to actively seek out ways to develop even more profound secret knowledge based on understanding celestial movements such as cycles of lunar or solar eclipses. High-ranking members would not only have had the motivation but they would have also had the resources to support

https://doi.org/10.1017/S0959774311000400 Published online by Cambridge University Press

specialists to make the necessary observations, to train others, and to pass on an accumulating body of such astronomical knowledge. Among Californian complex hunter-gatherers, chiefs provided 'salaries' for specialist dancers, singers and shamans for ritual performances (Holliman 2004, 59). Thus, even if elites did not develop detailed astronomical knowledge themselves, it seems entirely possible for elites in complex hunting and gathering societies of the Upper Palaeolithic to have supported or commissioned astronomical specialists to develop increasingly complex astronomical knowledge that could be used as secret-society esoterica. It is within this context that we could expect occasional notations of celestial observations on bone, antler, or stone to have been made, as represented by the Blanchard *plaquette*.

Calendars or tallies?

Another important domain of material patterning involves the interpretation of incised bone and ivory implements from the Upper Palaeolithic such as the marks on the Taï plaque (Fig. 1) that Marshack originally interpreted as calendar notations. While the interpretations of some of these items like the Blanchard *plaquette* seem fairly convincing, the calendrical interpretation of other examples seems much less convincing. We propose that an equally compelling case can be made to view some of these notational artefacts as tallies and that feasting might again help provide a useful explanatory framework for the creation of tallies in the Upper Palaeolithic. Feasting can place pressures on individuals and groups to develop some form of record-keeping system in order to keep track of the large quantities of food or gifts that are often given away at these events (Fig. 1) creating reciprocal debts that had to be paid back. As John Adams (1973, 111) phrases it in reference to potlatches: 'Indebtedness fosters elaborate record keeping'. At some point in the more complex feasting societies, the large number of feasts given, participated in, or supported, together with the large numbers of debts and items involved must have become too taxing for human memories to keep track of. Schmandt-Besserat (1992, 8) has documented the ethnographic use of stone pebbles or clay pellets for keeping records of animal exchanges among herders in the Near East and argues that this practice goes back to 8000 BC for recording a wide range of materials and debts.

On the Northwest Coast, records of blankets and other objects given away were created by notching sticks, or by keeping bundles of sticks that represented the number of items given and owed (Boas 1925, 57, 163–5, 207–9). Numbers involved often reached into the hundreds or thousands for large feasts. In addition there were specialized 'tally keepers' appointed for feasts. Similar practices were recorded among other transegalitarian hunter-gatherers such as the Tlingit (Kamenskii 1985, 43–4), the Nisenan who used whittled and painted 'dunning sticks' to remind borrowers of loans and debts (Wilson & Towne 1978, 393), and the Chumash who kept notched sticks for accounts and to record animals given or received (Hudson & Blackburn 1987, 257). The Pomo also developed a notational system for wealth involving knotted strings and sticks kept in bags until debts were paid (Loeb 1926, 229). The Evenki of Siberia used notched sticks for a slightly different purpose, albeit still in a feasting and probably competitive, context. They counted songs performed at feasts by means of notched sticks and the number of these songs sometimes reached 700 at a single feast (Oakes & Riewe 1998, 45, fig. 33). Hudson and Underhay (1978, 62) also report Chumash ceremonial sticks with 150 'tally' marks.

Transegalitarian horticulturalists used similar counting devices as reported by Lewis (1969) for the Akha who used notched sticks for keeping track of chickens or other animals owed to the village by different households (presumably largely for village feasts and rituals), and on Vanuatu where the feasting and trading activities of the secret societies were explicitly related to the development of a sophisticated counting system and the use of sticks for record-keeping (Speiser 1996, 251). Ron Adams (pers. comm.) also observed that the Torajan groups in Sulawesi place pig mandibles and water buffalo bucrania on their houses not only to display the animals sacrificed at important feasts, but probably also as aides in recording and remembering reciprocal debts and credits involving those animals. In Polynesia, Villeneuve also observed individuals who were assigned to keep track of gifts and quantities received at week-long feasting events. Their tallies were then used in determining quantities to be paid back to various individuals in the final distributions. This resulted in simple tallies which were no longer kept after the feasting events ended.

While the Abri Blanchard artefact and some other 'notational' pieces from the Upper Palaeolithic may represent calendrical records or astronomical observations, many of the Upper Palaeolithic notations that Marshack attempted to fit into the mould of lunar cycles could easily have been tallies of various kinds of items given (or acts performed) at feasts. Numbers of fish, buckskins, eagle feathers, ivory beads, pieces of dried meat all could have been recorded in this context, and they would have been expected to be returned at future feasts as reciprocal feasting rules require. Tallies that have been crossed out or broken are typical ways of indicating items paid back. Good

https://doi.org/10.1017/S0959774311000400 Published online by Cambridge University Press

examples of notations that appear more likely to have been tallies or counts of items include: the Taï plaque, the Předmosti ivory piece, the batons Marshack discusses from Santander, the baton from Placard and the Ishango bone (Marshack 1991c, 22, 82, 257, 265, 295). He also provided examples of crossed-out notations (1991c, 228, 344, 348–9). Bar-Yosef and Belfer-Cohen (1999) have similarly argued that several decorated objects from the Natufian layers of Hayonim Cave were probably notational and represented counts of something. The point in discussing these numerous examples is that notational devices are also commonly used in complex hunter-gatherer and other traditional societies for keeping track of debts (especially related to feasting) and therefore could also be part of the Upper Palaeolithic record and related, like calendrical notations, to aggrandizer strategies.

Concluding discussion: implications for the Upper Palaeolithic

Some researchers have lamented that there has been little systematic effort to discuss the manner in which classes of Upper Palaeolithic imagery function. What we now propose can be concluded, with relative confidence, is that Upper Palaeolithic groups living in the most productive environments constituted complex or 'transegalitarian' hunter-gatherers. It also seems evident that these groups used some type (or several types) of notational system. Furthermore, on the basis of comparative ethnology of complex hunter-gatherers, it seems highly probable that some of these notations resulted from and/or were used in monitoring solar and/or lunar movements. It is also quite likely that the motivation for accurate monitoring of such celestial phenomena was for the purpose of scheduling major events such as winter ceremonials, as seen in many of the ethnographic groups surveyed. With somewhat less certainty, it can also be suggested that some notations may have also been used as tallies for keeping track of debts associated with feasts. Certainly, much more comparative ethnographic research is warranted both on notational systems and astronomical observations of the sun, moon and constellations.

From an ethnological perspective, we would argue that the proposed Upper Palaeolithic examples of detailed solar and lunar monitoring and calendrical reckoning cannot be seen as unique phenomena. Rather, many of these elements appear as a recurring pattern among complex hunter-gatherers. Notable solar positions, such as solstices, appear to have been frequently favoured among recent hunter-gatherers for holding the most important feasting events or at least for use as the main reference point to calculate major feasting events. As Hayden has argued elsewhere (1995; 2001a,b; 2008), in many if not most of these societies, aggrandizers used feasts, prestige goods and secret societies as strategies to further their own interests. We suggest that the beginnings of a long and widespread pattern of such use likely began with the complex hunter-gatherers of the Upper Palaeolithic. Unfortunately, resolution of the Upper Palaeolithic material record is not (yet) fine-grained enough to be able to identify or associate feasting evidence with solstice and calendrical evidence. Nevertheless, this is an hypothesis worthy to pursue in the future.

In this context the engraved bone from Abri Blanchard may begin to fit a broader pattern of detailed lunar observations. In fact, in our survey of the ethnographic literature, we encountered many accounts of detailed lunar observations such as the Blanchard bone may represent. However, a full analysis of these data was beyond the scope of the present article. The engraved bone from Abri Blanchard is a deceptively simple object in appearance, but one with potentially remarkable implications that even Alexander Marshack had not fully appreciated.

In the realm of untested ideas are suggestions that *if* there were secret societies in the Upper Palaeolithic, it seems plausible that detailed knowledge of solar and lunar movements formed a central part of some of their innermost esoteric knowledge. Such detailed knowledge could even conceivably be developed about the constellations along the ecliptic, eclipses associated with 19-year lunar cycles (as proposed by Jeguès-Wolkiewiez 2005, 61). However, these developments would require major investments in training to maintain such knowledge similar to the efforts required to sustain writing systems much later. Suggestions that cave paintings may represent the spirits of animals in various seasonal poses (on the ground or in the sky), or even depict actual constellations, require considerably more analysis and assessment, as do ideas that some constellation concepts may have persisted from the Palaeolithic until historical times.

Chantal Jeguès-Wolkiewiez has argued that certain caves and rock shelters in the Upper Palaeolithic were decorated and used for rituals because their entrances were aligned with solstice and equinox positions of the sun. In her sample, *un*decorated caves and rock shelters show no such preferential orientations (Fig. 6). Somewhat speculatively, we might suggest that if some Upper Palaeolithic caves were being used in a fashion similar to the 'antap use of caves by secret societies (i.e. for some of their more important rituals or initiations), then using them at key solstice times of the year, when the sun would shine into their entry chambers, could have formed part of the supernatu-

https://doi.org/10.1017/S0959774311000400 Published online by Cambridge University Press

ral 'secrets' of the societies that possibly constituted visible proof of the depth of their knowledge of the supernatural world, both in the upper (celestial) and lower (underworld) cosmos. Privileged visitors from other communities and new initiates could probably have been awed at the more spectacular celestial events played out in the entryway of some caves, not to mention in inner chambers where dramatic decor created by powerful secret societies could have constituted visible proof of their knowledge, power and wealth. Of course, one of the critical tests of this solstice interpretation of cave use and decoration is whether the orientations of decorated cave entrances were non-randomly aligned with solstice and/or equinox positions as Jeguès-Wolkiewiez maintains. It will be of fundamental importance to verify this in future research. Nonetheless, the hypothesis of secret-society use of some caves in the Upper Palaeolithic is a concept that potentially has good explanatory value and should be worth further investigation.

Although we have emphasized feasting in many of our discussions, it can be observed that feasting and ritual often go hand in hand. While there may be limited recognition of feasting evidence in the Upper Palaeolithic, there is widespread recognition of the more dramatic evidence for complex ritual activity. We are convinced that these developments need to be viewed in broader social and political contexts which take into account the considerable information and understanding of these activities from a comparative ethnographic perspective. Ritual, especially certain forms which occur among secret societies, did not occur in isolation from behaviours such as feasting and dances, and it often incorporated celestial monitoring as well as contentious debates over when to commence important events or initiations.

As argued by Villeneuve (2008), a critical issue in evaluating some of these ideas is establishing what types of ritual are potentially represented in the painted caves or elsewhere (e.g. private/individual rituals, shamanic practices versus group or secret-society events) and who was involved in them (e.g. specialists, elites *vs* entire communities, children, specific genders and how many individuals). This requires new methods to identify and distinguish these different uses of the painted caves to help address questions of when we might start to see evidence for more complex organization surrounding their use (see Villeneuve 2008; Villeneuve & Hayden 2007). On the basis of the use characteristics of the caves dealt with, it appears that it is not until the later Upper Palaeolithic (Magdalenian) in the more elaborately painted caves (such as Font-de-Gaume and Lascaux) that a strong argument for complex social structures can be made. This may therefore represent a period of more institutionalized inequalities surrounding the ritual use of caves (Villeneuve 2008). However, evidence from earlier periods suggest some form of inequality and ritual elaboration was present much earlier. We might therefore then look more attentively for evidence of competing emergent elites using caves in their scheduled ritual (and feasting) celebrations. However, creative methods and ways of exploring these questions are required, especially since the contents of so many caves were emptied in the early years of exploration. Nevertheless, the social context of cave art is one of the most fascinating areas of archaeological investigation, and in conjunction with the study of feasting, inequality and record-keeping, it can open important understanding about the evolutionary development of Palaeolithic cultures and socio-religious practices.

In sum, while simple hunter-gatherers may have had general notions of counting (rarely with words for numbers higher than ten) and seasonal changes with corresponding astral changes, or even an awareness of general solstice periods, they appear to have lacked the motivation or need to develop any complex numerical or observational astronomical system. In contrast, complex hunter-gatherers, especially those with competitive feasts and secret societies, arguably did have strong motivations as well as the necessary personnel and resources to develop complex counting and astronomical systems related to their hosting of feasts and their ideologies of the supernatural, the cosmos and calendars. These differences alone might explain some of the developments seen during the Upper Palaeolithic, yet these are primarily theoretical ideas that warrant much more empirical testing.

We conclude by pointing out that while much of Marshack's work was speculative and did not explore possible social reasons for keeping calendars, some of his more central ideas concerning the Palaeolithic existence of notations, seasonal scheduling and lunar recordings appear to have been well founded. He proposed remarkable meanings in some of the most ignored and unprepossessing objects of the past. In doing so, he may have opened one of the more intriguing doors of inquiry in Upper Palaeolithic research.

Note

1. Detailed solstice monitoring also appears to have been incorporated into the exclusive ancestral-solar cults of the Pre-Pottery Neolithic (A) at Jericho (*c.* 8300 BC — only a few thousand years after the end of the Palaeolithic: Barkai & Liran 2008). Orientations of sanctuaries to key solar alignments also occur in the later Neolithic monuments of western Europe such as Newgrange, Stonehenge, Maes Howe and other

https://doi.org/10.1017/S0959774311000400 Published online by Cambridge University Press

locations where powerful elites erected enormous monuments that embodied astronomical knowledge. These monuments were symbolically equivalent to caves: (Dowd 2007; Lewis-Williams & Dowson 1993, 62–3). The summer solstice, the winter solstice or the equinoxes were preferred orientations for these monuments (e.g. Roslund *et al.* 2000). Sims (2006) has presented compelling arguments for a relatively complex system of astronomical knowledge held by high-ranking specialists at Stonehenge, and the astronomical knowledge of even more complex societies in Egypt and the Near East is well documented. Complex astronomy was also a central feature of privileged elite knowledge among Mesoamerican and Andean civilizations. And it appears to have been important in Mesolithic-level societies such as the Jomon in Japan where stone solar alignments have been documented (Kobayashi 2005, 178ff.). If some continuity of this tradition can be traced back as far as the Mesolithic/Epipalaeolithic, perhaps it is not too much of a conceptual stretch to extend the tradition back slightly farther into the Upper Palaeolithic.

Acknowledgements

Many people have helped assemble the diverse pieces of the picture that we have tried to assemble here. Curtis Dean originally found the link to Chantal Jègues-Wolkiewiez's research, and both she and Pedro Lima have been exceptionally generous and helpful in sharing their research with us. Staff at the Vancouver Planetarium have helped enormously, especially Wanda LeClair and David Dodge. Other students have helped to assemble information on hunter-gatherer astronomy, including Sara Cavanaugh, Andrea Hamel, Jessi Witt and Steve Hamm. Eldon Yellowhorn shared his knowledge of Pegan astronomy with us, and Jean Clottes provided encouragement and shared supporting unpublished research. We are extremely grateful to everyone who has made this analysis possible. Alexander Marshack was always extremely generous with his ideas, his data and copies of his work.

Brian Hayden
Archaeology Department
Simon Fraser University
Burnaby, BC
V5A 1S6
Canada
Email: bhayden@sfu.ca

Suzanne Villeneuve
Archaeology Department
Simon Fraser University
Burnaby, BC
V5A 1S6
Canada
Email: suzanne_villeneuve@sfu.ca

References

Adams, J., 1973. *The Gitksan Potlatch.* Toronto: Holt, Rinehart, Winston.

Aujoulat, N., 2004. *Lascaux, le geste, l'espace et le temps*. Paris: Seuil.

Barkai, R. & R. Liran, 2008. Midsummer sunset at Neolithic Jericho. *Time and Mind* 1, 273–84.

Bar-Yosef, O. & A. Belfer-Cohen, 1999. Encoding information: unique Natufian objects from Hayonim Cave. *Antiquity* 73, 402–10.

de Beaune, S., 1995. *Les hommes au temps de Lascaux*. Paris: Hachette.

Bégouën, R. & J. Clottes, 1981. Nouvelles fouilles dans la Salle des Morts de la Caverne d'Enlène, à Montesquieu-Avantès (Ariège). *Congrès Préhistorique de France* 21, 33–57.

Bernatzik, H. & V. Ogilvie, 1938. *Overland with the Nomad Lapps*. New York (NY): Robert M. McBridge.

Birket-Smith, K., 1953. *The Chugacho Eskimo*. Copenhagen: Nationalmuseets publikationsfond.

Blackburn, T., 1976. Ceremonial integration and social interaction in aboriginal California, in *Native Californians*, ed. L. Bean & T. Blackburn. Socorro (N. Mexico): Ballena Press, 225–44.

Boas, F., 1925. *Contributions to the Ethnology of the Kwakiutl.* New York (NY): AMS Press (reprint).

Bogoras, W., 1904–9. *The Chuckchee*. (Jesup North Pacific Expedition 7.) Leiden: E.J. Brill.

Bordes, F. & D. de Sonneville-Bordes, 1970. The significance of variability in Paleolithic assemblages. *World Archaeology* 2, 61–73.

Boscana, G., 1933. *Chinigchinich: Historical Account of the Belief, Usages, Customs, and Extravagancies of the Indians of this Mission of San Juan Capistrano Called the Acagchemem Tribe.* 1978 reprint. Banning (CA): Malki Museum Press.

Bouchud, J., 1953. Les paléolithiques utilisaient-ils les plumes? *Bulletin de la Société Préhistorique Française* 50, 556–60.

Broughton, J. & F. Buckskin, 1992. Racing Simloke's shadow: the Ajumawi interconnection of power, shadow, equinox, and solstice, in *Earth and Sky*, eds. R. Williamson & C. Farrer. Albuquerque (NM): University of New Mexico Press, 184–92.

Capitan, L., H. Breuil & D. Peyrony, 1916. *La Caverne de Font-de-Gaume aux Eyzies (Dordogne)*. Monaco: A. Chène.

Cashdan, E., 1980. Egalitarianism among hunters and gatherers. *American Anthropologist* 82, 116–20.

Ceci, L., 1978. Watchers of the Pleiades. *Ethnohistory* 25, 301–17.

Chamberlain, V., 1992. The chief and his council: unity and authority from the stars, in *Earth and Sky*, eds. R. Williamson & C. Farrer. Albuquerque (NM): University of New Mexico Press, 221–35.

Chedd, G., 1981. *Myths and the Moundbuilders*. Public Broadcasting Associates. [Video recording.]

Clottes, J., 2001. *Les Chamanes de la Préhistoire*. Paris: La Maison des Roches.

https://doi.org/10.1017/S0959774311000400 Published online by Cambridge University Press

Clottes, J., 2004. Le chamanisme paléolithique: fondements d'une hypothèse, in *Actes du Colloque de la Commission 8 de l'UISPP*, ed. M. Otte. Liège: ERAUL, 195–202.

Clottes, J. & D. Lewis-Williams, 2001. *Les chamanes de la préhistoire: texte intégral, polémique et réponses.* Paris: Maison des Roches.

Conkey, M., 1980. The identification of prehistoric hunter-gatherer aggregation sites: the case of Altamira. *Current Anthropology* 21, 609–30.

Conway, T., 1992. The conjurer's lodge: celestial narratives from Algonkian shamans, in *Earth and Sky*, eds. R. Williamson & C. Farrer. Albuquerque (NM): University of New Mexico Press, 236–59.

Cope, L., 1919. Calendars of the Indians north of Mexico. *University of California Publications in American Archaeology and Ethnology* 16(4), 119–76.

Corbett, R., 2004. Chumash bone whistles: the development of ceremonial integration in Chumash society, in *Foundations of Chumash Complexity,* ed. J. Arnold. Los Angeles (CA): Cotsen Institute of Archaeology, University of California, 65–73.

Dowd, M., 2007. The use of caves for funerary and ritual practices in Neolithic Ireland. *Antiquity* 82, 305–27.

Drucker, P., 1941. Kwakiutl dancing societies. *University of California Publications in American Archaeology and Ethnology* 2(6), 201–30.

Gayton, A., 1948. *Yokuts and Western Mono Ethnography*, vol. 1. Berkeley (CA): University of California Press.

Gibbon, W., 1964. Asiatic parallels in North American star lore: Ursa Major. *Journal of American Folklore* 77, 236–48.

Goldschmidt, W. & H. Driver, 1943. The Hupa white deerskin dance. *University of California Publications in American Archaeology and Ethnology* 35, 103–39.

Grøn, O. & M. Kosko, 2007. Stonehenge–Olenok, Siberia: universals or different phenomena? Ethnoarchaeological observations of a midsummer rite, in *From Stonehenge to the Baltic*, eds. M. Larsson & M. Parker Pearson. (British Archaeological Reports, International Series 1692.) Oxford: BAR, 175–82.

Grønnow, B., 1985. Meiendorf and Stellmore revisited: an analysis of late Palaeolithic reindeer exploitation. *Acta Archaeologica* 56, 131–61.

Gusinde, M., 1931. *The Selk'nam: On the Life and Thought of a Hunting People of the Great Island of Tierra del Fuego*. Vienna: Verlag der Internationalen Zeitschrift.

Gusinde, M. & F. Schütze, 1937. *The Yahgan: the Life and Thought of the Water Nomads of Cape Horn*. Vienna: Anthropos-Bibliothek.

Hallowell, I., 1942. *The Role of Conjuring in Saulteaux Society.* Philadelphia (PA): University of Pennsylvania Press.

Hayden, B., 1981. Research and development in the Stone Age: technological transitions among hunter-gatherers. *Current Anthropology* 22, 519–48.

Hayden, B., 1990. The right rub: hide working in high ranking households, in *The Interpretative Possibilities of Microwear Studies,* ed. B. Graslund. (Aun 14.) Uppsala: Societas Archaeologica Upsaliensis, 89–102.

Hayden, B., 1993. *Archaeology: the Science of Once and Future Things*. New York (NY): W.H. Freeman.

Hayden, B., 1995. Pathways to power, in *Foundations of Social Inequality*, eds. T.D. Price & G. Feinman. New York (NY): Plenum Press, 15–86.

Hayden, B., 2001a. Richman, poorman, beggarman, chief: the dynamics of social inequality, in *Archaeology at the Millenium,* eds. G. Feinman & T.D. Price. New York (NY): Kluwer/Plenum Press, 231–72.

Hayden, B., 2001b. Fabulous feasts: a prolegomenon to the importance of feasting, in *Feasts,* eds. M. Dietler & B. Hayden. Washington (DC): Smithsonian Institution Press, 23–64.

Hayden, B., 2003. *Shamans, Sorcerers, and Saints: a Prehistory of Religion.* Washington (DC): Smithsonian Books.

Hayden, B., 2007. Une société hiérarchique ou égalitaire?, in *Chasseurs-cueilleurs: comment vivaient nos ancêtres du Paléolithique Supérieur,* ed. S. de Beaune. Paris: CNRS, 197–208.

Hayden, B., 2008. *L'homme et l'inégalité: l'invention de la hiérarchie durant la préhistoire*. Paris: CNRS.

Hayden, B. & S. Villeneuve, 2010. Who benefits from complexity? a view from Futuna, in *Pathways to Power*, eds. T.D. Price & G.M. Feinman. New York (NY): Springer, 95–145.

Hayden, B. & S. Villeneuve, 2011. A century of feasting studies. *Annual Review of Anthropology* (online and in press) http://www.annualreviews.org/doi/abs/10.1146/annurev-anthro-081309-145740.

Hedges, K., 1981. Winter solstice observatory sites in Kumeyaay Territory, San Diego County, California, in *Archaeoastronomy in the Americas*, ed. R. Williamson. Los Altos (CA): Ballena Press, 151–6.

Holliman, S., 2004. The role of ritual specialization in the evolution of prehistoric Chumash complexity, in *Foundations of Chumash Complexity,* ed. J. Arnold. Los Angeles (CA): Cotsen Institute of Archaeology, University of California, 53–62.

Hudson, T. & T. Blackburn, 1987. *The Material Culture of the Chumash Interaction Sphere*, vol. 5. Menlo Park (CA): Ballena Press.

Hudson, T. & E. Underhay, 1978. *Crystals in the Sky: an Intellectual Odyssey Involving Chumash Astronomy, Cosmology and Rock Art*. Socorro (NM): Ballena Press.

Hudson, T., G. Lee & K. Hedges, 1979. Solstice observatories in native California. *Journal of California and Great Basin Anthropology* 1(1), 39–63.

Itkonen, T., 1984. *The Lapps in Finland up to 1945*, vol. 2. Helsinki: Werner Söderström Osakeyhtiö, Porvoo.

Jeguès-Wolkiewiez, C., 2000. Lascaux, vision du ciel des Magdalénien, in *Arte preistorica e tribale: conservazione e salvaguardia dei messaggi*. Presentation at Symposium 2000 d'Art Rupestre, Val Camonica. http://www.archeociel.com/lascaux.htm

Jeguès-Wolkiewiez, C., 2005. Aux racines de l'astronomie ou l'ordre caché d'une oeuvre paléolithique. *Antiquités Nationales* 37, 43–52.

Jeguès-Wolkiewiez, C., 2007. Cro-Magnon: premier astronome de l'humanité? *Science et vie* (Nov.), 93–101.

Jeguès-Wolkiewiez, C., 2008. Lascaux et les astres. *Les dossiers d'archaeologie* (Hors Série) 15, 22–9.

https://doi.org/10.1017/S0959774311000400 Published online by Cambridge University Press

Jeguès-Wolkiewiez, C., n.d. Orientation des Grottes et Abris Ornés des Vallées Dordogne-Vézère. Unpublished paper.
Jochelson, W., 1905–8. *The Koryak: Jesup North Expedition*, vol. VI. New York (NY): American Museum of Natural History.
Johansen, S., 2004. Secret Societies in Ethnography and Archaeology. Unpublished MA thesis, Archaeology Department, Simon Fraser University, Burnaby, B.C. [Subsequently published as: Grayson, C., 2009. *Secret Societies in Ethnography and Archaeology.* London: Lambert-Academic.]
Johnson, D., 1998. *Night Skies of Aboriginal Australia*. Sydney: University of Sydney.
Jonaitis, A., 1991. *Chiefly Feasts.* Seattle (WA): University of Washington Press.
Kamenskii, A., 1985 [1906]. *Tlingit Indians of Alaska.* Fairbanks (AK): University of Alaska Press.
Klein, R., 1969. *Man and Culture in the Late Pleistocene*. San Francisco (CA): Chandler.
Klima, B., 1962. The first ground-plan of an Upper Paleolithic loess settlement in Middle Europe and its meaning, in *Courses Toward Urban Life*, eds. R. Braidwood & G. Willey. Chicago (IL): Aldine, 193–210.
Kobayashi, T., 2005. *Jomon Reflections*. London: Thames and Hudson.
Kroeber, A., 1953. *Handbook of the Indians of California*. Berkeley (CA): California Book Company.
Krupp, E., 1993. Summer solstice: a Chumash basket case, in *Archaeoastronomy in the 1990's*, ed. C. Ruggles. Loughborough: Group D Publications, 251–63.
de Laguna, F., 1972. *Under Mount Saint Elias: the History and Culture of the Yakutat Tlingit*. Washington (DC): Smithsonian Institution Press.
de Laguna, F., 1991. *The Tlingit Indians*. Vancouver (BC): Douglas and McIntyre.
Laroulandie, V., 2003. Exploitation des oiseaux au Magdalénien en France, in *Mode de Vie au Magdalénien*, ed. S. Costamgno & V. Laroulandie. (British Archaeological Reports, International Series 1144.) Oxford: BAR, 129–38.
Leroi-Gourhan, A., 1979. La stratigraphie et les fouilles de la Grotte de Lascaux, in *Lascaux Inconnu*, eds. A. Leroi-Gourhan & J. Allain. (Gallia Préhistoire Supplement 12.) Paris CNRS, 45–74.
Lewis, P., 1969. *Ethnographic Notes on the Akhas of Burma.* New Haven (CT): Human Relations Area Files.
Lewis-Williams, J.D., 1994. Rock art and ritual: southern Africa and beyond. *Complutum* 5, 277–89.
Lewis-Williams, J.D., 1995. Modelling the production and consumption of rock art. *South African Archaeological Bulletin* 50, 143–54.
Lewis-Williams, J.D., 2002. *The Mind in the Cave.* London: Thames and Hudson.
Lewis-Williams, J.D. & T. Dowson, 1988. The signs of all times: entoptic phenomena in Upper Palaeolithic art. *Current Anthropology* 29, 201–45.
Lewis-Williams, J.D. & T. Dowson, 1993. On vision and power in the Neolithic: evidence from the decorated monuments. *Current Anthropology* 34, 55–65.
Lewis-Williams, J.D. & D. Pearce, 2005. *Inside the Neolithic Mind*. London: Thames and Hudson.
Loeb, E., 1926. Pomo folkways. *University of California Publications in American Archaeology and Ethnology* 19, 149–410.
MacDonald, J., 1998. *The Arctic Sky.* Toronto: Royal Ontario Museum.
Marshack, A., 1972. *The Roots of Civilization.* New York (NY): McGraw-Hill.
Marshack, A., 1985. A lunar-solar year calendar stick from North America. *American Antiquity* 50, 27–51.
Marshack, A., 1991a. The female image—a time-factored symbol. *Proceedings of the Prehistoric Society* 57, 17–31.
Marshack, A., 1991b. The Taï plaque and calendrical notation in the Upper Paleolithic. *Cambridge Archaeological Journal* 1(1), 25–61.
Marshack, A., 1991c. *The Roots of Civilization.* Mt Kisco (NY): Moyer Bell.
Marshack, A., 1992. A reply to F. d'Errico. *Rock Art Research* 9, 37–59.
Marshack, A., 2001. Öküzini: the complexity and variation of the symbolic imagery, in *Öküzini: Evolution du Paléolithique final au Sud-ouest de l'Anatolie*, eds. I. Yalçinkaya, M. Otte, J.-M. Léotard, I. López Bayón, J. Kozłowski & O. Bar-Yosef. (ERAUL 96.) Liège: Université de Liège, 285–332.
Marshall, L., 1976. *The !Kung of Nyae Nyae.* Cambridge (MA): Harvard University Press.
McIlwraith, T.F., 1948. *The Bella Coola Indians*, vol. 2. Toronto: University of Toronto Press.
Miller, J., 1992. North Pacific ethnoastronomy: Tsimshian and others, in *Earth and Sky*, eds. R. Williamson & C. Farrer. Albuquerque (NM): University of New Mexico Press, 193–206.
Oakes, J. & R. Riewe, 1998. *Spirit of Siberia.* Vancouver (BC): Douglas and McIntyre.
Odyssey, 1980. *Franz Boas* (videocassette). PBS Video.
Olson, R., 1936. *The Quinault Indians*. Seattle (WA): The University of Washington Press.
Ontañón Peredo, R. (ed.), 1999. *La garma: un descenso al pasado*. Cantabria: Consejeria de Cultura y Deporte.
Owens, d'A. & B. Hayden, 1997. Prehistoric rites of passage: a comparative study of transegalitarian hunter-gatherers. *Journal of Anthropological Archaeology* 16, 121–61.
Perodie, J., 2001. Feasting for prosperity: a study of southern Northwest Coast feasting, in *Feasts*, eds. M. Dietler & B. Hayden. Washington (DC): Smithsonian Institutuion Press, 185–215.
Pryde, D., 1972. *Nunaga: My Land, My Country*. Edmonton (Alb.): M.G. Hurtig.
Public Broadcasting Associates, 1981. *Maya Lords of the Jungle* (videocassette).
Radcliffe-Brown, A., 1922. *The Andaman Islanders.* Cambridge: Cambridge University Press.
Rappenglueck, W., 1997. The Pleiades in the 'Salle des Taureaux', Grotte de Lascaux, in *Actas del IV Congreso de la SEAC: Astronomy in Culture*, eds. C. Jaschek & F. Atrio Barendela. Salamanca: Universidad de Salamanca, 217–25.

https://doi.org/10.1017/S0959774311000400 Published online by Cambridge University Press

Rappenglueck, W., 2001. Palaeolithic timekeepers looking at the golden gate of the ecliptic: the lunar cycle and the Pleiades in the Cave of La-Tête-du-Lion (Ardèche, France) 21,000 BP. *Earth, Moon and Planets* 85–6, 391–404.
Romanoff, S., 1992. The cultural ecology of hunting and potlatches among the Lillooet Indians, in *A Complex Culture of the British Columbia Plateau*, ed. B. Hayden. Vancouver (BC): University of British Columbia Press, 470–505.
Roslund, C., Y. Kristiansen & B. Hardh, 2000. Portuguese passage graves in the light of the Easter moon. *Fornvännen* 95, 1–12.
Ross, R., 1992. *Dancing with a Ghost: Exploring Indian Reality*. Markham (Ont.): Octopus Books.
Sauvet, G., R. Layton, T. Lenssen-Erz, P. Taçon & A. Wlodarczyk, 2009. Thinking with animals in Upper Palaeolithic rock art. *Cambridge Archaeological Journal* 19(3), 319–36.
Schmandt-Besserat, D., 1992. *Before Writing*, vol. 1. Austin (TX): University of Texas Press.
Schapera, I., 1930. *The Khoisan Peoples of South Africa.* London: Routledge & Kegan Paul.
Silberbauer, G., 1981. *Hunter and Habitat in the Central Kalahari Desert.* Cambridge: Cambridge University Press.
Sims, L., 2006. The 'solarization' of the moon: manipulated knowledge at Stonehenge. *Cambridge Archaeological Journal* 16(2), 191–207.
Soffer, O., 1985. *The Upper Paleolithic of the Central Russian Plain.* Orlando (FL): Academic Press.
Soffer, O., 1989. Storage, sedentism and the Eurasian Paleolithic record. *Antiquity* 63, 719–32.
Soffer, O., 1990. The Russian Plain at the Last Glacial Maximum, in *The World at 18000 BP*, vol. 1, eds. O. Soffer & C. Gamble. London: Unwin Hyman, 228–50.
Solecki, R. & T. McGovern, 1980. Predatory birds and prehistoric man, in *Theory and Practice,* ed. S. Diamond. The Hague: Mouton, 79–95.
Speiser, F., 1996 [1923]. *Ethnology of Vanuatu*. Honolulu (HI): University of Hawai'i Press.
Stern, T., 1998. Cayuse, Umatilla, and Walla Wall, in *Handbook of North American Indians*, vol. 12: *Plateau*, eds. W. Sturtevant & D. Walker. Washington (DC): Smithsonian Institution Press, 394–419.
Tanner, A., 1979. *Bringing Home Animals.* St John's (Nfld): Institute of Social and Economic Research, Memorial University of Newfoundland.
Teit, J., 1900. The Thompson Indians. *American Museum of Natural History Memoirs* 2(4), 163–392.
Teit, J., 1909. The Shuswap. *American Museum of Natural History Memoirs* 2(7), 447–789.
UCECMIL (University of California Extension Center for Media and Independent Learning), 1963. *The Excavations at La Venta.* Berkeley (CA): University of California.
Villeneuve, S., 2008. Looking at Caves from the Bottom Up: a Visual and Contextual Analysis of Four Painted Caves in Southwest France (Dordogne). Unpublished MA thesis, Anthropology Department, University of Victoria.
Villeneuve, S. & B. Hayden, 2007. Nouvelle approache de l'analyse du contexe des figurations parietales, in *Chasseurs-cueilleurs: comment vivaient nos ancêtres du Paléolithique Supérieur*, ed. S. de Beaune. Paris: CNRS, 151–9.
Whitley, D., 2000. *L'art des chamanes de Californie*. Paris: Seuil.
Williamson, R., 1984. *Living the Sky: the Cosmos of the American Indian*. Norman (OK): University of Oklahoma Press.
Wilson, N. & A. Towne, 1978. Nisenan, in *Handbook of North American Indians*, vol. 8*: California,* ed. R. Heizer. Washington (DC): Smithsonian Institution Press, 387–97.
Woodburn, J., 1982. Egalitarian societies. *Man* 17, 431–51.
Wynn, T. & F. Coolidge, 2007. Did a small but significant enhancement in working memory capacity power the evolution of modern thinking?, in *Rethinking the Human Revolution*, eds. P. Mellars, K. Boyle, O. Bar-Yosef & C. Stringer. (McDonald Institute Monographs.) Cambridge: McDonald Institute for Archaeological Research, 79–90.
Wynn, T. & F. Coolidge, 2010. Beyond symbolism and language. *Current Anthropology* 51(Supplement 1), S5–16.
Zhornitskaya, M., 1996. *Culture Summary: Chuckchee.* New Haven (CT): HRAF.

Author biographies

Brian Hayden is Full Professor in the Archaeology Department of Simon Fraser University. He has always been keen to understand the activities represented by archaeological remains and the social, economic, and political organizations that the artefacts and activities formed part of. He has therefore conducted a number of ethnoarchaeological projects in Australia, Mesoamerica, Southeast Asia and British Columbia. These have included studies on feasting and rituals.

Suzanne Villeneuve is currently the project director for the Keatley Creek Archaeological Research Project in British Columbia. Her MA thesis was an analysis of the context and physical characteristics of art in four Upper Palaeolithic caves in the Dordogne region of France. She is interested in past ritual and socioeconomic organization, and has undertaken related archaeological and ethnoarchaeological research in several countries as part of this focus.

https://doi.org/10.1017/S0959774311000400 Published online by Cambridge University Press

McDonald Institute Monographs

Downing Street, Cambridge, CB2 3ER, UK
+44(0)1223-333538
www.mcdonald.cam.ac.uk

Join our mailing list:

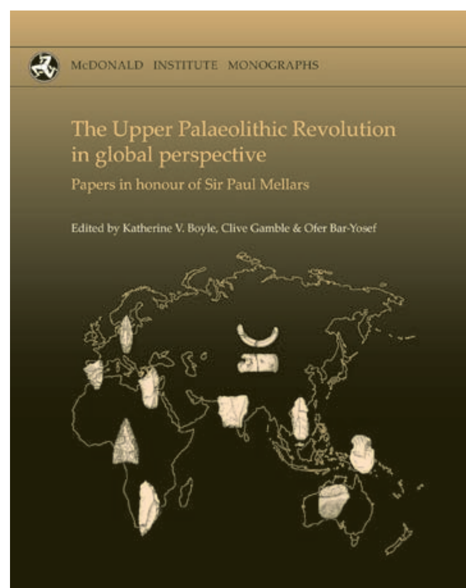
info@mcdonald.cam.ac.uk

The Upper Palaeolithic Revolution in global perspective
Papers in honour of Sir Paul Mellars

edited by Katherine V. Boyle, Clive Gamble & Ofer Bar-Yosef

£45/US$90

Order from www.oxbowbooks.com



The Palaeolithic is the only period in archaeology that can be studied globally. In the last half century one prehistorian, Sir Paul Mellars, has changed the shape and direction of such studies, adding immeasurably to what we know about humanity's earliest origins and the timing of crucial transitions in the journey.

This monograph is a collection of essays in his honour. Contributions cover both his own area of primary interest (Franco-Cantabria) as well as many other regions of the world all of which he has considered while writing about the Human Revolution in its wider geographical context.

Papers in this volume examine the archaeological record of the Upper Pleistocene from Australia, through eastern and western Asia, and Africa to northern Spain and the classic Périgord region of France, a cornerstone region which Mellars has been researching and publishing on since 1965. To papers on chronology, typology, subsistence and social complexity are added historical and theoretical contributions along with a biography. These illustrate not only Paul Mellars' impact on the current shape and direction of Palaeolithic studies but also how the subject has changed and continues to change.

Hardback | ISBN 978-1-902937-53-3 | xii+177 pp. | 286 × 220 mm | 51 figs., 13 tables | November 2010

https://doi.org/10.1017/S0959774311000400 Published online by Cambridge University Press