Thirty years ago, I undertook my first independent Paleolithic research, on the nature of the Cantabrian Mousterian. Motivated by a desire to extend the “new systematics” of artifact and assemblage classification developed by the late François Bordes to an area outside France, I sought to determine whether or not the distinctive and seemingly nontemporal constellations of similar Mousterian assemblages or “facies” he recognized could be identified outside their type area, and to find causes or correlates of their variation. It seemed logical to select, for this kind of study, an area not too distant from southwest France, where the sequence of major environmental changes during the last Glacial might be expectably related in understandable ways to what had happened in France at comparable times, and where one might even hope for some continuities in populations and traditions on either side of the Pyrenees. Cantabria is an attractive theater for this kind of study. Its Paleolithic record rivaled that of southwest France, and large, well-curated Mousterian collections from sites like Castillo, el Pendo, and Cueva Morín provided a rich field for reanalysis.

Those first investigations led over the course of time to a complete reappraisal of the Cantabrian Mousterian and a much different understanding of the Mousterian in general. That reappraisal is to some extent reflected in excellent recent publications.
Kaleidoscope or Tarnished Mirror?

by Cabrera (1983, 1989) and Cabrera and Bernaldo de Quirós (1992). Typological contributions have been made by Benito del Rey (1972–73, 1976), Cabrera (1989), and Santamaría (1984). Cantabrian Mousterian research has paralleled or stimulated work elsewhere in Iberia and the Pyrenees: recently, I. Baldeón (1974), Barandiarán (1973, 1979), Chauchat (1985), Villaverde (1984), Moure and Delibes (1972) have examined particular sites and collections, and Altuna (1989), and Butzer (1981) have studied environmental contexts from sediments, pollen, and/or faunal remains. I will not attempt to synthesize their work here, important though it is: Straus (1992) provides a recent review of northern Spanish developments, and Vega Toscano (1983) attempts a brief overview of the Mousterian in Spain as a whole, that may serve that purpose. Nor can I discuss evolving Mousterian adaptations to the changing environmental settings of the Late Pleistocene here. I aim only to present, for the first time, a very personalized historical narrative describing the course of our research on Cantabrian stone tool assemblages, and the successive stages of our interpretations from their beginnings to their present state.

A discussion of the development of Cantabrian Mousterian research and its results is most appropriate in a Festschrift dedicated to Joaquín González Echegaray, who has been from the outset a major participant in the investigations. Our conclusions have undergone successive modifications, that have unfortunately not always been appreciated by a new generation of students who lack firsthand familiarity with the Mousterian. Non-specialists often want opinions once crystallized to remain forever invariant.

Fortunately, our field inevitably evolves, and new and better understandings require that older interpretations be modified or abandoned in the course of time. My first involvement in these Mousterian investigations was a dissertation study of old museum collections, with all the defects of mixture and selection that such materials always entail, complicated by a tyro’s naïveté. Conclusions based on old collections—particularly those involving facies attribution—have had to be altered as data from modern, well-controlled excavations have become available for study, new assemblages from Morín and el Pendo replacing their older unreliable counterparts. While our joint research was under way, Henry de Lumley’s (1969–1971) work on Mousterian assemblages from the French Midi forced revision of the Typical Mousterian facies, and that too has had to be considered. Dibble and others (e.g., Dibble and Rolland 1992) have challenged traditional artifact typology. Each infusion of fresh data required reevaluation of the overall picture of Cantabrian Mousterian facies, only to lead, at last, to the rejection of the facies concept in its original form. As a result, the very nature of Mousterian research has itself changed. The study is not finished. Careful excavation of the Castillo Mousterian will certainly yield much new information, some of it surprising, in the not-too-distant future. All of these factors have made Cantabrian Mousterian research rather like a kaleidoscope of evolving interpretations.

When I began dissertation research, I hoped to identify the Bordes facies where they were present, define new ones as necessary, and try to learn the reasons for their existence: were facies distinctions the result of stylistic distinctions between different
synchronous local groups, as Bordes suggested, or were their differences mostly due to their economic and technological uses? Was some facies difference due to stylistic change over time, and was variation related to other entirely different causes? I hoped to learn what I could about the local antecedents of Mousterian industries, and to clarify the nature of the Mousterian–Upper Paleolithic transition. These last two goals were secondary to the major thrust of research, however: the identification and analysis of Mousterian facies.

The field was very exciting when I began research in Cantabria. In 1962, scholarship seemed on the brink of resolving the mysteries of the Mousterian worldwide. Bordes had systematically defined its numerous artifact types, and had decided that Mousterian collections in France fell into one or another of four broad, distinctive, apparently nontemporal groups he called “facies.” Bordes himself had classified some collections from other countries, including Italy and Spain (he identified what seemed to be the Charentian facies in Castillo Mousterian Beta, and defined a new complex he called the “Vasconian” for Castillo Mousterian Alpha). It nonetheless remained to be demonstrated that his facies classification was suitable and sufficient for the categorization of the Mousterian complex beyond southwest France.

Throughout, I was primarily interested in seeing how Cantabrian Mousterian materials would compare to the better-defined French sequence. That “Francocentric” orientation was normal: the French had developed paleolithic studies earlier and carried them further by the 1960s than had others, and French sequences and ideas were touchstones all Paleolithic prehistorians used. My training was partially French—I had studied Mousterian artifact classification under Bordes in his laboratory in Talence. Bordes was until his death the world’s leading authority on the Mousterian, who had virtually singlehandedly systematized the previously chaotic field of Mousterian studies. When I began “independent” research it was with the partial collections from Castillo then stored in the Institut de Paléontologie Humaine in Paris, and my classification at the IPH was guided at every step by Bordes and his colleague, Jacques Tixier.

My investigations were planned to carry on work in the Bordes tradition; they were a controlled application of his ideas and methods to a new area. But they also added something new. Jacques de Heinzelin (1960) had shown that descriptive statistics and graphic representation of multidimensional relationships could be used to refine artifact classification, providing a more objective and probabilistic basis for type definitions stated subjectively by Bordes. Without powerful computers, his work could provide no more than a few examples to show the potential of his approach; computationally costly procedures such as discriminant function analysis of large samples for several variables were beyond his reach (1960: 37, 55). With the electronic computers available in the 1960s, I hoped to go considerably further, introducing powerful statistical methods to the study, to evaluate the contribution of chance to assemblage differences, and provide a means for the objective demonstration of relationships that had previously been postulated subjectively on vaguely stated or ill-defined grounds. Such tests were absolutely essential to detect relationships between types and to search for the correlates of difference between the facies.
I began searching out and classifying relevant collections in the Provincial Museum of Prehistory and Archeology in Santander in late 1962. I had been introduced to the complexities of the Spanish Mousterian by Francisco Jordá Cerdá, who, in a fortunate moment, presented me to Joaquín González Echegaray, then its vice-director. Had it not been for Joaquín’s guidance, stimulation, and support, my career in Cantabrian prehistory would have been unproductive, boring, possibly frustrating, and certainly short. Thanks to him, Cantabria has ever since been for me an inexhaustible treasure trove of challenging evidence and the city of Santander has become my second home.

Joaquín and the Museum’s new director, Dr. M. A. García Guinea, placed its rich collections, its extraordinary library, and its valuable archive at my disposal. No other research environment was then remotely comparable to Santander. The museum was then world-class. It was known for the quality of its library and its collections, for its unselfish openness to all scholars, whatever their nationality, and for the stature of its directors. The international reputation of the young Joaquín González Echegaray was already well established, and his authority in Spanish Paleolithic studies universally acknowledged.

Of the greatest benefit to my work was the fact that Joaquín proved to be both extremely interested in, and thoroughly informed about, the current state of Mousterian research. He knew the Cantabrian Mousterian at first hand, having participated in the el Pendo excavations in the 1950s, and investigated the curious Cave of la Mora (González Echegaray 1957). He was one of the very few Spanish professionals who made habitual use of the Bordes classification. He took a personal interest in my research from the first. The most I could have expected from a busy museum director was disinterested facilitation of access to collections and documents. Instead, Joaquín spent hours discussing fine points of lithic typology, the Bordes system, Mousterian problems, and the aims and potential of prehistoric research with me. Our relationship led to the thirty-year program of collaborative research whose results are outlined here—research and conclusions now as much his as mine.

Prior to our work, most Spanish prehistorians, even some of the very best ones, still classified Mousterian collections in rather haphazard fashion. Despite the early efforts of the Comisión de Investigaciones Paleontológicas y Prehistóricas (1916) to formalize a series of mutually exclusive definitions of tool types, lithic classification in practice remained unsystematic; no single classificatory system was in general use, and even the best fieldworkers often used type definitions that overlapped.

Consideration of the nature of the whole collection was the exception rather than the rule; the classifier’s attention was instead focused on a few supposedly diagnostic “guide” types. Assemblages that contained crude large tools such as handaxes
were arbitrarily assigned to a supposedly “early” Mousterian, while collections lacking such pieces were attributed to a “late” Mousterian, called that or “the Mousterian of small types.” Classifiers generally assumed that any collection containing good proportions of large, crudely made tools must be Mousterian or earlier. Some collections of Upper Paleolithic tools from quarry/workshop sites in low terraces of the Manzanares and Jarama basins were misdiagnosed as Mousterian or Acheulean because of their rough, unfinished appearance, and pick-rich, post-Paleolithic assemblages on the coasts of Spain and Portugal were often wrongly classified as Lower Paleolithic—even Oldowan—a problem that persists today.

The best syntheses of the Mousterian in Spain were those of François Bordes and Francisco Jordá Cerdá. The differences between their diagnoses were largely terminological. Bordes had recognized in the collections from Castillo both a manifestation of the Charentian Mousterian (Mousterian Beta) and, in Mousterian Alpha, a “very specialized Mousterian facies . . . characterized by the presence of flake-cleavers, or Olha flakes, a frequent form in Africa . . .” (1953: 463–64), and proposed to call this collection a new “Vasconian” facies, one that he thought might represent a “passing infusion of Levallois technique and African typology” into an industry that is otherwise basically “Quina in nature” (Bordes 1953: 464). Jordá, comparing other Spanish collections to Castillo, concluded that the lower Castillo Mousterian was an Upper Mousterian (meaning a Mousterian like that at La Quina), while the old Morín collection and Castillo Alpha were an “Upper Mousterian of Acheulean Tradition,” implying the addition of bifaces (cleaver flakes) to a Quina-like flake tool series (Jordá 1957: 158). Though these opinions evidently influenced my work, I thought at the time that I had arrived at the best possible classification of the collections quite independently.

**LOCAL ROOTS OF THE MOUSTERIAN: THE ACHEULEAN AT CASTILLO**

Bordes’s claim to see African influence in the collection from Castillo Alpha raised questions about the origins and relationships of the Mousterian in Cantabria. The supposedly “African” types at Castillo, the characteristic “Vasconian” cleaver flakes, were known to Africanists as components of “Late Acheulean” assemblages from the Maghreb. Little was known about local pre-Mousterian industries. Such industries, containing cleaver-flakes, were claimed primarily on the basis of (mixed?) surface collections devoid of stratigraphic context. They were found partly rolled in superficial beach deposits, atop terraces, or atop rasas or other land surfaces in the vicinity of sites such as Altamira, el Pendo, and Cueva Morín. Such evidence was inconclusive.

There were bones and a very few nondescript flakes (but no cleaver-flakes) from “pre-Mousterian” strata at el Pendo, in undatable contexts. The only substantial in situ collections of apparently pre-Mousterian artifacts in Cantabria were (and remain) the materials from the supposedly Acheulean levels at Castillo. When I began research, these tools had not been reclassified nor their stratigraphic context verified.
since their excavation in the early years of the century. Whether or not they are truly Acheulean, as Bordes believed, was not clear.

In February 1963, assisted by Henry Irwin as recorder, I cleaned the standing section at Castillo, and identified and measured the visible strata. The cleaned section showed intact levels from the Upper Paleolithic at top, down through the Mousterian Alpha level (where cleaning produced a cleaver-flake), and on through what was tentatively identified as Mousterian Beta. Both Mousterian “levels” proved to be stratigraphic composites of multiple layers of sediment, with Mousterian Alpha (Level 20 in Cabrera 1984) being at least two levels, together measuring 1 meter in thickness, and Mousterian Beta (Cabrera’s Level 22) consisting of a block of about six levels totaling 1.25 meters in thickness. The two were separated by a “sterile” orange clay, about 60 centimeters thick (Cabrera’s Level 21). However, tools were not uniformly dispersed through these deposits, but seemed instead to occur in much thinner seams; the number of rich cultural horizons encompassed by each Mousterian bed identified by Breuil and Obermaier may possibly be quite small, and the so-called Mousterian Beta deposit may not contain Mousterian tools all the way to its base.

Later that year, González Echegaray and I cut a 2 m × 2 m trench in the southeast corner of the old excavation, and found the supposedly Acheulean basal deposits intact. Atop the sterile “cave clay” was a 30-centimeter layer of whitish clay with much broken bone, including several identifiable fragments of cave bear. In Cabrera’s revised stratigraphy, levels earlier than Mousterian Beta are numbered 23–26 from youngest to oldest. Our cave bear level has the characteristics of her Level 26. There were a very few flakes in its uppermost part. The bear layer was overlain by 60 centimeters of reddish clay with dispersed stones, and another 40 centimeters of chocolate-colored clay, containing bone fragments, with numerous stones in its lower half.

Some flakes but no identifiable retouched tools were recovered from either layer, and the two together probably equate with Obermaier’s culturally poor levels “below the Acheulean” (Cabrera’s Level 25). Immediately above was a 10-centimeter-deep “floor” of flakes, choppers, and small retouched tools, among which were both scrapers and denticulates. This should be Cabrera’s Level 24, at first called a “Moustérien fruste” (Mousterian Gamma), and later Acheulean, by earlier excavators. Above these deposits came some 70 centimeters of orange-brown travertinous deposits, with a dark, organic band some 20 centimeters above its base. This is thought to be Cabrera’s Level 23, a deep, sterile deposit separating Mousterian Beta from the “Acheulean.” Bischoff obtained a U-series date of 89,000 ± 11 ka/–10 ka BP on basal Level 23 (Bischoff, García, and Straus 1991), but I cannot ascertain its exact correlation with the deposit as revealed in my test. Though it is certainly later than the “Acheulean” and earlier than Mousterian Beta, there is no justification for assuming that it is any kind of a terminus for either the local Acheulean, which may have ended very much earlier, or the Mousterian, which may have begun locally either earlier or later than Level 23. Similar questions apply to a date of 92,800 BP for the Castillo “Acheulean” (Level 24?) obtained by Rainer Grün and reported by Cabrera and Bernaldo de Quirós (1992: 106).
Parts of the so-called Acheulean collections from Castillo were warehoused in Santander and parts in Madrid. It was only in 1972 that I had an opportunity to classify the Santander collections. Cabrera, in her invaluable monograph on Castillo (1984), also revised the “Acheulean” from that site, evidently on the basis of collections in Madrid. While our classifications should be completely complementary, some of the artifacts illustrated in her thesis are in fact pieces warehoused in Santander.1

The collections Cabrera saw apparently had more trimmed pieces and a different proportional representation of types than the collections I saw. Since collections from any single level were very small, I have combined pieces from all so-called Acheulean levels (see Fig. 8.1). There are 6 bifaces (1 irregular ophite biface, 3 partial bifaces of which 2 are cordiform, and 2 broken biface tips). The bifaces, though ill-made, are unlike bifaces in any Mousterian collection I know from Cantabria, and Cabrera figures a large amygdaloidal biface with a strikingly Acheulean allure. There are 106 pieces in my “essential flake tool” series, containing about 36 percent denticulates and 25 percent sidescrapers, but the proportional indices vary from sublevel to sublevel, with sidescrapers more abundant in the upper level (Cabrera’s 24) and denticulates more frequent lower in the sequence. Choppers and chopping tools are far more numerous than in any ordinary Mousterian assemblage from Cantabria, amounting to almost 15 percent of the essential flake tool series (Fig. 8.1). Indices of sidescrapers and denticulates in the partial collections classified by Cabrera were variable, but she also found that in Level 24, sidescrapers outnumbered denticulates substantially. However, her collections contained very few chopping tools, and more Levallois types than I know for any collection from Cantabria.

None of the flake tools would be out of place in a Mousterian assemblage. Except for their high proportions of choppers and chopping tools, the flake tool series from these levels could be called Mousterian. Nevertheless, I am reluctant to do that. The flake tools in some classic Micoquian assemblages look just as Mousterian, and the Micoquian is nevertheless called Acheulean by everyone. The shapes and technical characteristics of the bifaces, and the extraordinary proportions of choppers and chopping tools in these collections, are characteristics that are out of the range of variability for other Cantabrian Mousterian. That does not imply that I see a clear break between the Acheulean and Mousterian in Cantabria or elsewhere—in fact, I believe that continuity between latest Acheulean and earliest Mousterian is the rule, not disjunction. But I see no artifactual grounds for excluding the Castillo collections from the Acheulean at present.

Cleaver flakes were not found in the collections I saw. There is one somewhat irregular cleaver flake in the series Cabrera classified: that one piece, which cannot be intrusive from a very much higher level, suggests that local antecedents of the “African” type in fact do exist. There may very well be a long, continuous cleaver-making tradition in Cantabria, as there is elsewhere in Spain (I found good proportions of such pieces in the Tahivilla Acheulean), whatever their original relationships to African assemblages. We need not postulate a sudden later Mousterian importation of foreign techniques and types to account for Mousterian Alpha.
In 1963, the question of the nature of the local industrial transition from the Mousterian to Upper Paleolithic loomed large, as it still does. In France, the earliest Upper Paleolithic complex known seemed to be the Chatelperronian; some thought that it marked a real break with the Mousterian, while others, including Bordes, saw continuities between the Chatelperronian and one Mousterian facies. A minority held that wherever the complex had been found, levels were heavily cryoturbated or mixed. Cantabria seemed to offer the alternative possibility of regional variability: at the sites of el Conde in Oviedo and Cueva Morín in Santander, early excavators claimed to have found transitional Mousterian/Upper Paleolithic horizons, the so-called Aurignaco-Mousterian, or “Proto-Aurignacian,” with characteristics quite different from the Chatelperronian, which itself was still unknown from well-excavated contexts in the Iberian Peninsula.

Our research soon laid that complex to rest (González Echegaray and Freeman 1971, 1973). Almost all “transitional” collections, we discovered, were just misidentified. The two principal collections on which claims were based proved to be mixed. My test excavations at el Conde eliminated the supposed transitional level there: it was in fact a mixture of a Mousterian level and an Upper Paleolithic level (Freeman 1977). At Morín, too, the transitional level resulted from inadequate excavation: our predecessors had dug several levels, from the uppermost Mousterian deposits through the lower Aurignacian horizons, together as a unit.

Right atop the last Mousterian occupation at Morín, we found a perfectly characteristic Chatelperronian horizon: the first convincing level of its kind in Spain. Later, in examining the well-excavated assemblages from el Pendo, we found another interesting Chatelperronian industry in Level 8. As sometimes in France, the Chatelperronian from el Pendo overlies a horizon of Early Aurignacian materials. (An apparently Chatelperronian horizon has since been reported from the cave of Ekain as well.)

The early Upper Paleolithic in Cantabria—and elsewhere in Spain—is respectably old. One date of about 35,000 BP was obtained for the Morín Chatelperronian, but seems unreliable. Accelerator mass spectrometer radiocarbon dates more recently reported by Cabrera and Bischoff (1989) for the earlier Aurignacian at Castillo averaged 38,700 BP ± 1900. Were dates obtained by the same procedures available for the Chatelperronian and Early Aurignacian at Morín and el Pendo, they would probably indicate comparable antiquity.

My first investigations of the Cantabrian Mousterian proper, as I have said, were principally based on collections made by earlier excavators: collections excavated at Morín and el Pendo by Father Carballo; from the site of el Conde or el Forno in Asturias, made by the Conde de la Vega del Sella (who also excavated at Morín); from
Castillo, a site that was still our most important source of data about the Paleolithic industrial sequence in Spain, made by the Abbé Breuil and Hugo Obermaier; from la Flecha (Freeman and González Echegaray 1968) and la Pasiega in the Castillo hill, excavated by Dr. García Lorenzo and others; and some levels that proved not to be Mousterian or were too small for diagnosis, from sites such as la Chora, Otero, la Busta, and la Cuevona. I also classified materials from five levels in the Passemard excavations (Passemard 1936) at Abri Olha in the French Pyrenees, some of which contained cleaver flakes. In addition, I examined part of the collections from the well-controlled excavations conducted from 1953 to 1957 by an international group under the direction of J. Martínez Santa-Olalla at the site of el Pendo; a thorough study of the Mousterian levels would have been central to the thesis research, but Santa-Olalla had not decided their disposition, so I was not permitted to undertake a complete classification of tools from any level or to report my impressions of them. A small amount of information, mostly in the form of clarification of stratigraphic questions, was provided by very limited test excavations I conducted for the Santander Provincial Museum at Castillo and Cueva Morín in 1963, while my test for the Provincial Archeological Museum of Oviedo at the Cueva del Conde (Freeman 1977) added small uncontaminated assemblages from Paleolithic levels that had escaped clandestine excavation in a small cul-de-sac at the back of the vestibule.

The apparently simple task of reclassifying these older collections was complicated by the fact that they were dispersed, and information about the whereabouts of the different portions of each assemblage was incomplete. Locating the various parts of the collections and traveling to the several museums in different countries that housed them proved to be quite time-consuming.

The location of the Castillo collections is a good illustration of this difficulty. The flake tools from the major Mousterian collections were dispersed as shown in Table 8.1.

In addition, there were seven nondescript pieces from Mousterian Beta and six from Mousterian Alpha (as well as some 50 Mousterian tools from Cueva Morín) in the Nels C. Nelson collections of the American Museum of Natural History in New York, acquired in 1913.2

### CANTABRIAN FACIES I: THE CASTILLO COLLECTIONS (FIGS. 8.1, 8.2)

The first stage of research was the classification of tools in each collection, the calculation of percentages for tool type and of the characteristic indices. (A definitive list of cumulative percentages for the most reliable Mousterian collections known from Cantabria at this writing is given in Figure 8.1.) Graphs of the cumulative percentages of “essential” tool types were drawn. They and the indices were the data used to assign collections to facies. I knew, of course, that some of the collections might prove mixed or misleading, making facies recognition difficult or impossible.

The first collection classified was, however, not at all problematic. The huge collection (4,303 stone artifacts, 3,147 “essential” flake tools) from Mousterian Beta
Level 22 in Cabrera’s system) had only eight bifaces, almost no Levallois technique or Levallois tools, few denticulates, more than 65 percent sidescrapers in the “essential” flake tool series, and more than 30 percent of “Charentian” types. These characteristics, coupled with good numbers of Quina scrapers, made assignment to the Quina Charentian subfacies obvious. (Though I suspected that the Castillo Beta level included assemblages from more than one occupation, the levels confused must have been overwhelmingly Quina in content to produce the Mousterian Beta percentages.)

The Mousterian Alpha collection (Level 20 of Cabrera) was also immense. It provided 4,382 stone artifacts of which 2,530 were “essential” flake tools, and another 334, or 11 percent of the combined flake tool+biface series, were bifaces, including 303 cleaver flakes. At the time, the proportion of sidescrapers it contained, over 43 percent, seemed somewhat high for Typical Mousterian, and there were few of the Mousterian points that are so often found in that facies. Denticulates had risen to 31 percent of the collection. Levallois technique was more abundant, but still involved only 12 percent of flakes, and there were less than 1 percent Levallois types. While the Charentian index had dropped, there were still many Quina pieces. There were notable similarities between the graphs of the Mousterian Alpha and Mousterian Beta flake tool series, the principal difference between them being the increase of denticulates in Mousterian Alpha. Bordes, too, was more impressed by the similarity of the two graphs than by their difference. I finally convinced myself that Bordes had been right to consider Mousterian Alpha as basically Quina with an infusion of cleaver flakes and an anomalously high proportion of denticulate tools. (I now think Mousterian Alpha may actually be a mixture of Denticulate Mousterian, Typical Mousterian, and Charentian assemblages, but at the time it seemed appropriate to treat it as a valid collection with peculiar characteristics.)

The classification of the Castillo collections skewed facies assignment for the remaining Cantabrian collections. Applying Bordes’s facies definitions to the graphs and indices of his “essential” flake tool series, and what I thought I had learned at Castillo, I thought I could assign several of the other collections to one of two facies. The Quina variant of the Charentian Mousterian, recognized in Castillo Beta, was also present at Cueva Morín: the curve of the old, cleaver flake–rich collection from Morín was virtually indistinguishable from that of the Castillo level. The collection from Hornos de la Peña, though evidently somewhat selected, seemed most like them. The Charentian Mousterian was also certainly documented for the French

<table>
<thead>
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<th>Locale</th>
<th>Flake tools (Moust. Beta)</th>
<th>Flake tools (Moust. Alpha)</th>
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<tr>
<td>Museo Arqueológico, Oviedo</td>
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</tr>
<tr>
<td>IPH (Paris)</td>
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<td>876</td>
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<td>Museo Municipal, Madrid</td>
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</tr>
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<td>Museo Provincial, Santander</td>
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</tr>
<tr>
<td>Total</td>
<td>3,388</td>
<td>2,907</td>
</tr>
</tbody>
</table>

## Table 8.1, Dispersal of Castillo Mousterian
Pyrenees, in three levels at Abri Olha, Foyers inférieurs 2, 3, and 4, the first apparently the Ferrassie variant, and the latter two more probably Quina with cleaver flakes, as I then thought. Olha F. i. 2 actually had just too few sidescrapers to be attributed to Quina, but too many sidescrapers and Charentian types to have been assigned to the Typical Mousterian as then defined. (I considered it somewhat selected.)

The collection (Fig. 8.6) from la Flecha (Freeman and González Echegaray 1968) as well as the assemblage I excavated in Level 6 at the Cueva del Conde (Freeman 1977) were readily recognized as Denticulate Mousterian. Abri Olha F. i. 1, which had a single cleaver flake (seemingly in situ), and Olha Foyer moyen were also Denticulate collections.

Other collections, principally that from el Pendo, would have been much harder to assign to any facies, if I hadn’t used the model of Castillo Alpha. Though the collection from Pendo was short (only 38 "essential" flake tools) its graph was nearly identical to that of Castillo Alpha. That apparent similarity led me to conclude that other similar collections were probably Charentian too. If they fell short of the threshold value for sidescraper proportions for that attribution (IRes = 55 percent), it was either because some sidescrapers had been discarded, while other tools were selectively saved, or because the threshold value was set too high. I tentatively proposed lowering the required sidescraper index to 40 percent. Once that was done, all the anomalous collections could be accommodated in an expanded Charentian.

There was some contradictory evidence, though I couldn’t see it at the time. Had I placed my faith in the small assemblage excavated from el Conde 8/9, I should have seen that expansion of the Charentian was not what was called for. But that assemblage came from a narrow, limited cul-de-sac, contained a large number of geologically crushed (congelifract) pieces, and was small: there were only 65 “essential” flake tools.

Despite its faults, this early research made several positive and lasting contributions to our understanding of Cantabrian Mousterian facies. The first was recognition that Levallois tools and Levallois technique were virtually not represented in Cantabria: the technique was mostly found on ophite and exceptionally large quartzite pieces, both much larger than the usual raw materials in the region; it was almost never found among the ordinary quartzite and flint pieces, the vast majority of which were made on cobbles of small sizes and poor quality. Second, Cantabrian Denticulate Mousterian proved to be unusually rich in denticulate tools. Last, the collections from Cantabria and the Pyrenees proved that cleaver flake–bearing collections were otherwise heterogeneous; that did away with the so-called Vasconian as a viable industrial facies. Bordes somewhat reluctantly agreed that the Vasconian was untenable as a facies, suggesting that the designation should in future only be applied to the distinctive Cantabrian cleaver flakes themselves.

The thesis research taught me—the hard way—that the reliability of older collections was very irregular. Some provided useful, even invaluable information. Others proved to be less than ideal for many purposes, among those being facies attribution, though I was not fully aware of this at the time I wrote the thesis. While conclusions derived from the statistical tests described later proved robust in general
*Figure 8.1.* Cumulative percentages of "essential" flake tools in nineteen Cantabrian assemblages.
Kaleidoscope or Tarnished Mirror?

They can be shown to hold with the far superior data now available—the characteristics of the collections, many of which we know now to have been mixed, were in many respects misleading.

It also led me correctly to conclude that in some respects the Bordes system of facies designation was far from perfect. One of the strengths of the system, in theory, was the fact that it used the characteristics of whole assemblages, rather than the presence or absence of a few diagnostic "guide fossils," to classify assemblages. Yet, in practice, it was sometimes impossible to tell which one of two facies an assemblage belonged to in the absence of one or two diagnostic types. The Mousterian of Acheulean Tradition Type A contained from 30 to 40 percent sidescrapers, while in the Typical Mousterian there could be from 20 to 55 percent of those tools. The ranges of these thresholds overlapped. The Denticulate Mousterian had at least 35 percent denticulates and few sidescrapers, characteristics that didn't differentiate it from the Mousterian of Acheulean Tradition, Type B. To define a collection as Mousterian of Acheulean Tradition, there had to be appreciable numbers of either bifaces (Type A) or backed knives (Type B). The Charentian macrofacies always had more than 55 percent sidescrapers, but an assemblage with even more numerous

![Cumulative graphs, Castillo collections](image-url)
sidescrapers couldn’t be assigned to that taxon unless it had either good numbers of sidescrapers with a special kind of shape and retouch—Quina types—or good proportions of tools on Levallois flakes. In the museum collections I had examined there were sidescraper-rich collections that failed to meet these criteria. While Bordes claimed that well-excavated assemblages were not ordinarily problematic—that few or no assemblages were truly intermediate or hard to classify—the Cantabrian collections suggested that this might not be the case. (Later excavations soon yielded numerous “intermediate” or unclassifiable assemblages.)

The results of this study were incorporated in my 1964 doctoral dissertation for the Department of Anthropology of the University of Chicago, entitled “Mousterian Developments in Cantabrian Spain.” I then set out to learn about Mousterian developments elsewhere in Spain. During 1966, with a Richard Carley Hunt Fellowship from the Wenner-Gren Foundation for Anthropological Research, I classified all Mousterian collections then known from Spanish sites outside Cantabria. Those collections showed considerable regional variation, but that (apparently) stylistic variability was masked or essentially lost in the Bordes typology. Then my view of Mousterian complexity was more radically changed by the data from renewed excavations at Cueva Morín.

**FIGURE 8.3.** Cumulative graphs, Denticulate Mousterian (1), Morín
Kaleidoscope or tarnished Mirror?

CANTABRIAN FACIES II: NEW EXCAVATIONS AT CUEVA MORÍN

Morín, where our tests showed that extensive in situ deposits of cleaver-flake rich Mousterian still remained, seemed an ideal locale for excavation to clarify the nature of the Cantabrian cleaver flake Mousterian. Horizontal distributions could be exposed over large areas, and good bone preservation would permit the study of associations between particular faunal elements and particular types of stone tools.

In 1968, González Echegaray and I began work at Morín, financed by the National Science Foundation. Instead of the single homogeneous Mousterian deposit the earlier excavators thought they had discovered, we found eight different Mousterian deposits, and beneath them a ninth (Level 22), probably Mousterian, but too poor for certain classification (González Echegaray and Freeman 1971, 1973). The sediments were studied by Karl Butzer, who provided a paleoclimatic interpretation and a suggested chronology. Unfortunately, the Mousterian levels were not directly datable, and radiocarbon dates for the earliest Upper Paleolithic levels were not all satisfactory; we now suspect that they should have been very much earlier. Nor was pollen recovered from the Mousterian samples. Table 8.2 shows the facies

**FIGURE 8.4.** Cumulative graphs, cleaver flake assemblages, Morín
The Morín levels are those prefixed with an M. We had excavated these assemblages carefully, controlling for microstratigraphic difference as carefully as possible. By the end of the second and final season, the “essential” tool type count for each level was at least 90, and four of the assemblages were substantially larger. (Counts and cumulative percentages of essential tool types for the Morín Mousterian assemblages are given in Figure 8.1.)

Since we were now dealing with substantial and well-excavated artifact assemblages, it was surprising that some of the assemblages were still hard to classify. We no longer expected to find intergradation between large uncontaminated assemblages, or to find assemblages that fell between facies: discussions with Bordes had convinced me that my thesis problems were due solely to mixture or selection in the old collections. Yet intergradation is precisely what we found; and in this case, what our eyes saw, statistical tests confirmed.

Bordes’s practice in attributing assemblages to the facies was to use a series of fixed thresholds of abundance for sidescrapers, Charentian tool types, denticulate tools, etc., and a visual appreciation of similarity or difference between cumulative graphs.
percentage graphs. No one could say how meaningful these thresholds really were, or how well they differentiated assemblages, for no one could say just how much graphs had to diverge before they were really different. Some difference is always present, even between samples from the same assemblage, just due to chance alone, and no one in Mousterian studies knew how to calculate the possible contribution of such random errors to assemblage differences. By 1968, this had changed. We had found a powerful statistical tool for the objective evaluation of similarity between cumulative percentage lists: the Kolmogorov-Smirnov test, still the best one available for that purpose. Unlike tests that evaluate differences in central tendency—median tests, the Mann-Whitney U test, and such others—it is sensitive not just to differences in mean or median value, but to the magnitude of differences in any part of the frequency distribution. More powerful than chi-square, it is also more efficient.

In any collection, several tool types will usually be unrepresented. With chi-square, empty categories often have to be omitted or collapsed, and that is not necessary with Kolmogorov-Smirnov. True, Kolmogorov-Smirnov is sensitive to the order of the variables, a fact that has been seen as an objection to it, but those who use the Bordes type list always adhere to the same ordering. While that order is arbitrary, as long as it is invariant, the test can always be used to evaluate similarity between collections, and to check the reliability of subjective evaluations of similarity and difference.

When very large collections are compared, relatively small differences between them may have considerable significance. The fact that the Kolmogorov-Smirnov test detects significant difference between two assemblages is not always sufficient reason for deciding that they belong to different facies. But where the test can detect no significant difference between two assemblages that would be or have been assigned to different facies by any classifier following the Bordes system, there is obviously something wrong with the facies classification. That is precisely what we
found once we began to use the Kolmogorov-Smirnov test on Cantabrian Mousterian assemblages.

By the end of the second season (1969), we had recovered three assemblages that presented no classificatory problem whatever. Denticulate Mousterian, of the now-familiar, technically non-Levallois, unfaceted, variety was obviously present in Levels 11, 12, and Lower Level 17 (Fig. 8.3). The Kolmogorov-Smirnov test showed that while there were significant differences between Levels 11 and 12, both assemblages were very similar to that from Lower Level 17, and all three fit the Bordes facies definition. All of the other levels (Upper 17, 16NW, 15, and 14/13) contained varying quantities (just one from 14/13) of cleaver flakes. That of course was of little help in facies diagnosis. Unexpectedly, unlike the old, mixed, and selected Morín collection, none of these assemblages had enough sidescrapers to be called Charentian, and none had a high Charentian index (Fig. 8.4). The Kolmogorov-Smirnov test indicated substantial intergradation among them. Levels 13/14, 15, and 16 were each similar to the others. Upper 17 was certainly similar to 13/14, too, but not to the others—but, more important, it was also not significantly different from one of the Denticulate assemblages, that from Level 11. This paradoxical relationship was not
unique: Level 13/14 was also neither significantly different from Level 11, nor from Lower Level 17.

The cumulative percentage list for Upper Level 17 was so strikingly similar as to be nearly identical to the Pech de l’Azé 4 collection. Bordes classified that collection as Mousterian of Acheulean Tradition, Type A, despite the fact that it lacked bifaces. Assignment of the Morín levels to this facies seemed a very reasonable possibility. The number of flake tools showing some bifacial trimming was larger in these levels than in others. The proportions of sidescrapers in most of the levels were well within acceptable ranges for the Mousterian of Acheulean Tradition (as then defined), and Bordes himself had begun to recognize somewhat broader tolerances for sidescraper thresholds than those originally specified. The proportion of denticulate tools they contained was also within the range for Mousterian of Acheulean Tradition, but too high for Typical Mousterian as that facies was defined at the time. Though none of the Morín levels had more than a very few true bifaces, we suggested that the cleaver flake might be the local equivalent of the true bifaces characteristic of this facies in France. What we proposed amounted to the recognition of a new subfacies, within the Mousterian of Acheulean Tradition Type A. Into this new subfacies we proposed putting all the Morín levels with cleaver flakes—Levels 13/14, 15, 16, and 17.
While we early realized that intergradation was the rule for these assemblages, it was only during our second season that we began to see its full implications, and to realize that the problem of finding a way to somehow encompass these assemblages in the Bordes facies classification was a meaningless academic exercise. The facies didn’t really seem to exist in Cantabria. They were no more than arbitrary segments of a continuously intergrading spectrum. Of course, this was a revolutionary idea. We anticipated difficulty in convincing most prehistorians that a system, based on the work of the greatest authority in Mousterian studies, should be abandoned because of some anomalous assemblages in Cantabrian Spain. For the time being, it was necessary to do a kind of “schizophrenic” prehistory—to follow the Bordes tradition in Mousterian studies, so that we could continue to communicate with our colleagues in terms that they would accept and understand, on the one hand, and on the other, to continue to develop and present the evidence that we knew could eventually undermine that system’s very foundations.

Just before the second volume of the Morín monograph (González Echegaray and Freeman 1973) appeared, Henry de Lumley, similarly faced with well-excavated collections that would not fit into any of the traditional facies defined by Bordes, circulated a classification of Mousterian industries of the French Midi that effectively
proposed new sidescraper and denticulate thresholds for the Typical Mousterian facies; he included in that facies collections with more sidescrapers or more denticulates than the original definition would allow (de Lumley 1969–1971; de Lumley and de Lumley 1972). His scheme was received with little opposition.

In our second volume, we discussed the possibility of an alternative assignment of the Morín cleaver flake Mousterian to the newly amplified Typical Mousterian, concluding that whether or not that assignment was appropriate seemed to us to be simply a matter of preference. Unquestionably, the Morín assemblages could be classified that way. But at that point we were not at all in favor of widening the definition of the Typical Mousterian. Broadening its definition so much would make it a sort of trash can to contain anything and everything that didn’t easily fit any of the other, more narrowly defined facies. So, we continued to call the levels a special Cantabrian variant of the Type A Mousterian of Acheulean Tradition. But we stressed that although either alternative classification might be used, neither was really preferable, and that the facies designations were no more than arbitrary divisions of a continuum of variability.

The Morín volumes were reviewed favorably by Mme. Bordes, who, however, took exception to the use of the designation Mousterian of Acheulean Tradition for
assemblages lacking true bifaces. There is no doubt that her critique added pressure

to the evidence suggesting the alternative classification, but even before it appeared,

new data from el Pendo convinced us that a classification as Typical Mousterian was

more rational, even though the flake tool series in question were statistically as simi-

lar to some assemblages Bordes called Mousterian of Acheulean Tradition as they

were to any Typical Mousterian.

In 1978, we published a short popularized account of the Morín work (González

Echegaray and Freeman 1978). It reflected our new understanding of the nature and

reality of the Mousterian facies, stemming from our analysis of the assemblages

from el Pendo. It called the problematic assemblages Typical Mousterian, while

again stressing that the facies were really no more than arbitrary constructs, since inter-
gradation between Cantabrian Mousterian collections was complete and continu-

ous. But it was not until 1980, in the publication of the el Pendo materials, that this

statement was most forcefully made; there we finally insisted that the facies concept

had outlived its usefulness.

CANTABRIAN FACIES III: NEW DATA FROM EL PENDO

In 1972, González Echegaray, who had been charged with the publication of the
1953–57 excavations at el Pendo after the death of Martínez Santa-Olalla, invited
me to study the assemblages from the Mousterian levels at that site. The five usable el Pendo collections, recovered by a team including González Echegaray, André Cheynier, and both André and Arlette Leroi-Gourhan, were excavated with modern techniques and due attention to microstratigraphy; they are certainly as well controlled as assemblages from more recent excavations. As was the case at Morín, the el Pendo assemblages were both illuminating and surprising (González Echegaray et al. 1980).

With Karl Butzer, we had taken a suite of sediment samples from the site in 1969. González Echegaray and Freeman amplified that sample series in 1972. The samples were analyzed by Butzer. Unfortunately, there are no radiocarbon dates for the site. Pollen samples taken in the 1950s had been analyzed by Arl Leroi-Gourhan: only Mousterian Level 9, with too few tools to classify, provided a useful pollen spectrum, suggesting temperate mixed forest; arboreal and non-arboreal pollen are present in approximately equal proportions. Refer to Table 8.2 for the facies attributions, Butzer’s climatic interpretation, and suggested geostratigraphic age for these lower levels at el Pendo.

The el Pendo Mousterian artifacts were most informative. Two facies, as newly defined following de Lumley’s work, were obviously represented: the Denticulate Mousterian, present in Levels 16, 12/11, and 8D (Figs. 8.5, 8.6), and another facies, found in Level 13, with cleaver flakes (Fig. 8.8), and Level 14, without them (Fig. 8.9). In Level 16 we have a good case of an assemblage falling on the boundary between two facies. It might have been called Typical Mousterian, since it is quite similar to that from Levels 13/14 at Morín, which cannot be forced into the Denticulate facies—sidescrapers amount to 30 percent of its “essential collection.” However, the
closest affinities of Level 16 are with Level 8D from its own site, and that is certainly a Denticulate Mousterian level.

The assemblages from Levels 13 and 14 at el Pendo had far too many sidescrapers to be considered Mousterian of Acheulean Tradition, but Quina types and pieces made on Levallois flakes were not at all abundant, so neither collection fit the definition of either Charentian subfacies, despite the fact that the graph of Pendo 14 is so similar to that from the single Charentian level from Cantabria, Castillo Mousterian Beta (Fig. 8.9). The only possible way these levels from el Pendo could be classified in the current facies scheme was as an expanded Typical Mousterian, of the newly recognized sidescraper-rich variety. When this classification is adopted, as now seems the best alternative for those who continue to use the facies designations for purposes of communication, it forces the reclassification of the Morín collections that are statistically indistinguishable from them, and this includes all those collections that we formerly called Mousterian of Acheulean Tradition (Figs. 8.7, 8.8). It also requires the reclassification of Mousterian Alpha at Castillo. Had it been possible to analyze the el Pendo collections before excavating at Morín, we might never have considered attributing any of the Morín assemblages to the latter facies.

### Facies Differences: More From Morín

The facies as understood by Bordes were non-overlapping and largely nontemporal assemblage groups, whose definition was based on different proportional content of particular tool groups such as sidescrapers and denticulates. Bordes believed that the differences between the facies were not related primarily to the passage of time (despite some admitted temporal replacements) or to their adaptation to different environments, or to technologically “functional” differences between the tool groups that characterized them, but to the use of tool proportions as the stylistic markers of distinct, identity-conscious socio-cultural groups or vaguely defined “tribes.” Since no known socio-cultural groups have stressed their uniqueness by making different proportions of the same kinds of tools made by all groups, Bordes’s “stylistic” explanation for facies difference seemed unlikely. To prove the “stylistic” argument wrong required solid confirmatory evidence. Such evidence was found at Cueva Morín.

During the 1968–69 excavations, it was noted that some different tool types such as cleaver flakes and sidescrapers tended to be found in separate spatial concentrations in Level 17. If one only analyzed materials from selected grid squares, the collection looked quite Charentian, whereas if one selected other squares, the assemblage appeared to be more denticulate-rich. That suggested that had one by chance excavated in different restricted areas of the same archeological level, the partial assemblages recovered would have been assigned to quite different facies, even though all the recovered artifacts might have been made and used by a single social group. Bordes recognized that sometimes particular tools were found in spatially restricted accumulations, but insisted that if a “large enough” assemblage were excavated, those “random” differences would be evened out, and a faithful picture of the total characteristics of a whole assemblage would be obtained. However, the
spatial concentrations we discovered seemed deliberate, and there is no basis for believing that intentional differences must "cancel" each other in large excavations: if the spatial division of labor was systematic, compensating differences are unlikely to appear. The Level 17 evidence was no more than suggestive, since the sidescraper-rich squares in Level 17 were not contiguous, and the contents of several spatially segregated squares had to be combined to produce a large enough collection of "essential" tools—a minimum of 100 pieces—to produce what Bordes considered a minimally reliable graph. Later, however, we found a much more convincing case (Freeman 1992).

We had excavated a large (307 "essential" pieces) assemblage from Mousterian Level 16 from a 7-square-meter area in the northwest part of the vestibule—Level 16NW. Its cumulative percentage graph (Fig. 8.4) and indices indicated that the assemblage should be classified as sidescraper-enriched Typical Mousterian (with cleaver flakes). An adjacent part of this level, some 5 square meters in extent, was removed intact as part of a block of sediments containing an Aurignacian burial, and excavated later in laboratories of the Smithsonian Institution. This part of Level 16, designated 16UB, also yielded a large assemblage—222 essential tools—that unquestionably came from exactly the same level as the tools from 16NW. Its partial assemblage was quite different: it contained no cleaver flakes at all, and more than 37 percent denticulates, while in one small area, 40 centimeters in diameter, we found a cache of 14 Tayac points, a rare type in the rest of the level. The assemblage from Level 16UB was clearly Denticulate Mousterian, not Typical (Fig. 8.5). Yet these two large subassemblages were found in contiguous parts of a single archeological deposit, and the areas from which they were recovered were so small as to make the suggestion of simultaneous occupation of a single level by two different "tribes" untenable. The case of Level 16 was by itself adequate disproof of the "stylistic" theory. It suggested convincingly that causes for the different percentages of particular types were to be sought primarily, though not exclusively, in the economic uses to which different types of tools were put.

It is not difficult to understand why Bordes's attempt to define stylistically significant characteristics of Mousterian assemblages did not succeed. Such characteristics may well exist. But in trying to arrive at minimal definitions of the tool types that would hold universally, Bordes relegated all the potential stylistically informative attributes of artifacts to semi-oblivion in the "descriptive narrative" that was a secondary accompaniment to the studies of cumulative graphs and characteristic indices that were the principal focus of his publications and the basis of his facies assignments. The facies could not be stylistic variants because he had virtually eliminated stylistic attributes from consideration at the outset.

Bordes was proud of the fact that traditionally, folding knives used in his beloved Carsac had wooden handles that were differently shaped and decorated from those made, say, in the Lot or the Paris basin. Yet in classifying stone tools he insisted that a knife should be defined ignoring decorative or regional differences: a knife should always be called a knife, no matter where, when, or by whom it was made. He did not seem to recognize that applying the same rule to the classification of modern
folding knives would ignore just those stylistic variations that he so enjoyed in his own cultural tradition.

THE FACIES QUESTION DISSOLVED

In the Morin and el Pendo monographs, we showed how the statistical procedure called the Kolmogorov-Smirnov test may be used to produce a distance-like measure for discussing how similar or different assemblages are, and stressed that it is superior to other distance measures—it takes into account sample size and the contribution of random error or chance to assemblage difference, and is a more powerful measure of difference than any alternative. That statistic, Kolmogorov-Smirnov D, is a measure of the probability that chance alone could produce a difference as large as the one we actually observe. The smaller the value, the more likely it is that the difference observed is not “significant,” but is due just to chance. At least one in every five pairs of samples derived from a single original population will be so different by chance that their D value will reach 1.07. When D is 1.36 or greater, there is less than one chance in 20 that the samples could come from a single population, and when it reaches 1.63, the chances drop below one in 100. Most people would say that one chance in a hundred is pretty long odds—that there is very good reason to believe that samples this different are really different for important reasons other than chance. When samples differ by chance alone, they are very “close” in their characteristics; when they are very different, and D is large, they are very “far apart.” That is the reasoning that supports using the Kolmogorov-Smirnov value as a distance measure.

Applying the test to the Cantabrian Mousterian provides objective evidence that the facies are arbitrary constructs. Table 8.3 shows the Kolmogorov-Smirnov D values for the 15 most reliable Mousterian collections from the Autonomous Region of Cantabria—all the well-excavated assemblages from el Pendo and Morín, and the two large collections from Castillo. D values too low to indicate that chance alone could produce the observed differences at least as much as once in 20 cases are in bold face. (One borderline case is underlined.) For our purposes, the difference between assemblages with so low a D is insignificant.

It is easy to see that the assemblages intergrade completely—there is no group of assemblages whose members are like one another but consistently different from all the rest. Mousterian Alpha is only like Morin 13/14, but on the other hand Morin 13/14 is also like nine other levels. Mousterian Beta is only like Pendo 14, but Pendo 14 is also like Pendo 13 and Morin 15. No clear groups of similar assemblages stand out, and there are no real gaps separating any assemblage or set of them from the rest. The relationships between these assemblages could be shown diagramatically as a series of linked rings, forming a continuous, complex chain, as we did in the monograph on el Pendo.

Figure 8.10 is another graphic depiction of assemblage relationships: a dendrogram produced by a single-linkage cluster analysis based on the Kolmogorov-Smirnov values. While far from perfect—alternative clustering procedures such as
mean linkage or complete linkage algorithms produce somewhat different arrange-
ments—clustering with the Kolmogorov-Smirnov measure does better express over-
all similarity between lists including all essential flake tools than can any distance
measure that is based on reduced type lists. The resulting dendrogram is a more
reasonable and realistic expression of similarities than the one published by Cabrera
and Bernaldo de Quirós (1992: 107), and unites collections that would have been
considered similar by Bordes. All cluster analyses have the disadvantage that they
compress multidimensional difference into two dimensions, and since they must by
definition produce groups, they also suggest to the unwary classifier that the result-
ing groups must be real—that is, separated by significant gaps—which is not always
ture, and is certainly not the case here.

Assemblage intergradation is in fact sufficiently obvious when the cumulative
diagrams for 16 Mousterian assemblages are drawn together on the same chart, as is
done in Figure 8.11. The figure simply does not show the modal clusters of graphs
one would expect to see if the facies were really different groups of assemblages—no
significant tendency for clustering appears. The “facies” are in fact only arbitrary seg-
ments of a continuously intergraded series. Each assemblage curve is just another
somewhat idiosyncratic part of the intergrading spectrum.

The conclusion is obvious. The facies as Bordes defined them—as mutually ex-
clusive, well-differentiated modes of proportional representation of particular arti-
fact types—don’t really exist: they are arbitrary constructs of the classifier. There is
no sense in searching for the causes or correlates of facies differences: if they don’t
exist, they have no causes.

Bordes’s systematization was especially fruitful. Yet, as long as we continue to
work exclusively within the framework he defined for us, we shall be hampered by
the limits and inadequacies they impose. His vision of the facies, one of his greatest
analytical accomplishments, is now outmoded. Unless it is abandoned, there can be
little further progress in Mousterian research.

### DIMENSIONS OF ASSEMBLAGE VARIABILITY

Does this mean that Mousterian studies are fruitless, or that there is no meaning-
ful way to classify assemblages? Not at all. Bordes’s facies were only an analytical
construct. That they don’t exist doesn’t mean that the Mousterian assemblages have
disappeared: they are as real as ever. Some dimensions of their variability were in-
adegately explained using Bordes’s analytical framework that simply means that
we need to develop other procedures and formulate better definitions to move
ahead. Bordes’s definition of the facies was an essential step toward understanding
Mousterian interassemblage variation: a valuable working hypothesis that advanced
the discipline despite its errors. It stimulated the very research that made it possible
to show that the differences he thought to be most important were not the result of
stylistic stressing of group identity, by long-lived, ethnically distinct socio-cultural
groups, as he postulated. Through the very process of that invalidation, we are led to
a deeper understanding of differences between assemblages, and to develop new and
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<td>1.594103</td>
</tr>
<tr>
<td>PENDO 16</td>
<td>2.292711</td>
<td>5.043036</td>
<td>1.163315</td>
<td>2.570491</td>
<td>0.693460</td>
<td>2.079250</td>
<td>2.474486</td>
</tr>
</tbody>
</table>

**Table 8.3.** Kolmogorov-Smirnov Delta values from comparisons of fifteen Mousterian collections

(Boldfaced numbers indicate no significant difference at the <.05 probability level.)
<table>
<thead>
<tr>
<th>Site and Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>MOR 16UB</td>
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<td>0</td>
</tr>
<tr>
<td>1.039975</td>
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<tr>
<td>0.429755</td>
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<tr>
<td>1.035724</td>
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<tr>
<td>2.164878</td>
</tr>
<tr>
<td>2.870196</td>
</tr>
<tr>
<td>1.080004</td>
</tr>
</tbody>
</table>

CASMOUSTA
CASMOUSTB
MORIN 11
MORIN 12
MOR 13–14
MORIN 15
MOR 16NW
better schemes for their classification. Any future advance in our understanding of the Mousterian will inevitably be built over the foundation laid by François Bordes. And, since many prehistorians, slow to abandon old and accepted ways, were trained to use them, the facies designations will continue in use, for some time, as a means of communicating about the characteristics of assemblages.

Though the lines between the Mousterian facies have disappeared, inter-assemblage variation is by no means random. Even with Bordes type definitions, it is possible to detect a considerable degree of patterning in that variation. Meaningful regularities can be observed in differences between his graphs of assemblages and their characteristic indices. Bordes knew more about Mousterian collections than any other prehistorian; his typology and indices reflect factors systematic empirical observations show to be important. Those reflections can, however, be improved and their reasons clarified.
One fruitful approach to the design of better methods of interassemblage comparison is statistical. Multivariate tests on collections ("Factor Analyses" on rank-order correlation coefficients expressing the relationship between Bordes's types) long ago suggested that the Mousterian assemblages are made up of different groups of functionally related tool types, and that those types tend to vary in abundance in strict relationship to the frequency of other types in their group. Between groups, no such relationship holds. Three principal groups can be defined. The first consists of many kinds of sidescrapers; the second of notches, notched triangles, denticulates, burins, and alternate burinating becs (perforators may also be affiliated with this group); and the third of cleaver-flakes, bifaces, knives, and, sometimes, choppers and Levallois flakes. Endscrapers, some truncations, and Tayac points may constitute another group (in tests on some levels, they appear to be associated; if different assemblages are included their relationships change).

Much of the difference in content of (Bordes's) tool types in Cantabrian assemblages is adequately expressed by their linear placement along an axis representing increasing abundance of sidescrapers in one direction and increasing abundance of notches, denticulates, and related tools in the other (even though the tool types in these two groups do not really vary in inverse fashion). This axis is very robust.
It appears in virtually all analyses of assemblage differentiation: cluster analyses, “Factor” analyses, Kolmogorov-Smirnov test results, etc., in tests run by different analysts using data from different Mousterian sites in France and Spain, and it was a principal dimension of variation in Bordes’s facies classification. Adding another axis perpendicular to the first to represent abundance of the cleaver flake group in one direction and endscrapers, etc., in the other permits a usable approximate three-dimensional representation of relationships between all the assemblages, even though it is not a very “realistic” spatial depiction of those relationships. Presumably a more suitable representation can be developed when well-excavated assemblages are recovered from Castillo and other sites in the not-too-distant future. Such representations must eventually be replaced by more adequate analyses based on other approaches to typology, and other ways of looking at assemblages.

If we are ever to understand variation in Mousterian assemblages, artifact classification must be reformed. The Bordes typology is itself as good a point of departure as any; though accused of subjectivity it rests on a solid empirical foundation and Bordes’s profound knowledge of flint-knapping. From that starting point, we may hope to condense types that are simply variants of each other, to define new types as necessary, and to reincorporate those attributes excluded by Bordes that are most likely to bear the load of stylistic information he sought. Characteristics considered by the new typology will include many details of morphology that he downplayed—details such as the asymmetrically “skewed” appearance of flakes from Olha that makes them look so different from those found at Castillo, the remarkable straightness of scraper and point edges in some collections, or the peculiar “spire-ended” shape of points from some sites in the Middle East. A closer search for patterning in the types of working edges combined on single pieces such as déjeté sidescrapers is essential, and some new combination tools will be recognized. Before his untimely death, Bordes foresaw the need to admit new types for combined perforator/sidescrapers and notch/sidescrapers. Regional peculiarities in the production of retouch not due to constraints of raw material may betray shared toolmaking traditions. Careful studies of wear-polish and the effects of resharpening can add much functional information. Our experience suggests that morphological, rather than metric, attributes may prove to be the more stylistically informative. These are only a few suggestions from a much larger list of needed modifications.

The powerful computational means now available to anyone with a desktop computer and adequate software permit the objective definition of types and attributes by applying such statistical procedures as the Mann-Whitney test and discriminant function analysis (as de Heinzelin suggested) to multiple features of tools from large unmixed assemblages. Analogous “attribute clustering” procedures were applied with some success by Movius and his students at Pataud—only available sample sizes limited what they could achieve. Multivariate procedures for assemblage comparison will provide the basis for a better classification of whole assemblages. Studies of the spatial distribution and frequency relationships of artifacts and contextual data will show how tasks were organized, and all these lines of evidence will converge to indicate just what those tasks were. Working out a step at a time...
from the types identified in single assemblages, to other assemblages of the same complex in a single site, then to assemblages at neighboring sites in an environmentally similar locality, and then to successively larger and more diverse regions, will maximize results, permitting a better grasp of the real nature of interassemblage difference than has ever been available.

I have tried to tell a twofold tale. One part of my story chronicled fruitless attempts to rewrite the patchwork précis of the facies concept, as new contradictions kept appearing. The successive reclassifications of the Cantabrian assemblages were an attempt to repair a paradigm that was not just incomplete or dented, but irremediably broken. The other part was a brief history of some of the new excavations that provide the documentary facts from which a modern theoretical synthesis will be written.

The image of the kaleidoscope, used before, may seem an apt analogy for the story of Mousterian studies in Cantabria. There is little that seems stable in the way shifting facies designations have been applied to the single Castillo Alpha collection. The nonspecialist reader may well get the impression that Mousterian studies are little more than a game played by silly children. That is certainly not the case. Paleoanthropology is not simply play with a kaleidoscope of imagined interpretations. It is, instead, the search for reflections of other worlds, remote from us but as real as our own, in a dull and tarnished mirror.

The changes I have chronicled were not just different and equally valid glosses of a fictional text, to be judged by the quality of imagination invested in each. Nor were they the inevitable result of classificatory difficulties inherent in the artifacts: they stemmed instead from inappropriate preconceptions, or incorrect “hypotheses,” if you prefer. The facies classification was a hypothesis; we tested it; it was wrong.

Efforts spent trying to patch the old, broken synthesis were not time wasted. With each patch we learned something of value about Mousterian assemblages. The picture that appears as the old hypothesis crumbles away will be more complex, but at the same time somewhat better focused, more consistent and coherent, and different as well, because its constituent elements are changed. No amount of play with a kaleidoscope could accomplish that.

Progress in the last thirty years has led us to a better appreciation of the nature of the Mousterian complex in Cantabria. Research is generally much better informed, more meticulous, accurate, and reliable, and at the same time more sophisticated, than it has ever been. Our investigations helped reveal the inadequacies of what for many years seemed a viable and robust classification; at the same time, they have begun to unveil the still-hazy outlines of a new, more realistic Mousterian synthesis. Though we cannot yet see many of its details, new research in Cantabria and elsewhere will ensure that they will not remain hidden for long. It is a good time to begin studying the Mousterian.

NOTES

1. A number of others have also studied the Spanish Mousterian, or examined some Cantabrian collections. There is often substantial disagreement between
their classifications of these assemblages. That my classification sometimes differs from Cabrera’s is understandable. We did not examine exactly the same collections. Differences between my classifications and those of others may require other explanations. Major discrepancies are not inevitable, or due, as Straus (1992) would have it, to inherent subjectivity in the recognition of certain types. Bordes took pains to train me to replicate his own classification with a minimal margin of error. Apparently subjective aspects of the procedure turn out to have a sound empirical base, that cannot be appreciated from the available written descriptions: a real apprenticeship is required to learn correct procedures. Some who have studied Spanish Mousterian assemblages never received adequate training. Without it, certain consistent typological errors are inevitable. They include: (1) Misunderstanding of Levallois technique. It is not platform faceting, and Levallois flakes must be distinguished from irregular flakes from disc cores, large regularly shaped ordinary flakes, or flakes from “bifacial trimming” of disc cores or bifaces. (2) Failure to recognize rarer types, such as notched triangles, alternate burinating becs, bifacial leaf-shaped pieces, “hachoirs,” etc. (3) Misunderstanding of burination, and particularly confusion of narrow projections or broken surfaces with burins. (4) Where it occurs, confusion of geological crushing with retouch, especially denticulation. (5) Misunderstanding of Quina retouch and Quina scrapers. Not all steep, convex scrapers are Quina. Not all step-flaked scrapers are Quina, even when they are convex. (6) Misunderstanding of distinctions between platform regularization, faceting, and other regular retouch on flake butts, and of when the latter may legitimately be classified as tool-forming retouch.

2. This problem has not been satisfactorily resolved: collections are often harder to locate and study now than ever before, despite the repatriation of Spanish collections by the French. Victoria Cabrera, in her truly superb attempt to draw together and publish all existing information on the Castillo excavations by Breuil and Obermaier (Cabrera Valdés 1984: 143–98), was able to classify only 705 flake tools from Mousterian Beta (Level 22) and 681 from Level 20 (Mousterian Alpha). These were mostly pieces that had been returned by the French to the National Archeological Museum in Madrid. She only saw a tiny fraction of the much larger collection in the Santander Provincial Museum, and learned that by 1979 much of the Castillo material had seemingly lost provenience data while stored for remodeling of that museum. Klein and Cruz-UrIBE (1994) classified all Castillo faunal remains in Madrid, but saw none of the pieces classified earlier by Altuna, who must have had access to part of the collections housed in Santander. Since my research in 1962, no prehistorian has been able to locate and examine the whole artifact collection from any Castillo level, and it is not clear that it will ever again be possible.

REFERENCES


