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The Identification of Prehistoric Hunter-Gatherer Aggregation Sites: The Case of Altamira¹

by Margaret W. Conkey

IT IS A COMMON AND PERVASIVE ASSUMPTION among ethnographers and archeologists that most of the world's hunter-gatherers follow an annual cycle characterized by periods of concentration and dispersion. The aggregation site is an a priori type of hunter-gatherer site (e.g., Wilmsen 1974). In an ethnographic sample of 90 societies of "pedestrian foragers," Martin (1974) found seasonal dispersion and nucleation the dominant settlement pattern. Mauss and Beuchat (1904, cited by Lee

¹ A considerably shorter and simplified version of this paper was presented at the symposium "Aggregation and Dispersion among Hunter-Gatherers," held at the State University of New York, Binghamton, in April 1978 under the sponsorship of the Department of Anthropology and the Wenner-Gren Foundation for Anthropological Research. Extensive critical comments on the original version were offered by Keith Kintigh, who is responsible for the statistical calculations (although not, of course, for what has been made of them). Without his insights and assistance, it is unlikely that the paper could have materialized. Helpful comments on an informal presentation of these ideas were given by Stanley Ambrose, Marley Brown, J. Desmond Clark, James Deetz, Glynn Isaac, and Ruth Tringham. Advice on the organization and logic was given by Lester B. Rowntree and several anonymous referees.

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1972) distinguished two phases in the annual cycle of the Eskimo, public life (the large-group phase) and private life (the small-group phase). For the Eskimo and other observed hunter-gatherers, an ecological basis for two such phases is clear. Large camps may be winter sealing camps or permanent water holes of the desert dry season. Fission and fusion as an adjustment to changing ecological conditions has been part of the band model since Steward's pioneering work (1936, 1955; see also Helm 1969a, b; Damas 1969). There is more, however, to aggregation/dispersion than subsistence ecology. Although the ecological factors promoting aggregations among observed hunter-gatherers are well described and hence easily extended to archeological interpretations, the social and ritual components of aggregations should not be minimized. Once all factors are recognized, it is clear that there is not just one aggregation/dispersion pattern. The duration, location, cyclicity, extent, personnel, and activities of any aggregation may vary greatly. This variability has obvious implications for the identification or documentation of prehistoric aggregation sites by archeologists.

I suggest that the aggregation/dispersion settlement pattern is not necessarily universal or of any great antiquity among hominid hunter-gatherers. Although aggregations of the sort observed among ethnographically known hunter-gatherers may well have taken place among some Paleolithic (and later prehistoric) hunter-gatherers, the development of the aggregation/dispersion pattern does not demarcate a stage in the evolution of human hunting-gathering systems that has persisted into the present. The aggregation/dispersion pattern is not just a more detailed version of the "monolithic profile of Paleolithic life" (Martin 1974).

We can, however, hypothesize the broad socioecological contexts in which we might expect aggregations of hunter-gatherers to have taken place. If we can also specify the criteria for the identification of aggregation locales, we must then frame the highly specified analytical questions necessary for the demonstration of prehistoric aggregations. There is reason to believe that aggregation sites did exist for some Upper Paleolithic populations of southwestern Europe. Among the sites hypothesized to have been aggregation locales, where both ecological and social activities may have promoted an aggregation, is the Lower Magdalenian site of Altamira (Cantabria, Spain) (Freeman n.d., Straus 1975-76). I shall consider the evidence from Altamira in an attempt to elucidate the kinds of data and analy-

sis necessary to identify such sites. Particular attention will be given to the analysis of engraved bones and antlers from Altamira and other Lower Magdalenian sites in Cantabria.

I shall first review the aggregation/dispersion pattern as it has been portrayed by ethnographers and evaluate the pattern from an evolutionary perspective. Next I shall discuss test implications for the aggregation/dispersion pattern in general and with particular regard to Altamira. Then I shall review the Altamira data and describe the analysis of its engraved bone-and-antler assemblage as an approach to the testing of an aggregation hypothesis for this site.

THE AGGREGATION/DISPERSION PATTERN IN THE ETHNOGRAPHIC RECORD

Lee (1979) has described the aggregation/dispersion pattern on the basis of his observations of the recent !Kung San of the Kalahari Desert. One is justifiably weary of the "ethnographic tyranny" (Wobst 1978) of the !Kung San data (Ember 1978, King 1978, Schrire 1977), but some general features of Lee's interpretation are relevant to the formulation of expectations for prehistoric hunter-gatherer aggregation sites. These and the conclusions of other researchers (e.g., Binford 1979, Damas 1969, Helm 1969b, Yellen 1977) deserve our attention regardless of the data from which they are drawn.

If one accepts Lee's proposition that the larger the group the more work the individual member of it will do, it follows that the principle of least effort cannot be invoked to account for observed groupings of hunter-gatherers (Lee 1979). Despite an increase in work, aggregations for months at a time of many dozens of !Kung San, and of other hunter-gatherers (Lee and DeVore 1968), can, of course, yield dietary advantages. Resource variety, quantity, and reliability often accrue from large seasonal work groups (Yellen 1977). The motives for forming such groups, however, have over and over again been shown to be social as well as economic. Aggregations of otherwise dispersed hunter-gatherers—not at all analogous to the massing behaviors of other mammals and of birds—must be a "product of conscious purpose" if they are to carry out the requisite increased work and increased cooperation (Lee 1979:447). Such large groups are "inherently unstable," but the collective gatherings are "stabilized by a distinctly cultural method: the use of the sacred." Ritual that binds people together is a critical component of the aggregation/dispersion pattern.

For the !Kung San, Lee (1972, 1979) specifies the social and ritual factors that bring people together: trance-dance curing, long-distance trading, marriage brokering, and men's initiation. Many of these call for substantial personnel to carry out the requisite procedures and activities and to provide for the participants. Damas (1969:52) notes for Eskimo that in the autumn aggregations "economic activities were virtually at a standstill"; the possibility of extending social networks was the attraction.

Although many aggregations coincide with economically important locales or activities, Lee (1972) reminds us that, at least among the !Kung San, groupings may fail to materialize or to continue because of conflict or potential conflict. Unfortunately, the archeological correlates of potential or real conflict of the sort that seems to characterize these known hunter-gatherers (see also Bicchieri 1969) are not particularly striking. The relevance of such ethnographic observations is that social and cultural regulatory mechanisms are significant. As we frame our expectations for prehistoric locales, we must keep in mind that social and ritual processes may well have been concomitant—if not central—activities at such locales.

In the broad perspective on hunter-gatherer life, Lee (1979: 447) views the aggregation/dispersion pattern as pivotal: "In thinking about the human past, the dynamic of movement should hold a central place, as a mediating variable, that unites

the public and private life, work and leisure, in-group and out-group, nature and culture." He makes explicit the uncritical assumption of many archeologists that aggregation/dispersion has long been typical of hunter-gatherers: "cycles of social intensity and tranquility . . . probably have characterized the life of humankind for thousands of years." He does not, however, pursue its evolutionary implications. If such a life-style requires the social and regulatory mechanisms that ethnographers cite, then until humans had developed these mechanisms the aggregation/dispersion pattern as we know it could not occur.

AGGREGATION/DISPERSION IN EVOLUTIONARY PERSPECTIVE

Is aggregation/dispersion as a pattern of hunting-gathering activities something we can expect among pre-*sapiens* and pre-*Homo* hominids? In an evolutionary perspective on human hunting-gathering, it would not be surprising to find that the "characteristic" aggregation/dispersion pattern did not always exist. As described by ethnographers, it is a statement about group behavior—ritual, ceremonies, conflict. This is a relatively normative approach, and therefore it is not surprising that aggregation/dispersion is considered a type of hunter-gatherer behavior. It is clear, however, that no single type of aggregation exists, and it is not likely that there was ever a stage in the evolution of hominid hunting-gathering systems during which most hunter-gatherers adopted the aggregation/dispersion mode.

For the diachronic researcher, we must isolate the attributes of aggregation/dispersion that make it a qualitatively distinct patterning of humans through time and across space. We should ask if it has, in one form or another, always been a part of the hominid foraging mode, under what conditions it developed, and what role it played in human biocultural evolution. The adoption of such a pattern has important implications for the understanding of information exchange or prehistoric demographics (e.g., Wobst 1974).

With regard to the earliest archeologically known subsistence activities of Pleistocene hominids, Isaac (1978a, b), in particular, has stressed the "home base." Whereas this home base is conceived of as a "focus in space such that individuals can move independently over the surrounding terrain and yet join up again" (Isaac 1978a:92, emphasis added), the aggregation/dispersion pattern described by Lee (1972), Mauss and Beuchat (1904), and Damas (1969) involves the fission and fusion of groups of individuals, as well as the comings and goings of individuals, who, however, have specific group affinities and usually travel with kin (Yellen 1977). The difference between the two—the fission and fusion of groups and the movements of individuals—may only be one of degree, but one is structurally more complex and probably involves different regulatory mechanisms. It is appealing to see the home-base pattern as a foundation for later, more complex hominid settlement patterns.²

² For Isaac and others doing the archeology of those 1,000,000–2,000,000-year-old hominid sites, the demonstration of a home base is yet to be accomplished. Isaac (1978a: 100) cites "unambiguous evidence" that hominids were carrying things such as stones around and suggests that they also carried meat and "concentrated this portable food supply at certain places." Central to the concept of a home base are differential mobility of individuals, subsistence task differentiation, and food sharing or food exchange, which in turn implies reciprocity, delayed gratification, and a certain degree of trust and interdependence among individuals. The archeological visibility of these latter behavioral components of the home-base model is obviously limited. If, however, Isaac's research team can identify sites that were formed by concentrations of individuals bearing a diversified set of resources (both food and equipment) that could (only?) be the result of differential mobility and task differentiation, and if it can then differentiate these sites from those formed by other activ-

If early hominid home bases are documented—and they certainly developed at some point early in the Paleolithic—we see the foundation for a very human trait: the investment of space with meaning (Wagner 1972). With predictable or agreed-upon meetings among hominids, particular geographical locations take on new social as well as ecological dimensions. Resources and geographic locations are linked with social relations and food exchanges, presumably based upon reciprocity. This linking of the subsistence system with the social system is qualitatively different from the linkages in nonhuman primate life. In the case of the !Kung San, specific resources, such as water, in particular locations (permanent or dry-season water holes) are linked with specific social events and processes: curing, initiation, trading, mate exchange. It is perhaps not surprising that we find continuities of meaning between space and society: the linking of one's origin, marriage, stone tool, or clan to a place is characteristic of some known hunter-gatherers.

ARCHEOLOGICAL IMPLICATIONS

I have suggested that Lee's "cycles of social intensity and tranquility" may not always have been a part of hominid hunter-gatherer life, particularly if we must invoke the ritual and social integration characteristic of recent hunter-gatherers. To investigate the validity of aggregation/dispersion as a plausible framework for viewing at least some prehistoric *Homo sapiens sapiens* hunter-gatherers, we must frame hypotheses about the pattern that can be tested with data from the late Paleolithic forward.

Aggregation sites have indeed been postulated for the Pleistocene (Straus 1975-76, White 1978). That they are not often described for periods earlier than the late Upper Paleolithic is most likely because we do not yet have a model as to what we expect an aggregation site to look like. Much of the research in southwestern Europe, for example, has focused on caves, without much regard for the deposits in front of them (even if intact). It is therefore no surprise that aggregation sites of the scale that Lee discusses have not been identified. Most caves or rock shelters are probably not places in which a group larger than 100 persons would have gathered; in many cases, there would simply not have been enough room. In southwestern France, however, White (1978) has shown that large (more than 1,200 m²) Upper Magdalenian sites (e.g., Le Madeleine, Bout-du-Monde) tend to be at a mean distance of some 300 m from fords in the Vézère River, whereas small sites are at a mean distance of 2,000 m. These fords—along an otherwise predominantly steep-sided river—are probably places in which game (e.g., caribou) and humans could not only approach but also cross the river. White's suggestion is that the funneling of caribou herds at these crossings would have promoted human aggregations near them.

While there is more to aggregation than resources, ecological factors clearly may promote aggregation. It may not have taken many caribou hunters, for example, to effect a kill, but the limited number of fords at which caribou could cross may well have promoted the aggregation of several groups at one location. Ecological factors may not be sufficient to account for

ities, the theoretically appealing notion of a home base as a settlement innovation at some point in hominid evolution will gain support.

Hominids that shared or exchanged food at a home base may well have had an informational advantage over primates that did not (Isaac 1978a). At the same time, however, as Isaac points out, the food-exchange system as a primate novelty probably demanded new ways of dealing with conspecifics—at least new ways of "fine-tuning" or adjusting social relations. New or elaborated regulatory or integrating mechanisms had to be brought into play, the details of which can only be speculative. With the adoption of structurally more elaborate patterns such as aggregation/dispersion, we can expect concomitant adjustments or innovations to regulate, integrate, and sustain the new social situations.

the occupation of a particular site, but they may well provide a starting point for the identification of some aggregation sites. The suggestion that the Lower Magdalenian (Magdalenian III) Cantabrian site of Altamira was a seasonal aggregation site (Freeman n.d., Straus 1975-76) is based primarily on interpretations of the faunal assemblage. The site's occupation is seen in terms of the possible wild-harvesting of at least two locally (and seasonally?) available resources: red deer (*Cervus elaphus*) and shellfish (*Patella* sp.). I shall pursue the hypothesis that Altamira was an aggregation site in an attempt to elucidate what we may need to know to test for prehistoric aggregation locales.

I recognize that, given the research objectives and excavation methods of past decades, the testing of currently popular hypotheses about past human behavior may not be possible or valid. The identification of aggregation/dispersion is bound to be a difficult task. For one thing, it is a regional question. The assumption is that the aggregations are of otherwise dispersed, fragmented groups, the two "structural poses" (aggregation and dispersion) forming a settlement pattern. Most Paleolithic researchers have not been regionally oriented in a way that would be sensitive to this kind of patterning. Furthermore, as Yellen (1977) points out, the archeological visibility of short-term, smaller-group occupation sites—the kind that may be isomorphic with dispersion sites—may be limited. To the extent that, as Yellen has shown for the !Kung San, the diversity of the archeological remains, the area of a site and its internal components, and other features are correlated with group size and length of occupation, we may often be comparing sites that are relatively homogeneous. In any event, there must be sampling bias in the roster of known archeological sites for almost any region.

Straus (1975-76:146), in a summary of the data on Altamira, concludes by suggesting that we think about the human occupation at Altamira in terms of seasonality, wild-harvesting, diversity of assemblages, multifamily, multipurpose, and repeated occupations of extended periods, and activities of "possible magico-religious enculturational significance." Freeman (n.d.) makes a similar suggestion and draws on regional data as well:

Large, decorated caves like Altamira and Castillo might have served as periodic centers of assembly where seasonal ceremonies were conducted on behalf of the congregated population of a large surrounding area. When not engaged in intensive seasonal activities, Magdalenian peoples might have lived in smaller social units in base camps where the accumulated surplus of the seasonal "harvests" was consumed. This is one possible explanation for the extremely varied faunal lists from some Magdalenian sites.

Given the evidence that Freeman and Straus present, these notions are not far-fetched, but they remain undeveloped, if not for the most part unsubstantiated. Admittedly, it was not the intent of either author to test these notions. I propose to pick up where they have left off and to bring in classes of data that they have not employed. Although both interpretations cite Altamira's paintings as evidence for its having been a site of considerable cultural significance, these paintings cannot be conclusively correlated with the occupational debris of the site. The decorated mobiliary materials, most of which were recovered from a stratigraphic context, have not been systematically included in site interpretation. Because an explicit analytical framework for the analysis of engraved bones and antlers, a system designed specifically for the purpose of intra-regional comparative analysis, has recently been developed (Conkey 1978), the analysis of mobiliary art from Lower Magdalenian Cantabrian sites may be one viable approach to the testing of the hypothesis that Altamira was an aggregation locale of otherwise dispersed hunter-gatherers.

An aggregation site among hunter-gatherers is a place in which affiliated groups and individuals come together. Although Lee (1979) specifies the primacy of ritual, in its basic form an aggregation refers to the concentration of individuals and groups that are otherwise fragmented. The occasions for concentration may be ecologically or ritually/socially prompted, and there must be processes that effect the integration and allow the aggregation to take place. The duration, however, of an aggregation may vary. Short-term aggregations at ritual locales may occur; subsistence activities may not go on at the same place. Extended multigroup aggregations for subsistence "harvest" and ritual may take place for over several months. Many different persons may move in and out of the aggregated group, so that although group size remains relatively constant group composition varies radically (Yellen 1977, Damas 1969). The social relationships among participants in the aggregation may vary. The number of individuals contributing to the material-culture assemblage may also vary considerably.

In order to develop test implications for the identification of aggregation locales, it is fundamental that we differentiate the conditions under which aggregations may take place. Primary conditions that will structure our archeological expectations will include time (duration of occupation), space (spatial extent of an occupation), personnel (number and kinds of different individuals), and context (for example, ritual only; ritual and both daily and concentrated subsistence; concentrated subsistence only; social, perhaps with maintenance activities; etc.). (These are not the only possible conditions, but ethnographic observation and archeological work to date suggest that they are at least some of the basic ones.) Further, some locales may be repeatedly used as aggregation locales, others so used only once or occasionally. The archeological indicators of these differing sets of conditions will be different. Indeed, the indicators may differ even for the same set of conditions—e.g., ritual only of a small group for a short occupation—for different groups, in different environments, with differing subsistence modes, with differing ritual repertoires, and so forth. The real methodological challenge in the identification of prehistoric aggregation sites is to develop the test implications for each combination of possible conditions under which an aggregation might take place.

Ethnoarcheological research may assist in predicting the archeological correlates of some of these differing conditions of aggregations. Yellen (1977) has observed, for example, that the longer any !Kung San site is occupied, the greater the likelihood that any particular activity will take place there. That is, with longer duration there is greater diversity, or at least a greater range, of activities. Further, he reports that at sites occupied both longer and by more individuals, there tends to be not only more investment in arranging or structuring the use of space (such as the more regular arrangement of huts), but also more maintenance of the site and its internal features. Yellen has argued convincingly for the applicability of these generalizations to other archeological contexts, and some of them have been predicted by other archeologists, if only on theoretical grounds. Factors influencing site maintenance—and hence the nature of the archeological record—have been of considerable concern in ethnoarcheological studies (e.g., Binford 1979). These factors can be both environmental and cultural in origin. When the occupation area is limited, or in environments in which waste promotes disease, site maintenance may be a more critical activity.

Some of these general implications (see also Schiffer 1978) can be considered in the case of Altamira. If Altamira was an aggregation site that was occupied for the hypothesized three months of the "harvesting season" (Freeman n.d.), it should differ in a number of ways from other sites that are assumed to have been occupied by fewer individuals, for shorter time spans, and possibly with less turnover in personnel. We should

be prepared to investigate the archeological indicators of (1) larger group size and its relationship to the spatial extent of the occupation; (2) seasonal occupation that may or may not have been repeated, the duration of which may be congruent with the length of the "harvesting" season; (3) site structuring (how the different activities were carried out); (4) maintenance of relevant site features; (5) a greater total range of activities than at any one other (presumably dispersion) site; (6) at least some activities different from those that took place at smaller, presumably dispersion sites; (7) ecological factors that may have prompted or contributed to the aggregation; and (8) a "mixture" of regional personnel.

It is unlikely that we can address all of these factors with confidence, particularly given the antiquity of the excavations at Altamira and the relatively restricted exposure of the site at that time. We will probably be unable as yet to identify the *particular* activities, such as hide-working or plant processing, that took place at Altamira. If, however, the assemblage is characterized by more different classes, more different features (hearths, pits, etc.), and greater diversity within these classes and features than in other assemblages, we can begin to argue that a greater variety of activities took place there than elsewhere. The ways in which Altamira differs from the hypothesized dispersion sites is a fundamental question. *Relative diversity* is the key; even if a considerable range of activities is indicated, we must still investigate the degree to which intrasite variability is greater or less than that between sites, between levels in a site, or between regions. Relative diversity of archeological materials is often assumed to have resulted from a greater range of activities and/or personnel. Straus (1975-76: 145) claims for Altamira that "the size and diversity of both the artifact and faunal collections are strikingly great in comparison with collections from most other sites." As will be shown, the diversity of the Lower Magdalenian engraving repertoire at Altamira in comparison with that of other sites of the same period can be quantified.

The individuals who are bound together when in small dispersed groups must be able to transcend or extend those boundaries in order to aggregate as a larger group. The activities or processes that would contribute to the integration of the larger group are likely to be ritual and cultural in nature and unlikely to leave direct archeological indications. We may never know the details of those that went on among prehistoric hunter-gatherers. However, to the extent that these communal activities do leave archeological evidence—if only an empty space in the site (Yellen 1977)—we should be able to identify them. In a regional and comparative view, we might expect to find distinctive evidence at Altamira for activities and behaviors that occur only at this site. As will be seen, there is some evidence from the engraved portable art that supports this idea.

We may be most secure in identifying the ecological factors that would have promoted an aggregation. However, of at least four alternative hypotheses regarding the utilization of Altamira as evidenced by faunal data, only one would involve aggregation for the exploitation of seasonally available and dense resources. Although both Freeman (n.d.) and Straus (1975-76) suggest that such resources were wild-harvested, this subsistence pattern does not demand aggregation. Nor do other plausible variants of this pattern: the taking of local and seasonally available but not dense resources, such as caprids that descended during the winter months (see, e.g., Clark 1971b, Straus 1977), or the wild-harvesting of dense but not necessarily seasonally abundant resources. Each of these situations has its own set of test implications, and we must differentiate among them. The analysis of the Altamira fauna (from the Magdalenian III level) strongly supports the hypothesis of wild-harvesting of seasonal resources. Intra-regional variability in the composition and structure of faunal assemblages among and between Magdalenian III sites (see table 1) suggests

differential site utilization,³ but the degree to which this is indicative of an aggregation of differentiated social units is another matter.

Seasonal movement and/or wild-harvesting of resources are not the same as an aggregation/dispersion pattern, particularly in the sense discussed by Lee (1979). Ecological availability, on a seasonal or locational basis, of a high-density resource may be one factor promoting aggregations, particularly if the increased effort necessitated by an aggregation is, in part, inhibited or mediated by the density of resources. To the extent that group distribution parallels resource distribution (Winterhalder 1978), seasonal wild-harvesting of certain resources could predict aggregation. There are, however, certain features of the Altamira site and its archeological remains that support the interpretation of the site as not just a locale where wild-harvesting of (at least) two resources took place, not just a seasonally occupied site, but also an aggregation site. The remainder of the discussion will focus on these features.

ALTAMIRA AS AN AGGREGATION SITE

Cantabria—the two more western provinces of north coastal Spain, Santander and Asturias—is primarily a sequence of narrow, ecologically diverse east-west zones from the dramatic

³ The hypothesis that the late Upper Paleolithic subsistence pattern in Cantabrian Spain involved seasonal movement between the coast and the mountainous interior has been increasingly supported (Freeman n.d.; Freeman and Klein n.d.; Straus and Clark 1978b; Straus 1975a, 1977; Clark 1971b). On the one hand, there are several specialized cliffside sites with predominantly caprine remains (e.g., Collubil [González Morales 1974], Rascaño [González Echegaray 1979]). On the other hand, recent analyses of red-deer antlers and limpet (*Patella vulgata*) growth rings (Madariaga de la Campa 1976) from coastal Cantabrian sites suggest that seasonal wild-harvesting was practiced during early Magdalenian times. At more sites than just Altamira (e.g., El Juyo, Cueto de la Mina), faunal lists have been interpreted to reflect the simultaneous collection of at least these two diverse resources: "It is suggestive that red deer are maximally aggregated and easiest to hunt during the rutting season in September-October, and this period coincides with maximum spring tides during the autumnal equinox when shellfish would have been easiest to gather" (Freeman n.d.). Clark (e.g., 1971b), Freeman (1973, n.d.), Freeman and Klein (n.d.), and Straus (1975-76, 1977) discuss in greater detail the habits of the species involved that would support this interpretation. In fact, accumulating data suggest that some resources were increasingly—through time—being harvested at

coastline (some 230 km long) to the interior mountains. Syntheses and summaries of regional ecology during the late Pleistocene can be found in Clark (1971a), Freeman (1964), González Echegaray and Freeman et al. (1971, 1973), Freeman and Klein (n.d.), and Straus (1975a). The past 15 years have witnessed increasingly sophisticated and human-ecologically oriented excavations and research into Cantabrian prehistory (Straus and Clark 1978b), and consequently we are closer than before to the understanding of intraregional population dynamics needed for the testing of an aggregation model.

Altamira is one of perhaps as many as 23 Magdalenian III sites. Half of these have been reported on only briefly; most of the collections have been lost or disturbed or are otherwise unknown. A recent restudy (Utrilla Miranda 1976, cited in Freeman and Klein n.d.) claims to have definitively assigned levels from 11 sites (fig. 1) to Magdalenian III. Absolute dating of materials from three of these—Altamira, El Juyo, and La Lloseta (see Clark 1971a, b; Freeman and Klein n.d.; Straus 1975-76)—suggests that the Magdalenian III occupations bracketed 15,500 B.P. Freeman and Klein (n.d.) report the following dates (calculated on the new half-life of 5,730 years): El Juyo IV, 13,751 B.C.; Altamira, 13,957 B.C.; La Lloseta, 14,117 B.C.; and La Riera (?), 14,904 B.C.⁴ Relative contemporaneity, especially in Paleolithic terms, is notable.

Altamira is a cave in the karstic coastal zone, now about 4 km from the Cantabrian Sea. It was proximal to the resources of the sea and estuaries, of the rolling, probably open woodlands, of some more sheltered woods and hollows, and of the Río Saja, 2 km to the south. Although the original mouth of the Altamira cave is known, its exact orientation is not, and the collapse of the entrance during the late Würm is clearly evidenced in the area of the occupations. Straus (1975-76: 135) reports that there

some cost to the resource population (Madariaga de la Campa 1976, Freeman n.d.): "decreased limpet size is suggestive of biannual or even annual cropping which is too frequent to allow local population turnovers that maintain limpet size" (Freeman n.d.).

⁴ Recently published dates (Straus and Clark 1978a, Clark and Straus 1977a) for the "presumably 'Lower Magdalenian'" levels (10-12) at La Riera suggest even older occupations: 17,160 ± 440 B.P. (Level 10) and 16,420 ± 430 B.P. (Level 11) (both Libby half-life calculations), but it seems that these levels are not securely associated with Magdalenian III industries (Straus and Clark 1978a).

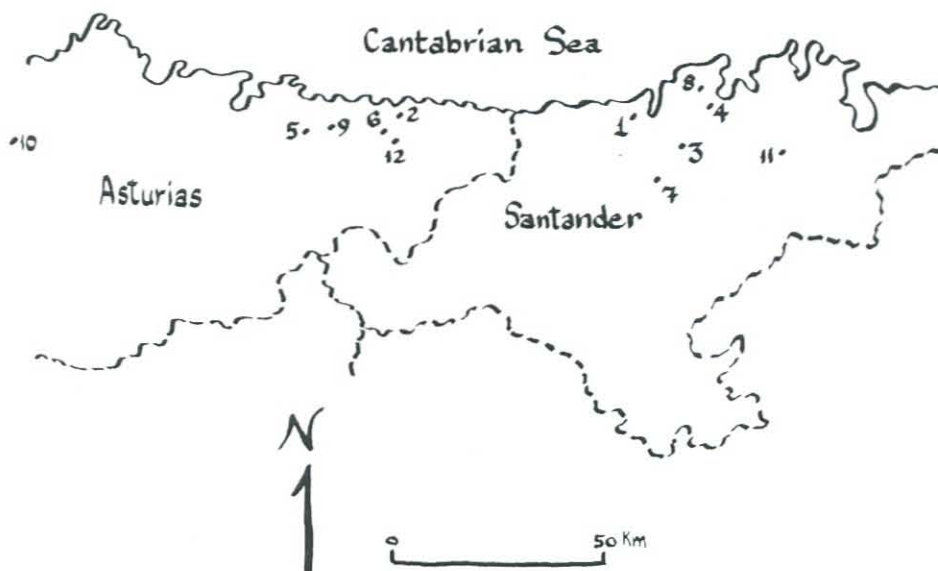


FIG. 1. Early Magdalenian sites in Cantabria. 1, Altamira; 2, Balmori; 3, Castillo/La Pasiega; 4, Camargo; 5, El Cierro; 6, Cueto de la Mina; 7, Hornos de la Peña; 8, El Juyo; 9, La Lloseta; 10, La Paloma; 11, Rascaño; 12, La Riera.

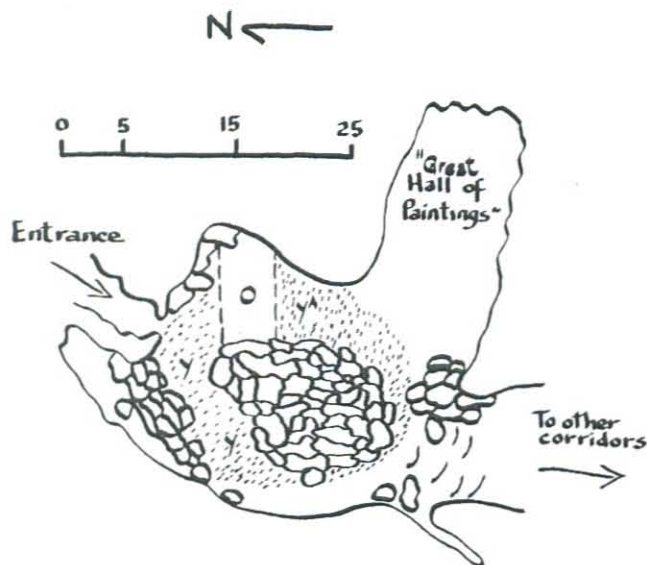


FIG. 2. Floor plan of "vestibule" and "great hall of paintings" of Altamira (roof supports constructed in 1925 not shown). *Y*, Paleolithic deposits visible to Obermaier and Breuil; *Y*^A, area of Alcalde del Rífo's (1906) excavations; *O*, area of Obermaier excavations (1924–25). (Redrawn after Breuil and Obermaier 1935:175.)

was repeated human occupation of a "vestibule," a roughly rectangular area about 20 × 25 m (fig. 2) that was "probably lit by the sun before the final collapse of the entrance." The important point here is the potential areal extent of prehistoric human occupation: some 500 m² in the vestibule alone. The area around the cave entrance is open and gently rolling and certainly was conducive to human occupation.

The discovery of the site and subsequent excavations and investigations are well described (Alcalde del Rífo 1906; Cartailhac and Breuil 1906; Breuil and Obermaier 1912, 1935; Sautuola 1880). Straus (1975–76) gives a concise summary of the two major excavations carried out in the vestibule area, that of Alcalde del Rífo (1906) and the cooperative excavation of 1924–25 by Obermaier, Breuil, and others (Breuil and Obermaier 1935). The painted ceiling was discovered by Sautuola in 1879 (Sautuola 1880).

From the investigations of Alcalde del Rífo, two major strata were recognized. The area excavated seems about 20 m² (Alcalde del Rífo 1906), and the upper, very ashy and thinner stratum was assigned by him to the Magdalenian. From this 35–45-cm-deep stratum are reported a very rich bone-and-antler industry and a relatively poor (in comparison with that from the underlying Solutrean level) lithic industry, abundant remains of shellfish (*Patella*, *Littorina*, and a few *Pecten*), and very fragmented faunal remains. The extant materials from these earliest excavations seem sparse, and it is unlikely that the collection that remains is at all a representative one (Breuil and Obermaier 1935, Straus 1975–76).

The Obermaier excavations, estimated to have covered at least 50 m² on the surface, confirmed the presence of two major strata, referable to the Lower Magdalenian and the Solutrean respectively. Again the Magdalenian level is reported as less thick than the Solutrean: a maximum of 50 cm of dark, charcoal-rich sediments that to Obermaier looked like a "kitchen" area, full of "cooking hearths," as well as dense molluscan deposits, phalanges of red deer (split, "probably to extract the oil"), and remains of other mammals. The Obermaier collections are in relatively good condition, and those at the Museo de las Cuevas de Altamira (Santillana del Mar) have recently been sorted and meticulously labeled by Straus. It is likely that the bulk of the data employed in analyses of Altamira

(e.g., Moure Romanillo 1974, Utrilla Miranda 1976) is derived from these excavations.

Although there is no internal differentiation of layers that might be correlated with multiple occupations, Obermaier suggests, without further comment, that internal subdivisions existed (Breuil and Obermaier 1935). In any event, given the relative lack of attention to microstratigraphy at the time of these excavations, lack of differentiation cannot be assumed. A major interpretive problem is, of course, differentiating between, on the one hand, sites that were repeatedly occupied, with levels that perhaps overlap and differing activities from one occupation to another, and, on the other hand, sites that were infrequently or uniquely occupied for some time and supported a wide range of activities. In some ways, and under some conditions, it seems likely that aggregation sites would be repeatedly occupied if selected for cultural as well as ecological reasons. The reuse and superpositioning that characterize the paintings and decorated walls of many late Paleolithic sites suggest that at least revisitations took place. Yellen's (1977) observations suggest no overlap of sites—for reasons of both hygiene and subsistence efficiency in foraging outwards from a given site. The environments of the Cantabrian Pleistocene and the Kalahari differ in significant ways with regard to the hygiene factors he cites, however, and none of his aggregation sites are loci from which wild-harvesting of resources takes place. Only future excavations at Altamira can contribute to the resolution of this problem of distinguishing repeated or single occupations. Attempts at interpretation would benefit, however, from information about depositional rates and site-formation processes. Is 50 cm of archeological deposits an unusually large amount of material to have accumulated in the course of a single (perhaps extended) seasonal occupation? It is critical that we ultimately know whether this was the case or whether the 50 cm represents a longer occupation and is the result of compaction of a once more highly organic and thicker deposit.

Assuming that all of the vestibule was occupied and none of it taken up by the roof-fall present during prehistoric times in at least some parts of it (Breuil and Obermaier 1935: figs. 163, 164), the total potential area was some 500 m². Only 70 m² seems to have been excavated during the two major excavations. Clearly, the interpretive statements made on the basis of this proportion of the total potential remains must be viewed with caution. Several aspects of the assemblages—faunal, lithic, and osseous—are, however, clearly different from those from excavations of similar areal extent at other Cantabrian locations. Overall, the intuitive observation of the richness and diversity of the Altamira remains demands further investigation. Table 1, for example, shows that a greater range of fauna was found in the Magdalenian III level at Altamira (and at Cueto de la Mina) than at sites such as El Juyo or Rascaño, even though the two latter have been excavated with considerable attention to the recovery of faunal remains. If more individuals occupied a site, and for several months, and carried out activities in addition to seasonally prompted hunting and/or collecting, relatively more diverse subsistence evidence might be expected than at a site such as Rascaño, which was probably repeatedly visited as a short-term butchering station primarily for alpine fauna (González Echegaray 1979). Again, Yellen's (1977) observations and generalizations are suggestive. Given a positive correlation between group size and length of occupation, increase in group size, in particular, is said to promote variety in diet. More individuals participate in high-risk/low-success activities; there are more individuals to gather more diverse items and also to gather more ecological information. Further excavations at Altamira will permit us to pursue the issue of dietary variety with more confidence, but in diet and even in lithics the picture of diversity is striking. It was, in fact, this aspect of the Altamira engraving repertoire that initially caught my attention.

TABLE 1
SPECIES REPRESENTED IN MAGDALENIAN III OCCUPATIONS IN CANTABRIA

SPECIES	SITE										
	Altamira	Castillo	Hornos de la Peña	Cueto de la Mina	La Lloseta 2	El Juyo XI	El Juyo X	El Juyo VII	El Juyo VI	El Juyo V	El Juyo IV
Mammalia											
<i>Lepus europaeus</i> (brown hare)	x	-	-	-	-	-	-	-	-	-	-
<i>Arvicola amphibius</i> (water vole)	-	-	-	+	-	-	-	-	-	-	-
<i>Homo sapiens</i>	-	x	-	-	-	-	-	-	-	-	-
<i>Canis lupus</i> (wolf)	x	-	-	+	-	-	-	-	-	-	-
<i>Vulpes vulpes</i> (red fox)	-	-	-	+	-	-	-	-	-	-	-
<i>Equus caballus</i> (wild horse)	4	+	-	+	+	-	-	-	8-10	3	7-8
<i>Cervus elaphus</i> (red deer)	19	xx	+	xx	xxx	6	3	7-8	xxx	7-8	20
<i>Capreolus capreolus</i> (roe deer)	2	-	-	-	-	-	-	-	-	-	-
<i>Rangifer tarandus</i> (reindeer)	-	x	-	-	-	-	-	-	-	-	-
<i>Bison priscus</i> (bison)	-	+	-	+	+	-	-	-	-	-	-
<i>Bos primigenius</i> (aurochs)	-	-	-	-	-	-	-	?1	4-5	1	-
<i>Bison/Bos</i> (indeterminate bovine)	4	-	-	-	-	-	-	-	-	-	1
<i>Capra ibex</i> (ibex)	1	-	-	+	+	-	-	-	-	-	-
<i>Rupicapra rupicapra</i> (chamois)	2	x	-	+	+	-	-	-	-	-	-
Mollusca											
Terrestrial gastropods	-	xxx	-	-	-	-	-	-	-	-	-
<i>Patella vulgata</i>	+	-	-	-	-	xx	+	xx	xx	xx	xx
<i>Patella</i> sp.	-	-	-	+	+	-	-	-	-	-	-
<i>Littorina littorea</i>	+	-	-	xxx	+	xx	-	xx	xx	xx	xx
<i>Littorina obliquata</i>	-	-	-	+	-	-	-	-	-	-	-
<i>Littorina</i> sp.	-	-	-	-	-	-	-	-	-	-	-
<i>Turritella communis</i>	-	+	-	xxx	-	-	-	-	-	-	-
<i>Nucella</i> (= <i>Purpura</i>) <i>lapillus</i>	-	-	-	+	-	-	-	-	-	-	-
<i>Buccinum undatum</i>	x	-	-	+	-	-	-	-	-	-	-
<i>Cassis saburon</i>	-	+	-	-	-	-	-	-	-	-	-
<i>Ostrea edulis</i>	-	+	-	-	-	-	-	-	-	-	-
<i>Arctica</i> (= <i>Cyprina</i>) <i>islandica</i>	-	+	-	+	-	-	-	-	-	-	-
<i>Pecten maximus</i>	-	-	-	+	-	-	-	-	-	-	-

SOURCE: Data from Freeman (1973, n.d.) and Straus (1977); table from Freeman and Klein (n.d.).

+, present (where no estimate of frequency is available); x, rare; xx, abundant; xxx, very abundant. Numbers indicate minimum estimate of individuals.

The Altamira excavations yielded at least 58 decorated/incised bone and antler pieces. Some of these are pieces of natural bone, while others have been modified into points, awls, or other supposed implements. On the basis of an analysis of 1,200 engraved bones and antlers from 27 different (Early, Middle, and Late) Magdalenian sites in Cantabrian Spain, I have developed a set of attribute categories for the analysis of the structure of the engraved designs or decorations (see Conkey 1978). Comparative analysis of two of these attribute categories as they occur on engraved materials from some of the Lower Magdalenian sites will form the basis for the testing of the aggregation hypothesis for Altamira.

At a most fundamental level of decorative structure are *design elements*, the basic invariant units that may be incised on the bone/antler. Originally, I developed a design-element hierarchy that attempted to account for the generation of increasingly specific design elements as based on differentially incised strokes. Nine major classes of linear strokes were identified (e.g., single, converging multiples, etc.); each was hierarchically subdivided. The 264 elements ultimately recognized were reduced to 57 classes. Analysis of the distribution of these design-element classes from unit to unit throughout the Magdalenian and across the region produced several interesting patterns, among them a striking diversity of elements in the bone/antler assemblage from Altamira.

A second attribute category is *structural principles*, principles of arrangement that structure the use of many design elements. Three broad classes of structural principles were identified:

longitudinal (nine variants), closing (three variants), and continuous (three variants). Not all of the engraved pieces were incised according to one (or more) of these principles. Some examples are shown in figure 3. More than half of the engraved pieces from Altamira (30 of 58) exhibit one or more of these

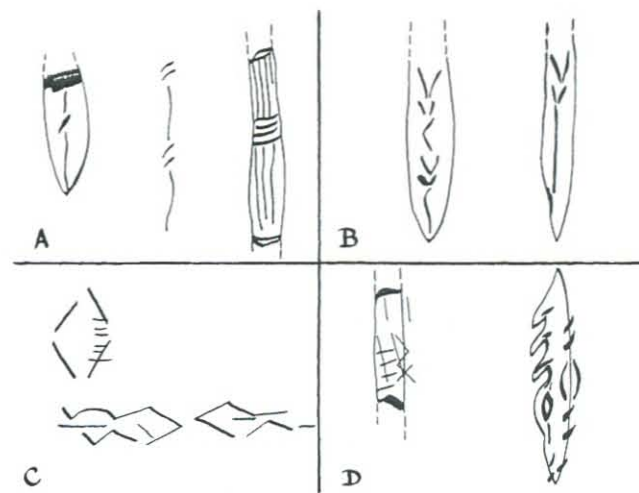


FIG. 3. Some examples of structural principles. A, interrupted longitudinal; B, longitudinal, convergence; C, diamond closing; D, continuous.

principles. Almost the full range of structural principles and design elements found in the Early Magdalenian assemblages studied is known at Altamira.⁵

Given the striking diversity of the occurrence of these attributes at Altamira, I decided to pursue their patterning to see what it might contribute to the testing of the aggregation hypothesis. Five Magdalenian III sites—Altamira, El Juyo, El Cierro, Cueto de la Mina, and La Paloma—yielded engraved bone/antler pieces that numbered more than ten per unit and that were (relatively) securely attributed to the Magdalenian III level(s) of the sites. These sites form the basis for the comparative analysis.⁶ Summary data on the numbers of engraved pieces, design elements, and structural principles can be found in table 2.

Although we cannot specify the uses of many bone and antler pieces or interpret the meanings, uses, or significance of the engravings, we can make some observations about Magdalenian engraving activities. Most incisions were not randomly made; whether made by one or many manufacturers, at one sitting or cumulatively, there is increasing reason to believe that there was considerable selection of elements and arrangements, if not of the raw materials themselves (Leroi-Gourhan 1965; Chollot-Legoux 1963; Conkey 1978, n.d.). The degree to which group-specific engraving styles or repertoires existed is not yet known. Some researchers, however, have argued for idiosyncratic and individualistic engraving activities that drew on a set of basic motifs or elements (e.g., Chollot-Legoux 1963). The degree to which some pieces were personal and others com-

⁵ A third relevant attribute is classes of symmetry, as defined by Washburn (1977). Preliminary analysis (Fritz 1975, Conkey 1978) suggested that, as an indicator of intraregional variability among Cantabrian Magdalenian assemblages, symmetry classes alone were not sensitive. Almost the full range of symmetry classes in use throughout the region during the Magdalenian was found among the Altamira materials, but the number of symmetry classes was small and not all engraved pieces bore decorative treatment arranged according to one or more symmetry classes. Furthermore, most usages of symmetry were translation (the most basic form). The statistical problems entailed by the limited number of categories and the fact that not all the engraved pieces could be included in the analysis reduced the usefulness of symmetry as an indicator of diversity, except to the degree to which it conforms to the patterns elucidated by the use of design elements or structural principles.

⁶ Although levels from as many as 12 Magdalenian III sites in Cantabria have yielded some archaeological materials, not all of these materials can be used with confidence as to their provenience. Many levels bore so few engraved materials, or so few that are now available for study, that the level or site could not be included in comparative analysis. It is highly likely, of course, that if we could control for loss or displacement of collections the differential densities of engraved materials among sites would be culturally significant. The case of Castillo is a particularly tragic example; here an extensive corpus of engraved materials from Lower and Upper Magdalenian levels has been mixed and labeled simply "Magdalenian." Problems of sample size and/or chronocultural proveniencing effectively eliminated the use of any Magdalenian III materials (excavated prior to 1974) from Castillo, Balmori, La Lloseta, Rascaño, and La Pasiega (see Conkey 1978).

munal is not known, nor is the degree to which the pieces may have traveled or been passed around or traded. Nevertheless, we know that even within Cantabria there were patterns of intraregional variability in the artifacts selected for engraving and the subject matter and its arrangement (Barandiarán 1973). Although a basic engraving repertoire was elucidated by my own recent analysis (fig. 4), not all elements and structural principles are in use everywhere. If groups and/or individuals in Cantabria that employed differentiated engraving repertoires were aggregating at Altamira, we can set up some expectations concerning the engravings from the Altamira assemblage:

1. The diversity of pieces at Altamira will be greater than at any other single (hypothesized dispersion) site.
2. Most design elements of the core Magdalenian engraving repertoire (Conkey 1978, Chollot-Legoux 1963) will be present everywhere or at least be widespread.
3. There will, however, also tend to be design elements and structural principles that are unique to Altamira.
4. Elements and principles lacking at Altamira should tend not to occur elsewhere.

The diversity issue is the central one, and I will return to it in some detail. First, however, the other expectations can be compared with the distributions of design elements and structural principles (see table 3). Because of the small number of structural principles and their relatively lower frequencies of use than for design elements, caution in interpreting these frequencies is called for.

Six design elements and three structural principles are found at all five sites. All six design elements are part of the core Magdalenian engraving repertoire identified for Cantabria and would also be considered basic motifs as identified for the Magdalenian pieces of the Piette collection, deriving from sites in the French Pyrenees (Chollot-Legoux 1963). The three structural principles found everywhere are also basic forms upon which more complex variants are built: a basic longi-

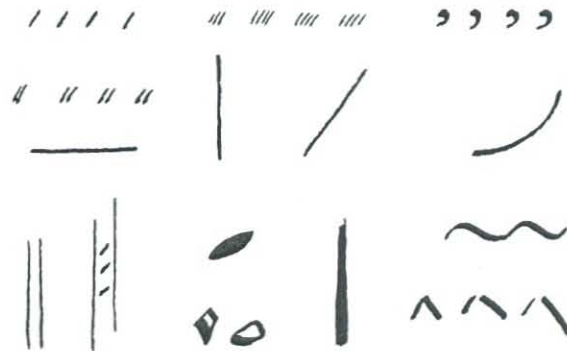


FIG. 4. Core or basic Magdalenian design elements (after Conkey 1978).

TABLE 2
DESIGN ELEMENTS AND STRUCTURAL PRINCIPLES ON ENGRAVED BONES AND ANTLERS AT FIVE CANTABRIAN MAGDALENIAN SITES

SITE	DESIGN ELEMENTS				STRUCTURAL PRINCIPLES		
	NUMBER OF ENGRAVED PIECES	Number of Instances	Number of Different Elements Used	Average Number of Uses per Element	Number of Principles Instances	Number of Different Principles Used	Average Number of Uses per Principle
Altamira.....	58	152	38	4.00	48	13	3.69
El Juyo.....	25	53	19	2.79	13	9	1.44
El Cierro.....	11	35	15	2.33	9	5	1.80
Cueto de la Mina....	36	69	27	2.55	27	8	3.37
La Paloma.....	22	23	12	1.92	12	7	1.71

TABLE 3

COMPARATIVE DISTRIBUTIONS OF DESIGN ELEMENTS AND STRUCTURAL PRINCIPLES AMONG CANTABRIAN SITES

ATTRIBUTE	SITE				
	Altamira	El Cierro	El Juyo	Cueto de la Mina	La Paloma
Design elements (44)					
Found here and at all other sites. . . .	6	6	6	6	6
Found here and at one or more others but not at all. . . .	27	9	13	16	6
Found only here. . . .	11	0	0	5	0
Absent, though present elsewhere.	6	29	25	17	32
Structural principles (14)					
Found here and at all other sites. . . .	3	3	3	3	3
Found here and at one or more others but not at all. . . .	10	2	6	5	3
Found only here. . . .	0	0	0	0	1
Absent, though present elsewhere.	1	9	5	6	7

tudinal line, a longitudinal line on two or more faces, and a continuous structure of elements or motifs.

There are eleven design elements that are found *only* at Altamira (fig. 5). Only one other site—Cueto de la Mina—yielded design elements unique to it, and the five unique to Cueto de la Mina are all lacking at Altamira. Thus the third expectation—uniqueness of the Altamira assemblage—is met, and so is the fourth: only six of the design elements in use among Early Magdalenian engravers are not found among the Altamira materials, and five of these are unique to Cueto de la Mina.

The distributional patterns of the structural principles do not conform so precisely to expectations. Only one site, La Paloma, evidences the unique use of a structural principle, and this is a single occurrence. With this exception, all Early Magdalenian structural principles are found on Altamira engraved materials. No other assemblage approximates such an extensive use of principles for engraving. If, however, the use of certain structural principles underlies the regional engraving system that is participated in (albeit differentially) by engravers who may be dispersed, then less intraregional variability in structural principles and more variability in the selection of design elements might be expected. That engravings at Altamira are differentiated from those at other locales more in terms of design elements than in terms of structural principles suggests that intraregional variability is being expressed at the design-element level.

One further point can be raised with regard to the observations discussed so far. That five of the six non-Altamira design elements are unique to Cueto de la Mina suggests that this site may also have been an aggregation locale. It is located about 60 km west of Altamira. Clark (e.g., 1971b) has described its ecological and topographical location as central, if not optimal, for the taking of sometimes dense and diverse resources of the same sort that are evidenced at Altamira: shellfish (especially limpets), red deer, and ibex. The Magdalenian III faunal list (table 1) shows that the Cueto de la Mina fauna is comparable in its diversity to that from Altamira, with particularly dense accumulations of a greater variety of molluscan species. Although the use of structural principles on the engraved pieces from Cueto de la Mina is not strikingly congruent with the Altamira pattern, reanalysis of the site features, fauna, lithics, and other dimensions of the engravings from Cueto de la Mina

should be undertaken from the point of view of its having been another possible aggregation locale.

The diversity—especially the relative diversity—of the Altamira assemblage has been a common observation (e.g., Straus 1975–76). Drawing on Yellen's formulations for !Kung San sites, I have addressed summarily some of the assumptions that might account for a relative diversity in diet (and, hence, to a certain degree, in faunal remains) and in lithics or other artifacts or features that would be components of activities carried out at the site. Length of occupation, extent of occupation, group size, and the number of different individuals all are suggested to generate a kind of diversity. If diversity is of concern, we need to know what meaningful diversity is, and we need a measure of diversity that conforms to our assumptions and understandings of the behaviors under consideration.

With the Altamira engraving repertoire, the relative diversity in design-element classes and structural principles is obvious (see table 2). Since Altamira is the largest sample (in terms of the number of engraved pieces, number of instances of the use of design elements, number of pieces incised according to one or more structural principles, and number of instances of the use of structural principles), the diversity suggested by the large numbers of different elements and principles used must be shown to be independent of sample size.

Up to a certain point, diversity is dependent on sample size. One must carve at least 44 design elements in order to achieve the maximum diversity of the Lower Magdalenian design-element repertoire, and then one can begin carving the old designs again. Only two sites in this study yielded fewer instances of the use of design elements than the total (44) of different design elements (La Paloma, 23, and El Cierro, 35); three sites had fewer instances of the use of structural principles than the total (14) of different principles (La Paloma, 12, El Cierro, 9, and El Juyo, 13). For the most part, there is correspondence between sample size (of design elements or structural principles) and the average number of uses of each element or principle, as we would expect if sample size and diversity were linked. At Cueto de la Mina, however, there are

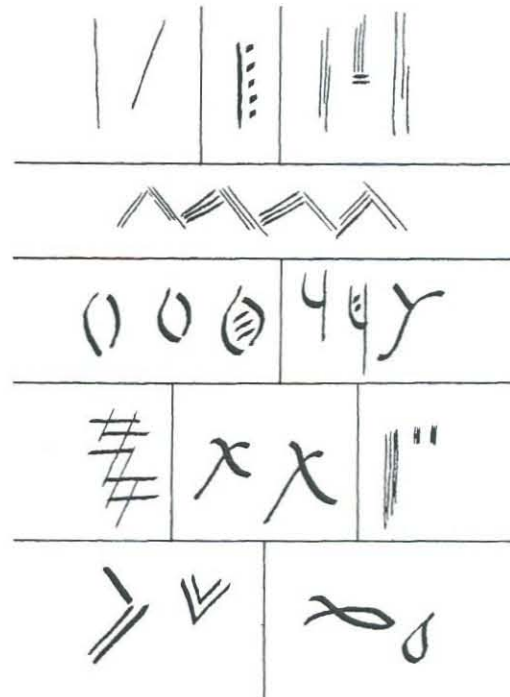


FIG. 5. Design elements unique to Altamira.

more design elements, each used less frequently, yielding a larger sample than at El Juyo, where fewer different design elements are used (on the average) more often, yet yielding a smaller sample. The same deviation from the expectation is the case with regard to some usages of structural principles (see, e.g., the figures for El Juyo in comparison with those for El Cierro and La Paloma in table 2). Although we get the same ordering of sites in terms of the number of instances of the use of design elements and number of different elements used (Altamira, Cueto de la Mina, El Juyo, El Cierro, and La Paloma; see table 2), the ordering based on the average number of uses per element is not the same (Altamira, El Juyo, Cueto de la Mina, El Cierro, and La Paloma). The orderings of the sites with regard to number of instances of the use of structural principles, number of different principles used, and average number of uses per principle are all different (see table 2). Here the low frequencies of some categories may well distort the interpretability of such orderings. In all cases, however, Altamira ranks first.

To understand the diversity at Altamira, other measures of diversity must be pursued. First, the number of different design elements and structural principles per site was plotted against the number of instances of the use of design elements and structural principles (figs. 6, 7). In both instances, Altamira fell below the curve that would be expected if diversity increased in direct proportion to sample size. This suggests that as a measure of the mixture of different repertoires the Altamira diversity is not simply a function of sample size.

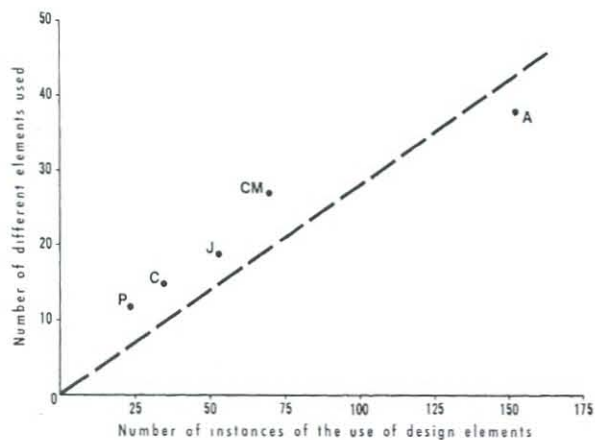


FIG. 6. Diversity curve for design elements.

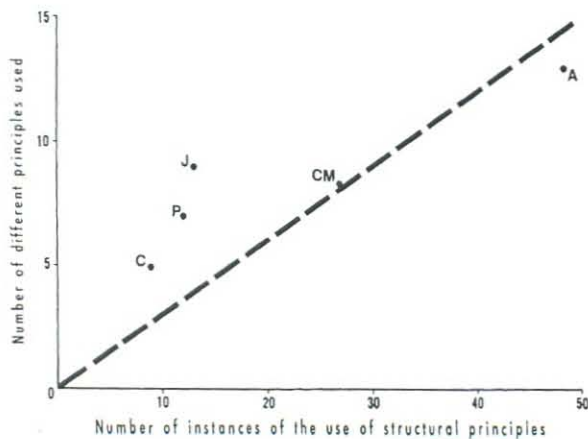


FIG. 7. Diversity curve for structural principles.

Secondly, the Shannon (or Shannon-Weiner) information statistic, H^1 , was calculated. While this statistic was developed by mathematical ecologists to measure diversity in categories they call "species" (Pielou 1966, MacArthur and MacArthur 1961), the name of the category should not theoretically matter if the assumptions underlying the measure can be met. In the ecological context, H^1 measures the diversity per individual in a many-species population. Pielou (1966:230) suggests that it is more a measure of uncertainty than one of information (in an information-theoretic sense): "If an individual is picked at random from a many-species population, we are uncertain which species it will belong to, and the greater the population's diversity (in an intuitive sense), the greater our uncertainty." That is, with an increase in diversity of engravings, it becomes difficult to predict the design element(s) that will occur on any piece chosen at random from the site. Both Yellen (1977) and Freeman (n.d.) have applied variants of this statistic to archeological remains. Freeman's use is closer to that of ecologists in that he attempts to assess relative diversity of faunal assemblages on the basis of species size-classes, not different species per se. Yellen investigates relative "richness": the number of different kinds of remains in a given site and the relative amounts of each. (The content—shell, bone, antler, etc.—is not of significance, just as for us the specific design element employed is not of primary concern.) Since this is a measure of relative diversity, it is particularly relevant to the testing of an aggregation hypothesis.

The results of the computation for diversity among Cantabrian Magdalenian III sites in the use of different design elements are given in table 4. Both statistics support the idea that diversity is not directly linked to sample size. While Altamira (.87) and Cueto de la Mina (.77) do rank highest in maximum diversity and in sample size (152 and 69), El Juyo and El Cierro exhibit the same measure of maximum diversity (.66) despite differences in sample size (53 and 35).

Yellen (1977) calculated different H^1 scores for the richness of archeological remains within and between Kung San camps. Within a camp, he has shown that there are differences in both areal extent and richness (H^1) between what he calls nuclear and special-activity areas. Because more time is spent in the nuclear area, it is larger and richer. Furthermore, within the nuclear area, both area and richness increase with length of occupation and the number of individuals who occupy it. Although it is plausible that the relative diversity of engravings at Altamira is correlated with greater length of occupation and greater number of individuals at the site, it is important to keep in mind that sheer increase in the number of individuals does not necessarily increase engraving as an activity, the number of engraved pieces brought to the site, or the number of different engravings made or brought to the site. It is the social contexts of engraving as an activity, of engravers, or of

TABLE 4
MEASURES OF DIVERSITY IN DESIGN ELEMENTS AMONG
CANTABRIAN SITES

SITE	H^1	MAXIMUM DIVERSITY
Altamira.....	3.27	.87
El Juyo.....	2.49	.66
El Cierro.....	2.49	.66
Cueto de la Mina.....	2.90	.77
La Paloma.....	2.33	.62

NOTE: H^1 is computed on the proportion of each design-element count in a site. It is the negative of the sum over all categories of the proportion of the sample in a category times the log of that proportion. Pielou's (1966) formula is $H^1 = -\sum_i (N_i/N) \log (N_i/N)$. Maximum diversity is calculated for all 44 design elements. This diversity index is expressed over a range of 0 to 1.0.

bearers of engraved items that will structure the relationship between engraving diversity and number of individuals at the site. Although these social contexts are not readily accessible, they must be given at least equal consideration with factors of time and personnel.

The third measure of diversity was presence/absence similarity (tables 5-7). Similarity is based on the presence of categories (structural principles or design elements) at the two sites being compared, not on the total number of elements or principles in the region. The measure does not indicate the frequency with which any given category is used. One thing the presence/absence measure shows is the greater similarity of Altamira to the other sites in structural principles than in design elements, supporting the interpretation offered earlier that intraregional variability is being expressed on the design-element level. Whereas Altamira is among the least similar to the other sites in use of design elements (.395), it has almost the highest average similarity measure (.530) in use of structural principles. It is also interesting that although there is mutually exclusive presence/absence of some design elements between Cueto de la Mina and Altamira, these two sites are more similar to each other than Altamira is to any other site. This may add to the reasons for investigating the hypothesis

TABLE 5
PRESENCE/ABSENCE SIMILARITY BETWEEN SITES IN DESIGN
ELEMENTS USED

	ALTAMIRA	EL JUYO	EL CIERRO	CUETO DE LA MINA
EL JUYO . . . . .	.46 (18/39)			
EL CIERRO . . . . .	.36 (14/39)	.55 (12/22)		
CUETO DE LA MINA . . . . .	.48 (21/44)	.53 (16/30)	.40 (12/30)	
LA PALOMA . . . . .	.28 (11/39)	.48 (10/21)	.42 (8/19)	.39 (11/28)

NOTE: Similarity measure is the number of categories present in both sites divided by the number present in one or the other.

TABLE 6
PRESENCE/ABSENCE SIMILARITY BETWEEN SITES IN
STRUCTURAL PRINCIPLES USED

	ALTAMIRA	EL JUYO	EL CIERRO	CUETO DE LA MINA
EL JUYO . . . . .	.69 (9/13)			
EL CIERRO . . . . .	.38 (5/13)	.49 (4/9)		
CUETO DE LA MINA . . . . .	.62 (8/13)	.55 (6/11)	.30 (3/10)	
LA PALOMA . . . . .	.43 (6/14)	.45 (5/11)	.33 (3/9)	.50 (5/10)

NOTE: Similarity measure is the number of categories present in both sites divided by the number present in one or the other.

TABLE 7
AVERAGE SIMILARITY OF EACH SITE WITH THE FOUR OTHERS IN
DESIGN ELEMENTS AND STRUCTURAL PRINCIPLES USED

	DESIGN ELEMENTS	STRUCTURAL PRINCIPLES
Altamira . . . . .	.395	.530
El Juyo . . . . .	.505	.532
El Cierro . . . . .	.433	.362
Cueto de la Mina . . . . .	.450	.492
La Paloma . . . . .	.393	.427

that Cueto de la Mina also may have been some sort of aggregation locale. Furthermore, the range of measures of average similarity among the sites is rather narrow, particularly with regard to the use of design elements. This suggests that the sites may be homogeneous in their relationship to each other, although not necessarily strongly similar, in their use of design elements and structural principles. Some sites (for example, El Juyo, with regard to design elements) appear to be just as similar to Altamira as they are to other sites.

If factors such as length of site occupation, group size, and number of personnel are directly correlated with both the archeological visibility of sites and relative diversity of activities, as Yellen has suggested, then it might not be surprising to find such seemingly restricted ranges of similarity measures and H^1 scores. Because Yellen had such a large sample of campsites, he was able to plot the number of occurrences of varying H^1 scores (at intervals of .3 H^1) (p. 111). A bimodal distributional pattern resulted that Yellen interprets as reflecting the difference in richness he had already identified between the remains of nuclear areas and those of special-activity areas. If our sample were considerably larger, and if a difference in diversity obtained between aggregation sites and dispersion sites, we might expect a bimodal type of patterning to emerge from a similar plotting. However, the similarity measures suggest that such patterning might not be as clear-cut. The range of H^1 calculations derived by Yellen is at least 2.5 times that calculated for these few Lower Magdalenian sites (0-2.43 for !Kung San camps, 2.33-3.27 for the Cantabrian sites). Clearly, sampling bias cannot be ignored, particularly since there is increasing reason to believe that, at least among French Upper Magdalenian sites, the overwhelming majority of engraved bone and antler comes from the very large sites (R. White, personal communication).

SUMMARY AND CONCLUSIONS

Throughout this discussion, I have drawn heavily on the theoretical statements made by Lee and others regarding aggregation of hunter-gatherers and on the methodological generalizations generated by Yellen's study of !Kung San campsites from an archeological perspective. My study is one in which probabilistic statements about the group are being made on the basis of the products of individual behaviors—engraved artifacts. It is not likely that by using such data I can prove Altamira to have been an aggregation site; I can only show that the data tend to support this hypothesis. I shall summarize by considering the Altamira data and test results in the light of some further generalizations drawn from ethnoarcheological research.

Although Yellen found no clear distinction between manufacturing and subsistence locations within a site, I suggest that the two kinds of activities be considered separately. This will perhaps spare us from lamenting the lack of broad horizontal exposures and precise spatial proveniencing that obtains in most Paleolithic excavations. It may also, as Yellen has suggested, allow us to pass over the distinction of precise activities and go on to statements of social and cultural context, as I have tried to do here. The analytical differentiation of these two activity types is based on the idea that food collection and processing or preparation almost always need to be carried out on a daily basis (even when stored food is being utilized), whereas knapping and bone-artifact manufacture tend to be evidenced in the archeological record of camps that are occupied for longer durations. Although the raw materials used among Upper Paleolithic peoples are not necessarily as light and easy to carry as those cited by Yellen for the !Kung San (e.g.,

ostrich egg shells), raw materials, partially manufactured items, and highly valued finished objects are more likely to have been transported among sites than subsistence resources.

In general, manufacturing activities are likely to occur less regularly than subsistence activities. It is indeed a plausible hypothesis that the longer any camp is occupied, the greater the probability that any activity will occur there. It is suggestive that the lithic materials from Altamira indicate knapping on the site (Straus 1975-76). Not all aggregations, however, are of long duration, and any diversity that is related to length of site occupation alone is not a universal predictor of aggregation. On the other hand, since individuals are responsible for certain activities, we could argue that the more individuals occupy or pass through a site and the more person-days are spent there, the more likely it is that any specific (and compatible) activity will take place there. This is why diversity in an archeological assemblage has important implications for temporal, spatial, and social aspects of site use and occupation.

In the case of Altamira, it becomes important to know if the occupation was a single event. The diversity of the assemblage might simply reflect the fact that the engraved pieces derived from two or more occupations. More significantly, through time enough deviations from a normative or cognitively structured engraving system will occur that any clear-cut pattern that may originally have existed will be obscured or diffused. Because the control over time is loose, there are obvious problems with an interpretation that, in large part, rests on the individual—and his/her products—as an analytical unit.

It is clear that many more questions have been generated than have been answered, but this is no surprise. Testing a notion such as the aggregation hypothesis is a complex undertaking. I have tried to draw attention to some of the data we need to support an interpretation of any site as an aggregation locale and to the kinds of questions we must ask.

The data analyzed here from the engravings—a previously untapped data set for this kind of settlement problem—do conform to the expectations set out above for an aggregation site. These expectations assume that either engravers who were otherwise dispersed carved at the site or individuals brought carved pieces to the site from other locales where varying engraving activities had taken place. To the extent that engraving was an individual task and not a craft specialization and to the extent that no highly specified design structure existed beyond the use of a certain range of elements, structural principles, and symmetries on certain classes of artifacts, one could expect that variability of engraved products would increase with number of individual manufacturers. Understanding the relative diversity of an archeological assemblage is key.

Lee's (1972, 1979) interpretations should, if nothing more, caution us as to the conditions and cultural requisites for an aggregation. We should not assume that all human hunter-gatherers had an aggregation/dispersion pattern of the sort cited for the displaced !Kung San. Not all "big" sites of hunter-gatherers are referable to the aggregation phenomenon. The data marshalled in previously published accounts of Altamira can only support a wild-harvesting hypothesis; they do not prove that otherwise dispersed social units and individuals aggregated at the site. The comparative analysis of one class of data, an analysis that attempts to get at relative variability in a regional context, has been presented as one way to begin to test notions of social aggregations among some Upper Paleolithic populations. The measurement of diversity is a difficult task, not often undertaken explicitly by archeological analysts; it rests on meaningful classification systems. In this instance, the demonstrated relative diversity of the Altamira engraving repertoire supports the hypothesis that otherwise dispersed engravers contributed to the engravings at Altamira, which may well have been concomitant with a social aggregation of some size and extent.

Comments

by ANTONIO BELTRÁN

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El problema de la ocupación de Altamira, su duración, espacio, número de personas y clases de ellas y tipo de actividades, rituales, sociales o de subsistencia, es el que los arqueólogos se han planteado repetidamente respecto de la significación del arte paleolítico, la cronología de la ocupación u ocupaciones y el carácter de «santuario» o de lugar de habitación de la cueva. Conkey insiste para sus planteamientos en el yacimiento fértil del Magdaleniense III y en los estudios (ya publicados) de Utrilla, pero los arqueólogos están acordes en que las pinturas y grabados de Altamira no fueron realizadas de una sola vez y que hay varias etapas fácilmente diferenciables en ellas. Por otra parte no es forzosa la sincronización del arte parietal con los restos de ocupación e incluso sería posible emitir la hipótesis de que mientras la cueva sirve como santuario no se habita con finalidad económica. A lo dicho no se opone la ocupación estacional postulada por Freeman (1978:157), y la solución está en la que se otorgue al hecho de pintar o grabar y al uso ritual o social que de las obras o conjuntos artísticos parietales se haga (cf. Beltrán 1978:2). Aunque no se admitan las hipótesis de Breuil para quien había en Altamira pinturas y grabados desde el Auriñaciense hasta el Magdaleniense superior y se simplifique su cronología en la forma que hace Leroi-Gourhan, con un santuario «de entrada» en el gran salón y otro de acceso fácil y profundidad media con los grabados y la serie de pinturas negras (en su estilo III), siendo del Solutrense final y de principios del Magdaleniense los grabados y pinturas negras y del Magdaleniense III y IV los llamados «pólcromos» (realmente bicromos), quedando para el Magdaleniense superior algunos grabados de la galería final; aunque así sea es necesario tener en cuenta los siguientes hechos indiscutibles: El gran salón tiene en toda su superficie una serie de pinturas rojas anteriores a los bicromos, rotundamente diferentes en estilo y concepción, con numerosos elementos no figurativos, tal como se advierte aún en su lado derecho sobre el que no se pintó después; en el conjunto de bisontes y caballos con añadidura de otros animales (excluyendo el jabalí, pues los ejemplares identificados son bisontes) existen varios autores, pero un solo proyecto y realización, y de ninguna manera puede fecharse en el Magdaleniense III independientemente de la presencia en el yacimiento de sólo Magdaleniense III. Otra cosa son los trazos lineares, trazos anchos y tintas planas del lado derecho. Lo mismo cabe decir de los grabados del corredor y de las figuras negras o violáceas de la grieta media, la sala baja y el corredor final o «cola de caballo»; en los grabados se va desde los «macaroni» con figura de bovino con cuernos en perspectiva normal, hasta los arañados finos comparables al arte mobiliario del Magdaleniense IV y al caballo en grabado profundo; o los ideomorfos y escaleriformes rojos de la grieta o los negros del corredor final. Parece indudable una secuencia evolutiva, en la que un momento sería la manada en la época de reproducción del gran conjunto de bisontes bicromos.

En cualquier caso hay que tener en cuenta para la valoración de la ocupación de la cueva de Altamira, los derrumbes antiguos (en la zona donde excavó Obermaier) y la consiguiente prolongación de la actual cueva bastantes metros al exterior.

[The problem of the occupation of Altamira—its duration, areal extent, number and kinds of persons, and their activities, ritual, social, or subsistence—is one that archaeologists have tackled repeatedly with regard to the meaning of the Paleolithic art, the chronology of the occupation or occupations, and the character of the "sanctuary" or habitation area of the cave. Conkey stresses the rich deposits of the Magdalenian III and the (now published) studies of Utrilla, but archaeologists agree that the

paintings and engravings of Altamira were not produced all at once and that there is no necessary contemporaneity between the parietal art and the occupational remains, and it is even possible to hypothesize that while the cave served as a sanctuary it was not occupied for economic purposes. This is not inconsistent with the seasonal occupation postulated by Freeman (1978:157), and the answer depends on what one assumes about the act of painting or engraving and the ritual or social use made of the works or groups of parietal art (cf. Beltrán 1978:27). Although one cannot accept the hypotheses of Breuil—for whom there were at Altamira paintings and engravings from the Aurignacian to the Upper Magdalenian and for whom their chronology was simplified as Leroi-Gourhan would have it, with a "vestibule" sanctuary in the big room and another of easy access and medium depth with engravings and the series of black paintings (in his Style III), the engravings and the black paintings being from the final Solutrean and the beginning of the Magdalenian and the so-called polychromes (really bichromes) from the Magdalenian III and IV, remaining for the Upper Magdalenian some engravings in the last gallery—it is necessary to keep in mind the following indisputable facts: The whole surface of the big room is covered with a series of red paintings earlier than the bichrome ones, entirely different in style and conception, with many nonfigurative elements, like the ones still apparent on the right side, which was not painted thereafter; the group of bison, horses, and other animals (excluding the wild boar, for the examples identified are bison) is the work of several hands but constitutes a single project and product, and in no way can it be dated to the Magdalenian III independently of the presence in the deposit of only Magdalenian III. Another thing is the linear strokes, wide lines, and colored planes of the right side. The same can be said of the engravings of the corridor and of the black and violet figures of the middle cleft, the lower room, and the last corridor or "horse's tail"; in the engravings one goes from "macaronis" with horned bovine figure in normal perspective to fine scratches comparable to the mobiliary art of Magdalenian IV and to the deeply incised horse, or the red ideomorphs and ladder forms of the middle cleft or the black ones of the last corridor. This seems without question an evolutionary sequence in which one stage would be the handprint of the time of production of the large ensemble of bichrome bison.

In any case, one must take into account in the assessment of the occupation of Altamira cave the ancient rockfalls (in the area excavated by Obermaier) and the consequent extension of the present cave a considerable distance outward.]

by G. A. CLARK

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How to identify prehistoric aggregation sites and how to distinguish them from limited-activity sites are certainly questions worthy of archaeological scrutiny, but the relative diversity of stylistic elements on engraved bone/antler objects may not be the most direct or profitable monitor of the regional settlement/subsistence systems assumed by Conkey's model.

For one thing, such objects are relatively and absolutely rare, not only within sites, but also within culture-stratigraphic units and especially within levels, which are the minimal behavioral units it is practical to analyze and thus the most appropriate for comparison. Conkey is almost certainly comparing objects fabricated over hundreds and possibly thousands of years by what—because of the time span involved—was probably a variety of distinct and not necessarily related social

entities. Style is used here to monitor regional interaction, which is fine, but while engraved items, unlike most classes of Paleolithic artifacts, do vary stylistically (it is next to impossible to identify an axis of stylistic variation on stone tools), the study would be more convincing if it were grounded on better or significantly larger samples (which probably are not available in the case of engraved bone objects). If the primary factors which determine hunter-gatherer fission and fusion are ecological ones, then a more direct approach would be to look at overall diversity in categories of things common to all sites—the archaeological and faunal assemblages.

Second, it seems highly unlikely that the Magdalenian III occupation at Altamira was a singular event. The activity suites there as elsewhere undoubtedly changed through the long period of occupation and probably changed during the Magdalenian III episode as well, with the site functioning at times as a limited-activity station, with a restricted diversity index, and at times as an aggregation site (or base camp—I don't think there is any difference), with diverse faunal, artifactual, and stylistic repertoires. This was certainly the case at contemporary La Riera (Asturias), where differences and similarities in the level composition of faunal and archaeological remains vary independently of both culture-stratigraphic unit affiliation and episode of macroclimatic change. To use classic culture-stratigraphic designations (e.g., Magdalenian III) as analytical units is ill-advised, as their meaning (if any) is not clear in behavioral terms (Clark and Straus 1977a, b; Straus and Clark 1978; Straus et al. n.d.).

Third, although it is reasonable to suppose that the largest and/or longest-occupied sites would have the most diverse archaeological assemblages, this may not always be true, and the case for Cueto de la Mina seems to contradict it. It is a very small site (area of cave and adjacent shelf is ca. 14 m²; area under overhang is ca. 170 m²). If people are going to aggregate, they need room to do so. At neighboring La Riera (habitable area ca. 150 m²) there is considerable variability in the diversity of archaeological and faunal assemblages which cannot be correlated with area occupied or with length of occupation. Some levels look like base camps, with generalized spectra of artifacts and fauna perhaps representing very diverse sets of activities; others look like limited-activity stations, with very restricted remains perhaps linked to a single "behavioral chain" (Schiffer 1976). The point is that the habitable area of a cave or rock shelter would be a more direct indication of whether or not it is a (potential) aggregation site than the diversity of the stylistic repertoire on scarce bone tools.

Would a bimodal curve for habitable areas result if comparable data were available from all Magdalenian III sites? Maybe—but variation across levels within sites would have to be taken into account. If aggregation sites can be equated with base camps, then periodically larger local aggregates would have to be accommodated. The relationship between local group size and habitable area can be expressed logarithmically, as is well known: $\log_e \text{population} = 1/b (\log_e \text{Area} - \log_e a)$, where a is a "space standard" (the average amount of space argued to be occupied by a person), $\log_e a = -0.23 \pm 0.68$, and $b = 1.96$ (Wiessner 1974, Nordbeck 1971, Jewett and Clark n.d.). It would be interesting to inspect the distribution of floor areas (and related local-group-size estimates) for Magdalenian III sites located in different microtopographic circumstances in the vicinity of Altamira (e.g., Castillo, La Pasiega, Camargo, Hornos de la Peña, El Juyo). As Altamira was not occupied or utilized in isolation, where it is located in relation to the distributions of critical resources and both

larger and smaller contemporary sites is crucial for an understanding of its roles in a regional Magdalenian settlement/subsistence system.

by J. GONZÁLEZ ECHEGARAY

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Encuentro muy interesante el estudio de Conkey. Especialmente es ingenioso y está bien desarrollado el proceso lógico que plantea para llegar a las conclusiones y sacar el máximo provecho de los escasos datos disponibles al respecto. Sin embargo, hay que andarse con mucha cautela al manejar datos procedentes de antiguas excavaciones, como son los utilizados por la autora. Téngase en cuenta que el área excavada por Obermaier en 1925 no pasa de 40 m² y la mayor parte del espacio estaba ocupado por enormes bloques de caliza desprendidos de la bóveda. Por ejemplo, el número de piezas líticas procedentes con seguridad del Magdaleniense III de Altamira es muy reducido. Sólo puede hablarse de 36 artefactos líticos (González Echegaray 1971) y no 215, como erróneamente cree Straus (1975-76), lo que ciertamente no permite deducciones serias de ningún tipo. El número de piezas óseas, sobre las que Conkey basa su estudio, es proporcionalmente mayor. Con todo, la colección Obermaier es muy reducida y las otras colecciones procedentes de excavaciones anteriores no ofrecen las garantías suficientes en cuanto a su determinación estratigráfica.

Recientemente se han realizado cuidadosas excavaciones en otros yacimientos del Magdaleniense III en la región, como en la Cueva del Rascaño (González Echegaray 1977, Barandiarán y González Echegaray 1979) y en la Cueva del Juyo (aún no publicado), lo que nos permitirá empezar a profundizar en el tema. De todos modos, el trabajo de Conkey marca una posible vía de investigación para el futuro que puede dar muchos frutos.

[I find Conkey's study very interesting. Especially ingenious and well developed is the logical process she uses for arriving at her conclusions and for extracting maximum benefit from the scant data available on the subject. However, one must proceed with great caution in handling data from old excavations like those employed by the author. It is important to keep in mind that the area excavated by Obermaier in 1925 is no more than 40 m², most of it occupied by huge blocks of fallen rock. For example, the number of lithic pieces safely attributable to the Magdalenian III at Altamira is very small. We are dealing with only 36 lithic artifacts (González Echegaray 1971), not 215 as Straus (1975-76) erroneously believes, and they certainly do not permit serious deductions of any kind. The number of bone pieces, on which Conkey bases her study, is proportionally larger. Nevertheless, the Obermaier collection is very small and the other collections from earlier excavations do not provide sufficient evidence as to their stratigraphic provenience.

Recently a number of careful excavations have been performed at other Magdalenian III sites in the region like the caves of Rascaño (González Echegaray 1977, Barandiarán y González Echegaray 1979) and El Juyo (not yet published). These will permit us to begin to explore the theme. In any case, Conkey's work points to a possible path for future investigation that may be very fruitful.]

by M. G. GUENTHER

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While, in my opinion, Conkey's paper fails to contribute substantially to the resolution of the specific question it poses—whether Altamira is in fact an aggregation site or simply a "big"

wild-harvesting site—it is successful in raising other questions about aggregation among hunter-gatherers in general. It advances well-taken criticism of the long-standing aggregation/dispersal debate among anthropologists and archaeologists for its a priori claim of universality and great antiquity for this pattern and oversimplification of its structure and organization. The author points to the considerable variation of aggregation with respect to its duration, location, cyclicity, extent, and personnel. She differentiates between "home base" and aggregation/dispersal as individual and group patterns respectively and argues for an evolutionary sequence of these two patterns. Aggregation/dispersal is structurally more complex and is generated and sustained not only by ecological, but also by social and cultural factors (such as ritual, marriage, and trade).

Conkey turns to such nonecological factors in order to demonstrate that Altamira is, indeed, to be considered a prehistoric case of aggregation—a hypothesis suggested but never proven by previous researchers on the basis of ecological evidence. While ingenious and sophisticated in methodology, the analysis of engraved design features on bones and the conclusion that the relative diversity of engravings at Altamira is correlated with greater length of occupation and greater number of individuals at the site are both lacking in cogency. A host of caveats—most of them recognized and spelled out by the author—attach to the analysis and conclusion, among them the limited archaeological visibility of some aggregation sites and, even more so, of the ritual and cultural activities that generate and sustain aggregation; the inadequacy of much of the archaeological record on Altamira, which was excavated some time ago with research objectives and excavation techniques substantially different from those of today (a problem so acute that the author could utilize only 5 of the 12 stratified Magdalenian III sites with archaeological materials); and the unresolvability of the crucial interpretive question whether Altamira was occupied infrequently or uniquely for some time or whether it was repeatedly occupied, with overlapping levels. Conkey even questions her own conclusion on the correlation of length of occupation and number of individuals with diversity by suggesting that in addition it is imperative that consideration be given to the social contexts of engravers and engraving.

Since such archaeologically inaccessible factors as social relationships and ritual are being considered within the prehistoric context, it is perhaps appropriate to suggest a further explanation to help account for diversity of design and structure of engravings: heightened aesthetic, mythopoetic stimulation experienced by Magdalenian engravers during their aggregation period. A number of students of religion (Turner 1969, Grimes 1976, Guenther 1979) have associated increased mental and aesthetic creativity with "dense moral interaction" and ritual activity. It is thus beguiling to speculate that Magdalenian expressive culture might have been similarly influenced by intensified moral and ritual states during aggregation.

In Conkey's words, "many more questions have been generated than have been answered." As a nonecologist of Durkheimian persuasion, I think that the most important issue to be raised by this paper is the hitherto excessively ecological orientation not only of the theoretical debate on hunter-gatherer dispersal/concentration but of hunter-gatherer research in general. The paper emphasizes that hunter-gatherers—even in prehistoric times—have important nonecological concerns and in their actions give consideration as much to social, political, ritual, and expressive matters as to ecological ones. It is heartening that Richard Lee, perhaps the most influential contemporary hunter-gatherer researcher among the anthropologists, who until recently tended to explain the !Kung San dispersal/concentration process in predominantly ecological terms (e.g., 1976) now (Lee 1979) appears to be placing much weight on social and especially ritual factors.

by JOACHIM HAHN

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As the author points out, the classification of Paleolithic sites into aggregation and dispersion sites presents some problems. To use the famous site of Altamira as a test case is another problem. The excavation distinguished one archaeological layer nearly 50 cm thick. Because this is only the compaction of an originally thicker layer, it surely corresponds to much more than one occupation. Although the sedimentation observed in the Lascaux cave (Leroi-Gourhan and Allain 1979), where 1–3 cm of the archaeological layer represented 10 to 12 occupations, may be extreme, one can easily guess at least 10 for Altamira. The observed diversity is probably the result of many occupations, maybe even by people with slightly different “traditions” but sharing the Magdalenian method of art and tool manufacture and disposal. The diversity of the fauna can also be interpreted in terms of the existence of several occupations. In any case, it would be interesting to know what picture would emerge with complete excavation—whether the overall diversity would increase, stay the same, or decrease.

Design elements and structural principles seem to be a good way to analyse art objects. I am not sure if the use of a statistic requiring random sampling is appropriate, because this condition is usually not met in small archaeological series. The comparisons of art objects from different sites attributed to the Magdalenian III is again problematic because the control of time is too different and the assemblages too few given the duration suggested by the radiocarbon dates. A problem not accounted for, and I wonder if ethnoarchaeology can give some suggestions here, is whether the places where the art objects were discarded are also those in which they were used. For the less mobile art on plaquettes this may be the case, but not for a group of decorated objects which probably had different functions.

by BRIAN HAYDEN

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As an archaeologist who has excavated ethnographically identified aggregation and dispersal sites in Australia (Hayden 1979), I find this article of extreme interest. It is one of the rare systematic attempts to deal with the identification of aggregation sites (see also Gorman 1972). Conkey's treatment of the data is sophisticated and convincing. I can find no major fault in the presentation or arguments. If anything, she is too modest with regard to the theoretical implications of her results. I would like to call attention to just one of the more important of these implications.

Wobst (1976) has argued that (1) self-propagating endogamous populations must minimally maintain a mating network of 175–475 individuals; (2) population density up until the end of the Pleistocene was so low (0.05–0.005/km²) that one such endogamous group would have included all of southwestern France or at the very least all of the Périgord (the presence of multiple ethnic groups—Mousterian or Upper Paleolithic—in the Périgord is therefore dismissed as unrealistic); (3) repeated interaction among a limited number of bands for the purpose of securing mates normally leads to closed, endogamous social networks and “ethnic” identities among hunter-gatherers; and (4) the sparse populations found throughout the Paleolithic and the long journeys required to obtain mates meant that bands could not afford to maintain closed boundaries with any surrounding group if they were to obtain sufficient mates for self-propagation, a situation which supposedly inhibited the development of ethnicity (distinct dialects, rituals, etc.) among hunter-gatherers until Recent times. All of these claims can be indirectly challenged on theoretical or empirical bases. For ex-

Conkey: PREHISTORIC HUNTER-GATHERER AGGREGATION SITES

ample, groups of only 100–200 persons can survive as endogamous populations (MacCluer and Dyke 1976). Furthermore, evidence of intergroup killing throughout the Pleistocene (Roper 1969) clearly indicates that bands did not maintain cooperative social relationships with all surrounding groups. More importantly, the data Wobst used for his model are highly biased. His population-density estimates are all taken from modern groups living in extremely harsh environments and using transportation aids such as dogsleds and boats. It is dubious whether Paleolithic groups lacking such transportation aids would have been able to cover the same area or exist at such low densities.

Although Wobst fails to provide criteria for determining the density level at which we can expect the formation of ethnic groups, the ethnographic record clearly demonstrates that distinct group dialects, rituals, and customs were present despite very low population densities, for example, in the Western Desert of Australia and in the Subarctic. While ethnic differences may be more pronounced in richer environments, this is more likely to be because of the need for widespread cooperative subsistence alliances in resource-poor areas than because of the requirements of the mating system (see Strehlow 1965; Harris 1971:296–302; Sahlins 1972:221). The modern occurrence of ethnic groups even in low population densities again clearly indicates that interaction for mates probably did not need to be uniform in all directions at any time during the Pleistocene and that patterning in interaction is more likely to have been a result of other factors.

Without transportation aids, it is improbable that bands of 25 individuals could have covered much more than 2,800 km², the traditional range of the Australian band I worked with. This band was situated in what Gould (1973) has termed one of the harshest environments man has ever successfully inhabited. Even in such an environment, ethnic groups emerged with specific names for themselves and others such as the Pitjantjara, Pintupi, Ngadajara, Walbiri, and Yankuntjara. Contrary to Wobst's assertion that gatherings of 175–475 persons (endogamous groups) were impractical for most hunter-gatherers, there is documentary evidence that even in these harsh environments traditional tribal groups were perfectly capable of gathering in groups of up to 270 persons (Hackett 1937:289; Tindale 1935:199). If, as is usually assumed, southwestern France in the Upper Paleolithic was relatively rich in resources (which both Wobst and David [1973] dispute), then we should expect even clearer evidence for different ethnic groups (maximal bands) with aggregation centers within each ethnic range. Perhaps even more important, such aggregation centers should be closer together than they are in extremely harsh environments. Using Wobst's hexagonal models and a “minimal-band” range diameter of 60 km (2,800 km²), such aggregation sites should occur approximately 300–780 km apart in the Western Desert of Australia. In substantially richer environments, the distance between aggregation sites should be considerably less.

It is here that Conkey's data provide direct evidence as to the accuracy of Wobst's formulation. Not only does she have strong indications of two aggregation sites in northern Spain indicating two contemporary, stylistically distinct populations (Altamira and Cueto de la Mina), but these sites are only 60 km apart. It is difficult to escape the conclusion that they represent focal points for two maximal bands, self-perpetuating and endogamous, situated in relatively rich environments. The contemporary elaborate cave art and mobiliary art, the numerous sites, and the burials with primitive valuables similarly attest to resource-rich surroundings capable of supporting somewhat economically competitive, status-ranked societies. Similarly, White (n.d.) has identified a number of aggregation sites in the Vézère Valley of the Périgord, and the very large

(probable) aggregation site of Gare de Couze is only about 40 km away. This evidence, together with Conkey's important data, tends to negate Wobst's model. Consequently, his conclusion that the difficulty in obtaining mates prevented occupation of some economically suitable environments (including coastlines and peninsulas) and necessitated widespread interaction in *all* directions, among all contiguous bands, must be questioned.

In response to Conkey's question concerning deposition during single-season occupations, my research suggests a one-season overall deposition of 50 cm to be extremely improbable. Even an overall deposit of 1-2 cm would be exceptional. I would also place more emphasis on ecological considerations, not simply as contributing, but as absolutely essential, factors in the occurrence of aggregation sites. Finally, Conkey's delineation of criteria for the recognition of aggregation sites is the best and most thorough discussion in the literature. I would, on the basis of my own experience, heavily emphasize site size, together with stylistic diversity.

by K. PADDAYYA

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In recent years there has been a welcome trend in Stone Age research shifting the focus of attention away from the study of technology and typology, subsistence and chronology. *Social Archeology*, edited by Redman and his associates (1978), is one of the best illustrations of this trend; Conkey's article is another example. I would like to think that this article once again proves that the New Archaeologists are not at all making a tall claim when they say that the archaeological record is not mute and, with the necessary methodological devices, can be made to yield interesting information about the non-material (social, religious, political, etc.) aspects of past cultural systems.

I have no hesitation in accepting Conkey's view that Altamira served as an aggregation site for Magdalenian groups. In fact, as she herself concedes, this conclusion had already been arrived at by other workers on the basis of faunal studies. The originality of her study lies rather in the use of an altogether different category of evidence for reaching this conclusion, viz., the designs occurring on bone and antler objects found at Altamira and other sites. What is more significant, since she has used the conclusion of earlier workers as a hypothesis and has deduced from it (four) test consequences and judged them in the light of design repertoires actually available, I would regard her study as a vindication of the usefulness of the much-derided hypothetico-deductive method in archaeological research.

Secondly, I believe that this phenomenon of aggregation/dispersion must have characterized, in some form or other, most of the Stone Age groups with a gathering-hunting economy. As a probable example of the ecological factors that contributed toward such a phenomenon, I wish to cite my own study of the Acheulian sites of the Hunsgi Valley in South India (for details, see Paddayya n.d.). The valley is enclosed on all sides by limestone and shale tablelands and forms the headwaters of a tributary of the River Krishna. Of the more than 45 sites known thus far, as many as 20 occur as a cluster around Hunsgi, within a radius of 2 to 3 km, and occupy a central position in the valley. They are located along the main stream known as the Hunsgi *nullah* or its tributaries. As against this concentration, the remaining sites are found randomly dispersed all over the valley floor. One important difference between the two groups of sites is that sites of the Hunsgi group are much larger in extent, with artefactual yields of several hundred specimens, and appear to have witnessed repeated occupation. The valley-floor sites are much smaller and yield only a few dozen artefacts; the occupation seems to have been both single-cycle and temporary in nature.

On the basis of inference that the past environments of the area were essentially similar to those obtaining today, I have put forward the interpretation that the two groups of sites represent phases in the annual life-cycle of the Acheulian groups of the area. The sites forming the Hunsgi cluster were probably occupied during the dry part of the year, when groups were forced to come together because the channel flow in this stretch of the Hunsgi *nullah* (issuing from geologically old artesian springs) forms the only source of drinking water during this season. Further, the thickets along the stream would supply a variety of plant foods and also serve as hide-outs for securing game coming in search of drinking water. The Hunsgi cluster of sites thus appears to constitute an aggregation locale. The valley-floor sites, on the other hand, mark the dispersal of human groups all over the valley during the wet season, when water as well as animal and plant foods are in plentiful supply everywhere. I will be glad to have information about possible parallels in the Palaeolithic cultures of other parts of the Old World.

by LAWRENCE G. STRAUS

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I am pleased to see Conkey put to further use the major Obermaier collections from Altamira which I relocated, organized, and studied (Altuna and Straus 1976; Straus 1976-77, 1977) and which I showed to her in June 1974. (Since the article includes acknowledgments, I am somewhat surprised that there is no acknowledgment of this essential fact—or of the information I supplied to her on the worked bone collections in the museums of Santander, Oviedo, Madrid, and other cities.)

While I naturally agree that Altamira was likely to have been a major multiactivity site, possibly involving (seasonal?) aggregation of fairly large numbers of early Magdalenian (and Solutrean) hunter-gatherers, there are some difficulties with Conkey's intriguing analysis. These largely stem from the nature of the data and from her interpretation thereof. My basic reservation is that she is trying to do a very fine-grained analysis (i.e., demonstration of the aggregation of separate, individual social units) on the basis of very coarse-grained data (i.e., lumped collections from very thick series of archeological deposits excavated without concern for modern standards of stratigraphic subdivision). Put bluntly, Conkey's results from Altamira could just as well be explained by a *series* of occupations of the cave by different individuals, groups, or generations over a long period of time. The Magdalenian deposit (referred to by Breuil and Obermaier [1935:177] in the plural as "levels") is not only $\frac{1}{2}$ m thick, but divided in two by at least one major rockfall (!) (Breuil and Obermaier 1935:177, fig. 164). (The Cueto de la Mina "Magdalenian III" deposit was also about 50 cm thick [Vega del Sella 1916:45], while there are over 2 m of "Magdalenian III" at El Juyo [Janssens and González Echegaray 1958:78].) The question of stratigraphic resolution—particularly in repeatedly occupied caves and rock shelters—is a serious one affecting not only this work but, to varying degrees, all studies of old collections. It cannot be lightly dismissed if the results of such a paleosociological study as Conkey's are to be taken seriously (see Straus 1979).

Another crucial archeological problem is the use of the designation "Magdalenian III" in order to assert the contemporaneity of collections from El Juyo, El Cierro, Cueto de la Mina, and La Paloma with the Altamira collection. Use of such a term betrays a slavish belief that industries defined in southwestern France by Breuil (1912) and others must have exact (and strictly normative) counterparts in northern Spain—even if there are significant typological differences between the French and Spanish assemblages from this period (e.g., ratio of burins to end-scrapers) and major differences among Cantabrian assemblages labelled "Magdalenian III" by various authors (cf. Jordá 1958 versus González Echegaray 1960). As

in southwestern France (see review by Rigaud 1976), the chronological and typological relationships between "early" Magdalenian industries and both Solutrean and Upper Magdalenian ones are at present far from clear-cut in Cantabria. I have demonstrated (Straus 1975b) that there are striking similarities between certain Solutrean lithic assemblages (including those of Altamira, El Cierro, and Cueto de la Mina) and certain so-called Magdalenian III assemblages (Altamira, El Cierro, and El Juyo), all of which have high percentages of various types of scrapers. These assemblages (like those scraper-rich assemblages from the new Solutrean series at La Riera [Straus et al. 1978]) are (functionally?) associated with large numbers of red deer. The deer were apparently hunted using mass surround or drive techniques, according to dental evidence from El Juyo (Klein et al. 1981), Altamira (K. Allwarden, personal communication) and La Riera (Straus, unpublished data). Other assemblages sometimes labelled "Magdalenian III" have, on the contrary, very large quantities of backed bladelets. These include La Lloseta and the early Magdalenian levels (12, 11) at La Riera, as well as the uppermost Solutrean levels at the latter site and other Solutrean assemblages from the region (see Straus 1978). There are also some similarities between so-called Magdalenian III and Upper Magdalenian assemblages. Thus, when first excavated, the assemblage at the site of Tito Bustillo was provisionally assigned to the Magdalenian III by García Guinea (1975), only to be later reassigned to the Upper Magdalenian when more extensive excavations uncovered a few harpoons and greatly augmented the sample of stone tools (Moure and Cano 1979). In short, assemblages called "Magdalenian III" are not only variable and ill-defined in composition, but bear many similarities (perhaps functional in nature) to some assemblages pertaining to preceding or succeeding culture-stratigraphic units.

A listing of available ¹⁴C dates makes the problem of the so-called Magdalenian III even clearer (see my table 1). The deposits bracketed by the Solutrean and Upper Magdalenian (i.e., with harpoons) from Urtiaga, El Juyo, Altamira, and La Riera have all been labelled "Magdalenian III" at one time or another by one or several authors (e.g., Jordá 1958, González Echegaray 1960, Utrilla 1976), although they range in age from 17,000 to 14,000 B.P. Rather than to continue employing the French-based Roman numeral to describe such a variable and long-enduring series of assemblages, thereby promoting a false impression of tight chronological control, it seems more appro-

priate to use a less temporally specific term such as "Lower Magdalenian." While the significance of Lower Magdalenian (nontemporal) interassemblage variability remains to be determined, it seems quite unrealistic for Conkey to use the vague, artificial designation "Magdalenian III" as a basis for claiming meaningful sociocultural contemporaneity among the various old collections she has analyzed.

Evidence from the specialized cliffside, ibex-hunting site of Rascaño (Straus 1977, Altuna 1978, González Echegaray 1979) in Santander would seem to contradict Conkey's hypothesis that manufacturing activities such as bone/antler working are more likely to occur at long-term, generalized sites. Despite its small size, Rascaño has long been known for the (qualitative and quantitative) richness of its Magdalenian bone industry (Carballo 1922, Obermaier 1923). This was even true in the limited 1974 excavation. It is worthwhile to note the example of the Mask site, an Eskimo hunting stand, where Binford (1978) reports a substantial amount of time spent in craft activities while the hunters awaited caribou spotting. With regard to faunal diversity, Conkey refers the reader to her table 1 for information on Rascaño, which, however, is not presented. In fact, no faunal list has yet been published except Obermaier's (1923). The faunal list from the new El Juyo excavations is in fact long and very diverse (Klein et al. 1981). Diversity in faunal lists may, I am afraid, be in part a product of differential preservation, the quality of the excavations, the state of the collections, and the relative expertise of the faunal analysts as well as a reflection of prehistoric subsistence activities.

In conclusion, Conkey's analysis is suggestive, but, for the reasons that I have stated (and that she tries to minimize), the data from Altamira and other old Cantabrian collections are inadequate to the task of isolating individual social units because of problems of stratigraphic resolution and archeological definition. The best case for Altamira's having been an aggregation site probably still rests on its rupestrial art. The complexity and variety of paintings and engravings and the fact that the representations and sanctuaries are of both "public" and "private" character suggest repeated ceremonial uses of the cave. These were probably associated with collective red-deer drives and exchange of mates, materials, and information, etc., much as envisioned by Carballo (1923:39) nearly 60 years ago.

TABLE 1

CANTABRIAN RADIOCARBON DATES

SITE	SAMPLE NUMBER	DATE B.P.	CULTURE-STRATIGRAPHIC UNIT
Tito Bustillo 1 . . .	(8 separate dates)	15,400-13,500	Upper Magdalenian
El Juyo 4	I-10736	13,920 ± 240	Lower Magdalenian
El Juyo 7	I-10738	14,440 ± 180	" "
El Juyo VI	M-830	15,300 ± 700	" "
La Lloseta	GaK-2549	15,200 ± 400	" "
Altamira	M-829	15,500 ± 700	" "
La Riera 11	Q-2116	15,230 ± 300	" "
La Riera 11	Q-2110	15,520 ± 350	" "
La Riera 11	GaK-6448	16,420 ± 430	" "
Urtiaga F	GrN-5817	17,050 ± 140	" "
La Riera 13	GaK-6445	16,900 ± 200	Solutrean
La Riera 13	GaK-6444	17,070 ± 230	" "
Chuffin 1	CSIC-258	17,420 ± 200	" "
Aitzbitarte VIII . .	GrN-5993	17,950 ± 100	" "

SOURCES: Almagro and Fernández-Miranda (1978) and various primary publications, except that the two new (I) El Juyo dates are from Klein et al. (1981) and the two new (Q) La Riera dates were kindly provided by V. R. Switsur of Cambridge University. The Tito Bustillo dates are discussed by Moure and Cano (1979).

by KAREL VALOCH

Moravské Museum, Brno, Czechoslovakia. 28 III 80

Die Applikation des Aggregation/Dispersion Pattern auf das Jungpaläolithikum ist ein sehr beachtenswerter Versuch. Theoretisch kann man voraussetzen, dass das Leben der jungpaläolithischen Jäger-Sammler in bestimmten Zyklen verlief, bei denen es an ausgewählten Orten und zu besonderen Gelegenheiten zu Versammlungen mehrerer Menschengruppen gekommen war, so wie man es durch ethnographische Beispiele belegen kann. Viel schwieriger, wenn nicht völlig unmöglich, wird es jedoch sein, konkrete paläolithische Höhlen- und Freilandsiedlungen (camps) als solche aggregations sites nachzuweisen. Die von Conkey für das Magdalenien III von Altamira analysierten und vorgelegten Daten entbehren zwar nicht wichtige Hinweise auf die Verhaltensweise der Menschen, wie jedoch Verf. selbst zugibt, sie können nur Hinweise für die Unterstützung der Hypothese bieten.

Wenn man die von der Verf. in Betracht gezogenen Bedingungen (Ausmass der Fundstelle, Grösse der Fauna-, Stein- und Knochenassemblages) auf die mährischen Lösssiedlungen überträgt, dann könnte man alle vier als —wahrscheinlich nicht gleichzeitige— aggregations sites betrachten. Da an ihnen jedoch Hüttengrundrisse festgestellt wurden (Dolní Věstonice, Pavlov, Petřkovice) oder vermutet werden können (Předmostí), werden sie, ebenso wie die grossen Siedlungen Osteuro-

pas (Meziriči, Mezin, Judinovo, Avdejevo, Gagarino usw.) für langfristig beständige Rastplätze der besonders auf die Mammutjagd spezialisierten Jägergruppen angesehen. Dazu kommt noch, dass z.B. in Mähren neben diesen grossen Lagerplätzen keine anderen kleinen gleichzeitig existierenden Stationen bekannt sind. Die Möglichkeit, dass die mährischen Lössiedlungen solche aggregation sites wären, ist also höchst unwahrscheinlich.

Bisher besitzt man gar keine objektiven Kriterien zur Unterscheidung von langfristigen und kurzfristigen, jedoch wiederholt innerhalb geringer Zeitabstände (saisonmässig) besuchten Rastplätze, zu welchen auch die aggregation sites gehören würden. Nach heutigen Kenntnissen kann die Paläontologie die einzige Disziplin sein, die gewisse Unterlagen bieten kann, deren Resultate jedoch von der Ökologie des jeweiligen untersuchten Gebietes abhängig sind und nicht generalisiert werden können. Ob die Analyse von Gravurenelementen eine brauchbare Stütze der erwogenen Hypothese sein kann, müsste durch weitere Untersuchungen bestätigt werden. Es ist wahrscheinlich, dass die Benützung besonderer Zeichen durch die Tradition einzelner Menschengruppen gebunden ist. Zweifellos ist aber, dass gerade im Magdalénien viele Elemente eine weite Ausbreitung bis nach Mitteleuropa erfahren haben. Andererseits ist aber ohne Zweifel, dass nur die relativ dicht besiedelten Gebiete SW Frankreichs und Nordspaniens zum Testen solcher Hypothesen geeignet sind.

[The idea of applying the aggregation-dispersion pattern to the late Palaeolithic is a worthy one. Theoretically, we can assume certain cycles in the life of the Upper Palaeolithic hunter-gatherer which brought him to selected sites on specific occasions, and this can be verified by ethnographic research. It is much more difficult, if not impossible, however, to identify Palaeolithic caves and campsites as aggregation sites. The data which Conkey has presented and analyzed on the Altamira Magdalenian III contain many important points concerning the behaviour patterns of the people of that era. However, as she herself admits, they can only provide some pointers in support of the hypothesis.]

If we were to apply the conditions mentioned by the author (extent of the site and size of faunal, lithic, and bone assemblages) to the Moravian loess campsites, we would have to consider all four of them aggregation sites (though probably not contemporaneous). However, since hut foundations have been established (Dolní Věstonice, Pavlov, Petrkovice) or can at least be assumed (Predmostí) there, these sites are considered, along with the other large settlements of Eastern Europe (Meziriči, Mezin, Judinovo, Avdejevo, Gagarino, etc.), as the long-term camps of groups of mammoth-hunters. In addition it should be mentioned that beyond these large camps in Moravia no other campsites from the period are known. Thus it is highly improbable that the Moravian loess settlements were aggregation sites of the type the author describes.

We have as yet no objective criteria by which to differentiate between camps occupied for long periods and those occupied repeatedly at short intervals (i.e., seasonally), which would include aggregation sites. According to what we know today, paleontology is the only discipline which can offer evidence, but its results depend on the ecology of the particular area under study and cannot be generally applied. We would have to confirm by further investigations whether an analysis of the elements of engraving would provide useful support for the hypothesis under consideration here. It is probable that the use of particular signs is bound up with the traditions of individual groups. It is quite certain, however, that in the Magdalenian period many elements had already undergone a wide dispersal as far as Central Europe. It is also true that only the relatively densely populated areas of southwestern France and northern Spain are suitable for testing such hypotheses.]

Reply

by MARGARET W. CONKEY

Santa Cruz, Calif., U.S.A. 19 v 80

I wrote this article, in part, to encourage the formulation of more explicit and diverse models for interpreting hunter-gatherer settlement systems and site utilization. I hoped to receive constructive comments on the concept and practice of hunter-gatherer aggregation and dispersion and on the many factors that may be involved in the interpretation of a site as an aggregation site. Only a few of the comments have fulfilled my expectations. I would have liked my reply to have centered on theory and methodology, but most of the concerns raised require discussion of aspects of Cantabrian prehistory and Paleolithic archeology.

I cannot possibly take up all of the commentators' points. Since the Altamira data seem to be the most problematical, I will address the more significant issues. There are also several less fundamental points raised by reviewers that deserve clarification or elaboration. Last, the nature of the comments as a whole compels me to make a few observations on the state of hunter-gatherer archeology, particularly that of the Paleolithic.

At least three problems with the Altamira case study are not insignificant, and I do not think I deliberately minimized them in the paper as is claimed. First, there is the problem of whether we can consider the Magdalenian III at Altamira a single event. On the one hand, there are some compelling reasons to believe that more than one occupation took place at Altamira. First, as I indicated, Obermaier did originally refer without elaboration to Magdalenian levels. Second, as is noted by Beltrán and Straus, there is the problem of the significance of the rockfall in the Magdalenian level. Third, the volume of cultural materials excavated, particularly for such a relatively small area, suggests intensive if not also extensive occupation. Last, the 50 cm of Magdalenian deposit does appear to most investigators to be a compaction of once-thicker deposits. In light of Hayden's ethnoarcheological observations on depositional rates, I should rephrase my question about the deposit to read "Is a 50-cm-deep archeological deposit (some 15,000 years later) unusually deep to contain materials deposited during a single (perhaps extended) prehistoric occupation?"

On the other hand, there are assumptions about the Altamira deposits that must be scrutinized. First, Clark's view that "the activity suites there *as elsewhere* undoubtedly changed through the long period of occupation and probably changed during the Magdalenian III episode as well, with the site functioning at times as a limited-activity station . . . and at times as an aggregation site" (emphasis added) is just a hypothesis. There are relatively few Cantabrian sites excavated so precisely that this can be accepted as a general regional model for site histories. Further, the emphasis I have added to his statement highlights the questionable tendency of archeologists to generalize from one archeological context to another. No wonder we have a monolithic profile of Palaeolithic life. Second, we cannot uncritically assume that depositional depths are a direct reflection of any one behavioral factor, such as length or number of occupations or number of individuals. The amount of any archeological deposit has to do with a great number of factors, including site maintenance practices, the "bulk" associated with any activities carried out there, and, of course, postdepositional history (e.g., Wood and Johnson 1979). More specifically, we can no longer assume in Paleolithic sites that with increased depth there will be more subdivisions or distinct occupational events. At a growing number of sites, conjoinable contemporaneous artifacts have been recovered from deposits up to 1 m deep (e.g., Cahen and Moeyersons 1977, Villa n.d.). "The example of Meer II (where artifacts, left

by a single group during a single occupation episode, have been found spread over vertical distances of up to 50–70 cm) suggests that we should reconsider implicit assumptions about archeological time units, layers, and years" (Villa n.d.; see also Van Noten, Cahen, Keeley, and Moeyersons 1978).

There is no doubt that the interpretation of Altamira as the scene of a single aggregation event cannot yet be substantiated. At this point, I believe reexcavation is the only possible solution. A closer reading of my paper, however, would have shown Straus that the alternative explanation for diversity that he offers—a series of individuals contributing to the assemblage through time in different occupations—was in fact put forth.

From the problem of the Altamira Magdalenian deposit immediately arises the problem of relative contemporaneity among the Lower Magdalenian or Magdalenian III sites used in the analysis. I certainly concur with Clark's point, expounded upon at some length by Straus, with regard to the Magdalenian III as a viable analytic unit. Few Paleolithic archeologists would take issue with Clark's comment that the meaning (if any) in behavioral terms of such culture-stratigraphic units is not clear. I am grateful to Straus for summarizing here the Magdalenian III problem in Cantabria; further elaboration can be found in Straus and Clark (1978b). It was not within the scope of this paper to investigate the assumptions underlying some of these designations, particularly at the level of whether "normative counterparts" cooccur in Spain and France. I have here used "Lower Magdalenian" and "Magdalenian III" interchangeably, and this is admittedly imprecise.

The assumption that deserves to be questioned is the relative contemporaneity of the materials being compared, as Hahn points out, but Straus's suggested label (Lower Magdalenian) is explicitly nontemporal. The contemporaneity issue has certainly been confounded further by the new C¹⁴ dates from El Juyo. In reporting these, Klein et al. (n.d.) succinctly summarize present concerns with the Cantabrian Magdalenian: "We consider these dates basically reliable, though they suggest either that the 'Magdalenian III' persisted somewhat later than had previously been thought or that some rethinking is necessary on the subdivision of the Magdalenian in Cantabrian Spain." Both may well be the case.

Of course I would like it to be shown that the engraving repertoires found at Lower Magdalenian sites other than Altamira derive from archeological deposits of the very same groups that would have aggregated at Altamira, but I would also be the first to admit that such resolution is unlikely. Differential engraving repertoires do characterize the different assemblages of decorated bone and antler, and one primary difference is that of diversity in the use of design elements. It is interesting that the design-element classes found on Magdalenian engraved objects do not increase significantly in number through time. All but 13 of the 57 design-element classes are found on pieces from Lower Magdalenian levels, and all but 3 are found on pieces from Lower and Middle Magdalenian levels (Conkey 1978). That not many new design elements are added to the repertoire through time is striking given that the number of engraved objects from Late Magdalenian levels is at least three times that of the Lower Magdalenian. With a relatively stable engraving repertoire, there is less likelihood that considerable diversity of elements among and between sites occupied decades or generations apart can be accounted for in terms of mere drift or chance.

Two final points should be made regarding the problems of old data. First, as González Echegaray points out, the area excavated is really only a very small sample of the archeological deposits. However, this makes the diversity shown a minimal estimate. Second, as Beltrán notes, the rockfalls into the Altamira Magdalenian deposit may be clues to the occupational history of the site; unfortunately, he does not develop this. We need to know if the rockfalls interrupted an occupation, oc-

curred between occupations, or accumulated while the vestibule was more or less continuously occupied. The spatial distribution and even the presence/absence of certain activities may have been affected by a change from an occupational area without rockfalls to an impacted area. Rigaud (1978) has shown how rockfalls have, in fact, structured the "activity areas" in one Upper Paleolithic rock shelter (Le Flageolet).

In sum, I was explicitly cautious about the stratigraphic context of the Altamira data, in terms of the internal differentiation of the Magdalenian level and—as Valoch suggests—the problem of repeated site occupation as distinguishable from a continuous occupational sequence. Straus has somewhat misstated what I would agree to be the methodological problem of this paper if its only purpose had been to prove that Altamira was an aggregation site. The valid criticism is that the problem (not the analysis, as Straus suggests) being addressed—the identification of particular prehistoric social unit(s)—is too fine-grained for the rather gross data and context. The intent of the paper, however, was to "elucidate the kinds of data and analysis necessary to identify [aggregation] sites" and to contribute to the hypothesis put forth by Straus (1975–76) and Freeman (n.d.) that Altamira was an aggregation site. Their interpretation was based on the presence of undatable wall art that, as Beltrán reminds us, cannot at all be shown to correlate with the archeological deposits and on data (lithics and fauna) from the *very same* archeological levels—with the same problems of sampling and context—as the engraved pieces studied here. There is absolutely no reason for diversity in faunal and lithic assemblages (Straus 1975–76) to be more admissible as evidence for the aggregation hypothesis than the demonstrated diversity of engraved objects from the same archeological context.

Clark raises a question that is itself the topic for another entire paper: What constitutes appropriate data for the monitoring of regional interaction? Stylistically treated artifacts seem acceptable to him, but, with Hahn, he sees a problem in the sample size for such artifacts as engraved bone and antler. In the analysis of design elements, it is not the number of engraved objects that comprises the sample, but the number of elements used, and with up to eight different elements per object for some Cantabrian materials the sample is not quite as lean as Clark supposes (Conkey 1978). Clark suggests he would be more convinced that stylistic diversity meant something with regard to regional interaction if larger samples were available and their distribution were more homogeneous (i.e., they were common to all sites). Since measuring style among the more abundant and common stone tools seems to him "next to impossible," however, must one abandon stylistic inquiry? I propose that, despite what is a relatively small sample size of engraved objects and despite differential distributions and densities of engraved objects among the sites (and I believe that the latter two variables are culturally significant), the patterns of stylistic diversity among engraved materials may be used to develop a set of specific hypotheses about regional interaction that may be tested not just against additional attributes of design structure, but also against other classes of archeological data.

Both Hayden and Clark take up the issue of the best indicators of potential aggregation sites; both stress site size or habitable area, and Clark in fact strongly prefers this to stylistic diversity. At Altamira, the potential habitable area is indeed adequate (500 m² in the vestibule), particularly when we add Beltrán's reminder that prior to the rockfalls the cave may well have extended outward a considerable distance. I would agree with Clark that stylistic diversity in some contexts is a necessary but not sufficient indicator of aggregation. In some contexts, diversity may not be expected at all. Clark mistakenly equates aggregation sites, however, with base camps, and although this may not alter the central importance of habitable

area in the identification of an aggregation site it does mean that we do not necessarily expect the base-camp "generalized spectra of artifacts and fauna" at all aggregation sites. As was noted, not all known hunter-gatherer sites are the loci of economic or maintenance activities; many aggregations may be short-term and/or ritual in scope. The classic site-use dichotomy seen in the Binford's Paleolithic research (e.g., Binford and Binford 1968) between base camps and special-activity loci is far too restricted a pattern (see also Yellen 1977 for critique). One of the major intentions of this paper was to emphasize the many kinds of potential aggregations and the many factors that promote aggregations that in turn will structure our expectations of what an aggregation site will look like. To equate aggregation sites with base camps is to miss the point completely.

Although Hayden has been generous in his support of the paper's discussion of aggregation/dispersion and is the only commentator to pick up and pursue theoretical issues, his model of proximal aggregation locales calls for more evidence than we have available that Cueto de la Mina was an aggregation site. Although Clark is skeptical about Cueto de la Mina on the grounds of habitable area, I wonder if he would reconsider on the basis of its unique topographic context (see Clark 1971:78-79; Straus 1975:120-23). The site is one of several caves (including La Riera and La Bricia) in a grossly semicircular distribution in a limestone formation facing onto a small valley adjacent to the Rio Calabres. The "front yard," so to speak, of these caves could have been areally conducive to aggregation.

Paddayya and Valoch both bring in their own data in relation to the aggregation/dispersion hypothesis. Valoch's example of Moravian sites reaffirms my points that there is no generalized, universally applicable aggregation/dispersion pattern and that the aggregation/dispersion phenomenon is a regional one. Paddayya's observations on the distributions and contexts of different sites in the Hunsgi Valley are provocative, and if he were able to test successfully for their conformance to an aggregation/dispersion pattern this would certainly add greater antiquity to this pattern than I would expect.

Straus uses data from Rascaño and from Binford's Mask site to question the observations of Yellen (1977) and others who suggest that "craft activities" such as bone/antler engraving are more likely to occur at sites occupied for some time. This is only a probabilistic statement, and the data from the Mask site are, in fact, congruent with the assumption underlying Yellen's statement. Binford himself has stressed the compatibility of activities as a determinant of site use. Yellen has shown some of the spatial and temporal manifestations of activity compatibility among the San, such as that certain "messy" activities take place at some distance from the central area of camp activity and occupation. That craft activities cooccur with the waiting of caribou spotting is a fine, very specific example of activity compatibility.

The case of Rascaño, which has so far been reported to be a specialized ibex hunting/processing(?) site (González Echeagaray 1979), is suggested to be an exception to the probabilistic statement because of its strikingly abundant bone-and-antler industry. However, the duration of the occupation has not been demonstrated, and bone working may well be compatible with ibex-hunting strategies, which probably do not include stalking and certainly do not include collective drives. Further, despite the abundance of the bone-and-antler industry, the number of engraved pieces from both the 1974 and older excavations is relatively small. Before inferences are made regarding differential site use at Rascaño, it is necessary to quantify the richness of the bone industry in relation to the lithic industry, in relation to the relative density of the archeological deposits excavated, and in relation to the relative proportions of bone/antler to lithics per unit volume from other Cantabrian sites.

Finally, faunal diversity among Cantabrian Magdalenian

sites is clearly not completely understood. Earlier summaries (Freeman n.d., Freeman and Klein n.d.) suggested differences among sites in faunal diversity, differences that possibly highlighted differential site utilization. This observation reinforced the plausibility of a regional aggregation/dispersion pattern. Straus correctly notes that extreme caution is called for in interpreting most faunal assemblages because of differential excavation, selection, preservation, and curation histories. Furthermore, on the basis of the reexcavations at El Juyo and La Riera and the reanalysis of extant faunal collections (e.g., that from Altamira), Klein (personal communication) would say that the only significant variability with regard to Cantabrian faunas is between assemblages with lots of red deer and ones with lots of ibex; these site differences clearly correlate with topography (see also Straus 1977). At present there are no meaningful differences in taxonomic diversity (Klein, personal communication).

Crown-height measurements of red-deer teeth from levels at both El Juyo ("Magdalenian III" [Klein et al. n.d.]) and La Riera (from both Solutrean and Magdalenian levels, made by Straus, as reported in Klein et al. [n.d.]), the proportion of prime-age adults taken by the hunters was roughly the same as that in live herds. The implication of this age structure is that entire red-deer social groups were being driven into corrals or other traps where prime-age adults became as vulnerable as young and very old individuals.

Straus invokes "collective red-deer drives" for the Altamira inhabitants and suggests that dental evidence from Altamira—as from El Juyo and La Riera—supports this. However, the Altamira faunal assemblage derives from the very same "unacceptable" archeological contexts as the engraved bones, and although Straus did the best anyone could do in rescuing and labeling the faunal collection from Obermaier's excavations it is not a complete sample, and it is impossible to determine whether it is representative or not. It is therefore not possible to say what the age structure of the Altamira red deer was. Furthermore, even if the age structure could be ascertained, the stratum from which the teeth derive has repeatedly here been called into question as representing a single occupation. That collective red-deer drives were carried out by Altamira inhabitants, though plausible, remains untested.

It is a somewhat unfortunate statement on the practice of Paleolithic archeology that after all of Straus's very rigorous critique and helpful comments on typology, C¹⁴ dates, culture-stratigraphic units, and faunal assemblages he lapses into the typical intuitive conclusion that the case for Altamira as an aggregation site rests on the complexity and variety of its paintings and the fact that there are both "public" and "private" sanctuaries and representations, suggesting repeated ceremonial use of the cave "probably associated with collective red-deer drives, exchange of mates, materials, and information, etc." If we have come no farther than this image of Altamira as Carballo envisioned it some 60 years ago (see also Straus 1975-76 on its "magico-religious enculturational significance"), this tells us something about the inability of most Paleolithic archeologists to deal with aspects of prehistoric life other than stone tool types and functions, adaptive strategies in a narrow sense, and environmental context.

In recent attempts to understand the structure of archeological discourse Lagrange (1980) and Gardin (1980) make it painfully obvious that most archeological constructions fall short of the requirements of scientific thinking. Lagrange asks (pp. 16-17), "Isn't there some discrepancy between our growing concern for the accumulation of more and better data of the 'hard' sort, through improved acquisition techniques, and our enduring ability to produce and consume intellectual constructs that prove as 'soft' as ever, when submitted to the crudest forms of structural analysis?" I happen to concur in general with Straus's "soft" notions on the interpretation of Altamira, but the intent of this paper was to try to bridge the gap between the "soft" and the "hard" by commencing—not concluding—

with the interpretation and putting forth test implications. Paleolithic archeology will not have much to contribute to the reconstruction or explanation of past lifeways if certain classes of data are so rigorously challenged that they cannot be employed while others can be invoked to make speculative leaps. For the sake of hunter-gatherer archeology, I hope that other researchers will pursue the methodological implications of aggregation/dispersion patterns with as much zeal as some Paleolithic archeologists resist the pursuit of certain questions and the use of certain methods and classes of data.

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