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Nine Medieval French Limestone Reliefs: The Search for a Provenance*

*A collaborative research project between the Research Laboratory of the Museum of Fine Arts, Boston, and the Chemistry Department of Brookhaven National Laboratory.

The largest group of French Romanesque reliefs in the United States consists of nine figures of outstanding quality dispersed among four museums: two apostles in the Museum of Art of the Rhode Island School of Design; a St. Peter in the Smith College Museum, Mass.; an apostle and angel in the Memorial Art Gallery, University of Rochester, N.Y., and four apostles in the Duke University Museum of Art, N.C. (figs. 1-9).

The reliefs are approximately the same size; in their present state, the blocks range from 33 to 35 1/8 inches in height. Traces of a reddish-brown pigment are visible on several of the figures. The reliefs show, in varying degrees, the effects of time and the elements. Three of the heads have suffered severe breakage, the surfaces of the Rochester reliefs are considerably weathered, and there has been some infilling and minor reworking. Otherwise, they are remarkably well preserved and have lost none of the energy of the original conception.

St. Peter faces outward toward the viewer, his right hand raised, his left clutching a large key. Two of the extant apostles turn to the side, gesticulating eloquently. Several gaze upward, in the direction of the pointing apostles and angel, as though witnessing some central vision. The poses and gestures convey a sense of communication, excitement, and awe. Presumably an upper zone would have depicted the Christ of the Ascension flanked by two dynamic angels, similar to the one found at Rochester, dramatically linking the upper and lower zones.

The reliefs share certain formal and stylistic features: the rectangular block, the inclined ledge, the same degree of projection, the halos with pearled borders, the triple-ridged system of drapery patterns, as well as drilled pupils, large feet and hands, and expressively elongated fingers. Aspects of the styles of the Rouergue, Limousin, Quercy, and even western France have been cited by various writers,[1-5] but the stocky proportions of the figures, as well as their awkwardly endearing poses and gestures, have eluded classification within any particular school.

Until the late 1960s, the United States reliefs were not recognized as members of the same group; furthermore, little was known of their provenance other than that each had passed through the hands of Joseph Brummer, one of the foremost American dealers in medieval art. Examination of the Brummer files revealed that the reliefs had been purchased from the dealer Altounian in Mâcon (Burgundy) at the end of 1928 and they arrived in this country in February of 1929.

During the next few decades, the reliefs entered American collections; the Smith St. Peter was purchased in 1937, the Rhode Island apostles in 1941, the Rochester angel in 1943, the Rochester apostle in 1949 from the Brummer estate, and the remaining four apostles in 1966, when a significant part of the Ernest Brummer collection was acquired by Duke University. Both correspondence with Brummer in museum files and discussions with former museum personnel suggest that at the time of each sale no mention was made of existence of others of the group.

Thus, for many years the individual reliefs were viewed in isolation. It was only in 1969 that they were identified by Robert C. Moeller III as part of the same sculptural complex, a monumental Ascension, similar to those found today on the tympana of portals in south central France (Mauriac, Collonges, Cahors) or, in western

Fig. 1. Apostle, Duke University Museum of Art, Durham, N.C.: 1966.147.

Fig. 2. Apostle, Duke University Museum of Art, Durham, N.C.: 1966.148.

France, distributed over the surface of the facade (Angoulême, Ruffec). On the basis of stylistic comparisons with capitals *in situ*, Moeller attributed the United States figures to the church of Saint-Martin in Brive (Corrèze) or, alternatively, to a church in the immediate vicinity.[2-4]

While subsequent scholars agree that the individual figures represent participants in an Ascension, Moeller's identification of the United States reliefs as part of the same Ascension program has not been universally accepted. Certain stylistic discrepancies within the group, the range of variation in clarity and surface detail produced by weathering, as well as the lack of further corroborative evidence, have raised questions regarding the composition of the group. Moreover, Moeller's admittedly tentative attribution of the reliefs to the former western portal of the church of Saint-Martin in Brive has proved untenable.

Fragments of a monumental *Descent into Limbo*, discovered in 1878 during the demolition of the masonry of the western porch of Saint-Martin and now in the Musée Rupin in Brive, show little stylistic affinity with the United States group.[6] More importantly, the stone of the portal fragments, as well as that of the Brive capitals, and of the

Reference See # 1. on Holmes, Little & Sayre

Fig. 3. Apostle, Duke University Museum of Art, Durham, N.C.; 1966.149.

Fig. 4. Apostle, Duke University Museum of Art, Durham, N.C.; 1966.150.

Fig. 5. Apostle, Museum of Art, Rhode Island School of Design, Providence, R.I.; 41.045.

Fig. 6. Apostle, Museum of Art, Rhode Island School of Design, Providence, R.I.; 41.046.

Brive area in general, is distinctly different in composition from that of the United States apostles.

The objections outlined above raise two major questions that more traditional art historical methods seem unable to resolve. Do all nine reliefs in the United States collections indeed form a single homogeneous group, and what was the original location in France of this monumental complex? These questions form the basis of the present study.

The quality of the limestone of the United States figures is not so fine as to warrant transportation any great distance; therefore, a local origin can be presumed. Earlier work has shown that trace element characterization of limestone can be of use in provenance studies.[7] Consequently, it was decided that neutron activation analysis and petrographic study of samples from the reliefs, in conjunction with analysis of comparative samples from French quarries, might provide invaluable evidence in determining the character of the group and in attempting to localize the origin of the monument.

In the first stage of analysis, one of the Providence reliefs was sent to the Research Laboratory of the Museum of Fine Arts in Boston. These and subsequent samples were analyzed by neutron activation analysis at the Department of Chemistry of Brookhaven National Laboratory. Powder samples of various sizes were taken from the back of the relief at three different locations to establish the relative homogeneity of elemental compositions within one block. It was found that samples of one gram were representative for the bulk composition with regard to most analyzed trace elements.

Subsequent analysis of samples from the lower back of all nine blocks demonstrated that the concentrations in all nine reliefs are remarkably similar (table 1). They are as closely related to each other as the members of almost any compositionally related group of other materials encountered in similar trace element characterization studies.

A more immediate measurement of the uniformity of the nine reliefs is given in table 2, which shows that the spread in results among the nine separate reliefs is not significantly different from the spread in results among the multiple analyses of the single relief RISD 41.045 initially tested.

These findings are complemented and corroborated by petrographic analysis of thin sections of all nine reliefs. The rock is a

Fig. 7. Apostle, Memorial Art Gallery of the University of Rochester, N.Y.; 49.6.

sandy biopelsparite. The physically reworked carbonate clastic grains are fairly well size-sorted: mostly they are broken and rounded fragments of bryozoa and indeterminate shelly fragments (possibly ostracods), but also foraminifera and coccoliths, in a crystalline calcite cement (as opposed to a fine-grained lime-mud). The limestone is very well recrystallized. Little clay is scattered around in the pore spaces. The carbonate is mainly calcite (confirmed by means of x-ray diffraction), indicating, along with previous characteristics, deposition in a shallow, marine environment. The rock would have to be classed as "sandy"; the sections typically have 15-25% terrigenous grains—mostly well-sorted, equant, medium-sized sand quartz. Limonite, in part weathered from metallic trace minerals, and in part related to organic matter, is disseminated through the rock and imparts to it its yellow color. Modal analyses bear out the similarities in a particularly convincing way. Carbonate-quartz ratios vary very little and even the subcategorizations are extraordinarily similar (e.g. dominance of pellets over discrete fossil fragments, dominance of matrix spar over lime-mud, dominance of strained over unstrained and composite quartz).

In summary, both neutron activation analysis of the trace element compositions and petrographic study of the thin sections demonstrate that all nine reliefs were quarried from a very similar stone. This reinforces the presumption that these reliefs once formed part of the same monumental complex.

The second stage of this investigation—pinpointing the quarry area in France and hence, the probable original site of the sculptural complex—obviously presents more difficulties.

Close examination of geological maps of France and of samples from French monuments in the collection of Monuments Historiques, consultations with French sedimentary geologists, and examination of both active and abandoned quarries narrowed the search to the present-day department of the Dordogne (roughly the area of old Périgord) in southwestern France.

The Dordogne, the third largest department of France in area, lies between the Massif Central to the east and the lowlands of the Aquitaine Basin to the west. The northeastern section of the department is made up of an extensive band of crystalline rocks that constitutes the southwestern margin of the Massif Central. In the southwestern regions of the department, tertiary sands, clays, and gravels cover a considerable area. The vast central plateaus, cut by beautiful valleys, are made up, for the most part, of Cretaceous limestones. The northern section of this central region, Périgord Blanc, takes its name from the frequent outcrops of chalky limestone that impart a whiteness to the landscape. In Périgord Noir to the southeast, bounded by the Vezère and Dordogne rivers, the limestone takes on a yellowish cast; the name of the area seems to derive from the greater density of trees that cover its plateaus. The region is known to archaeologists and tourists for the numerous rock shelters, dating from Paleolithic times, cut into the cliff walls of its river valleys. It is here that stone most closely resembling that of the United States reliefs is found.

This latter area, Périgord Noir, with extensions to the west, southwest, and south, became the focus of the first survey. The purpose of the survey was to characterize the general source area and to attempt to further localize the source. Samples were taken from abandoned and modern quarries at several locations in the region bordered to the northwest by Périgord Blanc and to the east and south by the extensive Jurassic formations of Quercy (fig. 10).

Analysis of these samples showed one of them, taken from a particular limestone formation in the region of Sarlat, to be most compatible with the stone of the reliefs (fig. 11). Except for iron and scandium, all of the concentrations for this sample lie within the 95% confidence limits for the elements reported for this group of reliefs, and neither iron nor scandium values greatly exceed these limits. The next step was to confirm these findings, and to attempt to further localize the source. With the aid of geologists from the Université de Bordeaux, and the Bureau de Recherches Géologiques et Minières, the limits of the particular formation under investigation were defined. The formation is marked by crosshatch in figure 10, and represents an area approximately twenty by twenty-six kilometers.

This particular formation, suggested as the possible source rock of the reliefs, was sampled throughout, and comparative quarry samples were taken from beyond the formation. A total of 111 samples was collected. Three individual quarries were sampled extensively: the remains of the abandoned quarries of Combe-de-Lama and Griffoul (indicated in the earlier study as close to the stone of the reliefs),

Table 1
Some Major. Minor and Trace Components in Related Limestone Reliefs

Sample I D	CaO (%)	Fe_2O_3 (%)	MnO (%)	Na_2O (%)	K_2O (%)	Rb_2O (ppm)	Cs_2O (ppm)	Sc_2O_3 (ppm)	ThO_2 (ppm)	Cr_2O_3 (ppm)	La_2O_3 (ppm	CeO_2 (ppm)	Sm_2O_3 (ppm)	Eu_2O_3 (ppm)
Duke 45	38.6	0.240	0.0104	0.0193	0.291	11.4	0.366	0.813	1.44	17.3	4.60	11.6	1.47	0.211
Duke 50	39.2	0.225	0.0138	0.0204	0.278	11.3	0.346	0.710	1.20	17.0	3.70	9.0	1.28	0.174
Duke 146	40.6	0.257	0.0110	0.0215	0.326	12.5	0.415	0.782	1.24	18.1	4.27	10.5	1.56	0.213
Duke 148	38.7	0.225	0.0130	0.0197	0.281	9.3	0.328	0.828	1.22	16.7	4.16	10.2	1.48	0.190
R.I.S.D 41.045	36.9	0.268	0.0129	0.0249	0.322	12.9	0.439	0.857	1.36	18.2	4.12	9.8	1.17	0.207
R.I.S.D. 41.06	40.3	0.240	0.0137	0.0314	0.272	10.6	0.350	0.712	1.79	16.3	4.80	14.7	1.13	0.194
Rochester 43.35	39.0	0.257	0.0115	0.0204	0.287	12.4	0.396	0.804	1.58	16.8	4.69	11.5	1.33	0.206
Rochester 49.6	38.3	0.246	0.0130	0.0210	0.266	10.8	0.390	0.824	1.28	18.1	3.98	9.6	1.08	0.206
Smith 1973:12-1	36.1	0.289	0.0106	0.0266	0.344	13.5	0.496	1.025	2.00	18.7	5.28	13.6	1.32	0.243
Mean	38.6	0.250	0.0122	0.0228	0.296	11.6	0.391	0.817	1.47	17.5	4.40	11.2	1.31	0.205
Group Std. Dev(±)	1.4	0.021	0.0013	0.0040	0.027	1.3	0.053	0.093	0.28	0.8	0.48	1.9	0.16	0.018

Table 2
Similarities of Analytical Ranges Among Multiple Samples of a Single Relief[1] and those Within the Group of Nine Related Reliefs

Element Determined	Percent Spread[2] in Single Relief	Percent Spread[2] in Group of Reliefs
Calcium	3	4
Sodium	18	17
Potassium	13	9
Rubidium	12	11
Cesium	11	13
Scandium	14	11
Lanthanum	19	11
Cerium	23	17
Samarium	19	13
Europium	16	9
Thorium	29	19
Chromium	8	5
Manganese	9	11
Iron	6	8

[1]R.I.S.D. 41.045 Relief

[2]Group Standard Deviations as Percent of Means

Table 3
Cerium-Lanthanum and Thorium-Lanthanum Values for Three Quarries, the Reliefs and Six Samples from Outside the Formation

	Ce La	Th La
Griffoul	2.1	0.34
Combe-de-Lama	2.2	0.30
Les Combarelles	2.1	0.42
Reliefs	2.5	0.33
Ajat	1.1	0.068
Couze	2.2	0.38
Nazareth	1.5	0.11
Paussac	1.9	0.25
Grammont	2.0	0.28
Thenon	1.2	0.11

both to the south of Sarlat; and les Combarelles, a modern quarry approximately sixteen kilometers northwest of the city.

At les Combarelles, a relatively small quarry typical of the region, one gallery was sampled systematically. Petrographically there are significant differences between the lower horizon of the gallery (which is a fine-grained, pelletal limestone) and the upper horizon (which is coarse-grained, mostly a fossil hash); nevertheless, the elemental compositions proved relatively homogeneous. At Combe-de-Lama and Griffoul the stone is, in large part, exhausted. However, lateral sampling of both abandoned quarries shows considerable overlapping with each other and with les Combarelles (fig. 12).

Some distinctions can be made: for example, Combe-de-Lama has a higher range of values for iron; the values for europium at Combe-de-Lama tend to be on the high side as do the tantalum values at Griffoul. Griffoul and les Combarelles are perhaps more difficult to distinguish. Interestingly enough, petrographic examination of thin sections separates out the samples from les Combarelles, especially those of the lower horizon, as different from those taken at the Griffoul and Combe-de-Lama quarries. In general, however, on the chemical evidence, the differences between the three quarries were found to be of the same order as the spread within a single quarry; all three quarries are quite closely related to each other.

When the individual quarries are compared to the reliefs (fig. 13) the present-day samples from Combe-de-Lama, again, are not as close as the other two quarries. The smaller size of the Combarelles gallery is generally reflected in a tighter range, often of the same order or slightly larger than that of the reliefs. The spread at Griffoul, a larger quarry, is admittedly wide, but accepting that spread, the relation to the reliefs is rather close; the values of the reliefs fit quite well within the range of the Griffoul quarry.

Fig. 8. Angel, Memorial Art Gallery of the University of Rochester, N.Y.; 43.35.

Fig. 9. St. Peter, Smith College Museum of Art, Northampton, MA; 1937:21-1.

The ranges for the formation as a whole, including samples other than that from the three quarries mentioned, are, as one might expect, not as tight as those for the individual quarries (fig. 12). Nevertheless, average and standard deviation ranges for the formation correspond quite well to what would be expected from the three quarries combined.

The next question then, is whether samples from outside the formation are distinctly different. When six samples taken from outside the formation (Couze, Paussac, Ajat, Thenon, the stone of Grammont, Nazareth) are compared to the ranges for the formation as a whole (fig. 14), four of these immediately fall out on the excessively high or low absolute values of their trace element concentrations. (The stone of Grammont, which is quarried near villages of the same name within the Brive basin, has been suggested to be the material of the Brive sculpture discussed earlier in this study).

As would be expected, a study of correlations between elemental concentrations adds significantly to the interpretation of the analytical data. Illustrative is the high degree of correlation between lanthanum and cerium concentrations for samples from the Griffoul and Combe-de-Lama quarries. While, for instance in the Griffoul quarry the group standard deviation for both lanthanum and cerium is about 32%, the group standard deviation for the lanthanum-cerium ratio is only 9.5%. Such correlation behavior may in itself be highly diagnostic.

Table 3 shows cerium-lanthanum and thorium-lanthanum ratios, both for the three major quarries, the reliefs, and the six samples from outside the formation under study. Quarries and reliefs show very close values for these ratios, but three of the six outside samples show much lower ratios for both the cerium-lanthanum and the thorium-lanthanum ratios.

Thus it becomes necessary to employ multivariate statistical techniques that take into account both absolute values and correlations. The data set was analyzed using the computer program "ADCORR," which calculates probabilities of group membership for individual samples on the basis of Mahalanobis distances.[6] It is interesting that, using these techniques, at a confidence level of 80%, the sequence of samples from the Combe-de-Lama quarry tends to separate out from all quarry samples as well as from the reliefs. Such definite distinctions cannot be made for the other two major quarries. The samples from outside the formation do not fit in any of the quarry groups

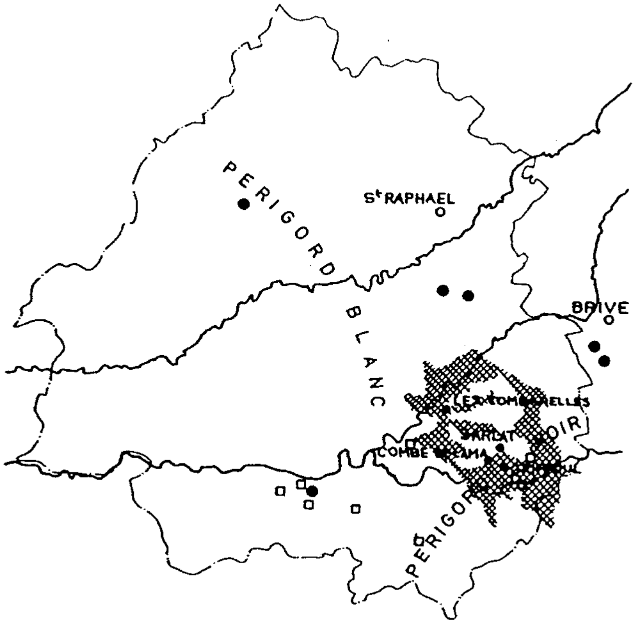


Fig. 10. Map of the Perigord region of France indicating first samples ( ) and (•) comparative samples from quarries outside the Sarlat formation. Crosshatch delineates the limestone formation.

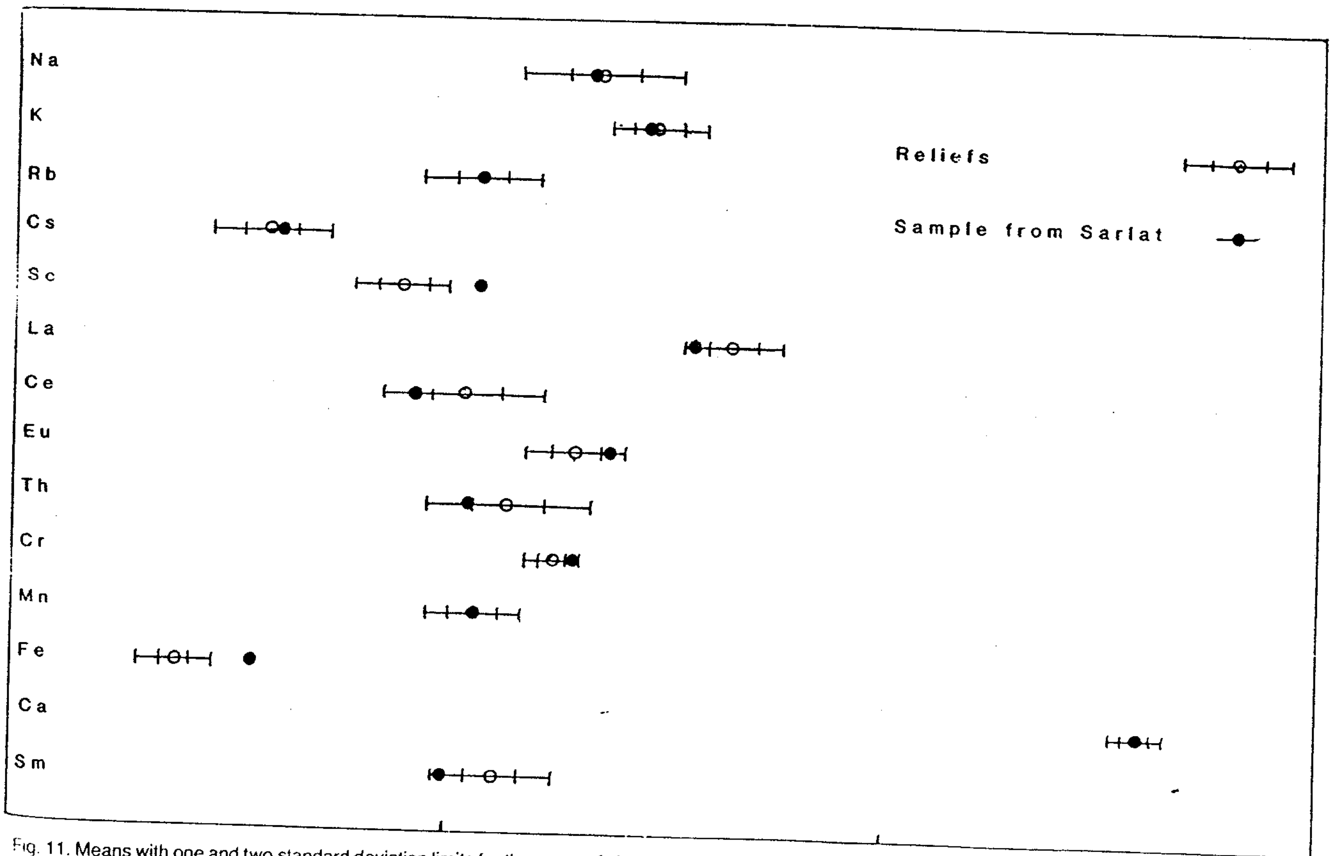


Fig. 11. Means with one and two standard deviation limits for the group of nine reliefs, compared to a sample from near Sarlat.

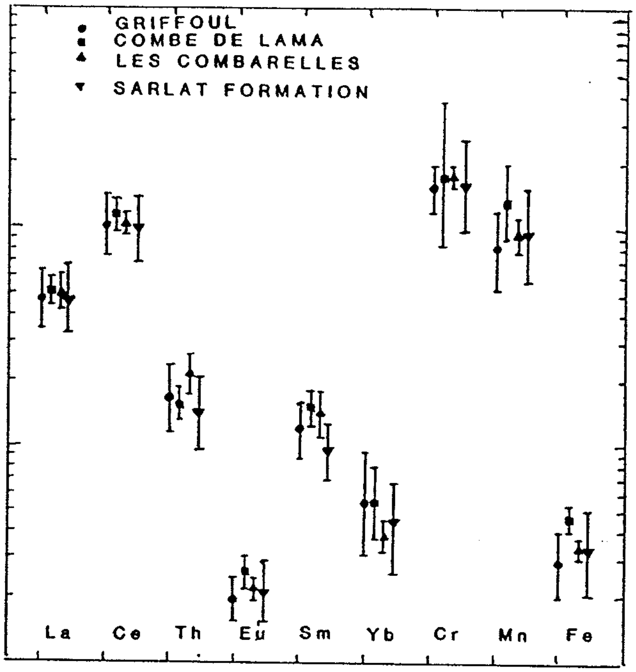


Fig. 12. Means and standard deviations for three quarries and for all samples taken from within the formation.

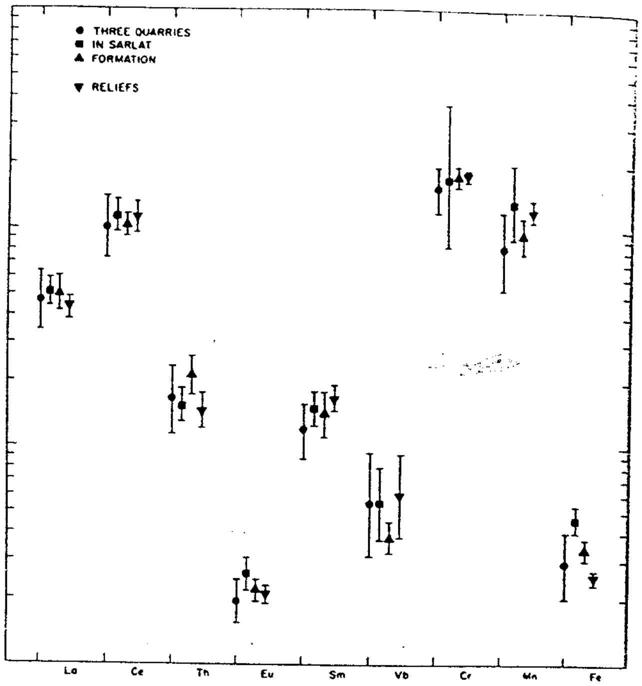


Fig. 13. Means and standard deviations for three quarries and the group of nine reliefs.

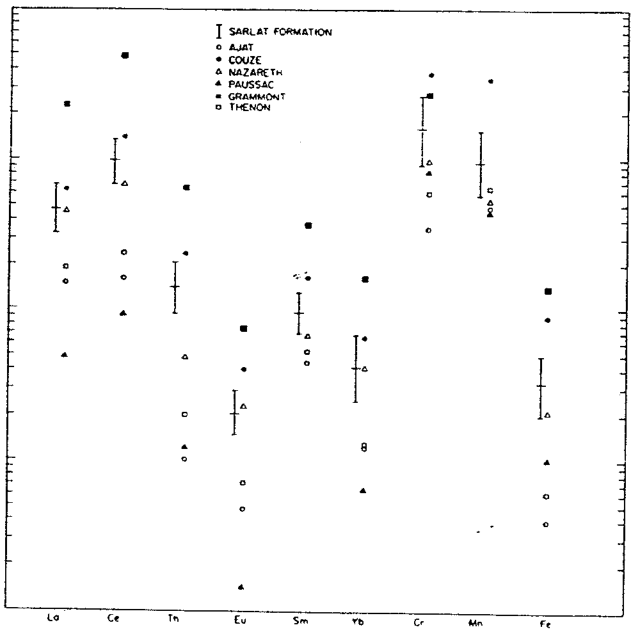


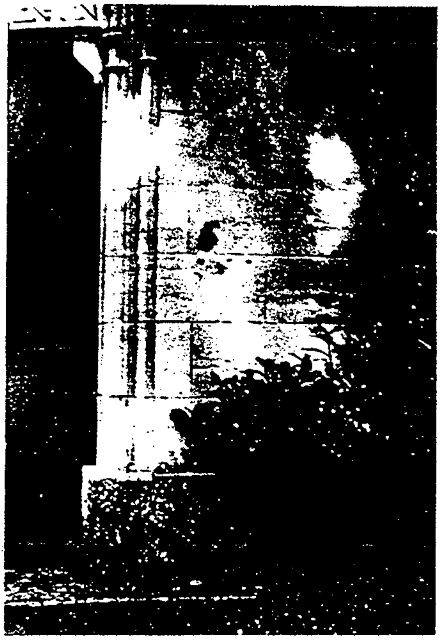
Fig. 14. Means and standard deviations for the formation, compared to six samples taken from outside the formation.

nor in groups formed by combinations of quarry samples.

When the reliefs are used as a core group, the number of samples admitted with a higher than 20% probability varies, of course, with the number and identity of the elements used in the calculation. Typically, however, samples from Griffoul, from les Combarelles, from le Pech de Giroux, and from several other locations within the formation are included in the core group for different combinations of elements. Chemical evidence indicates that the stone of the reliefs does originate from this formation; however, the exact location within the formation is not determinable.

On the other hand, when petrographic analysis of the samples is brought into the picture, a further refinement may be possible. For example, petrographic analysis of the thin sections tended to rule out the samples from both les Combarelles and le Pech de Giroux. When thin sections of all samples from the formation were subjected to petrographic analysis, a number of samples (primarily from Griffoul and Combe-de-Lama) were found to be "close" and "moderately close" to the reliefs; however, only certain samples from Combe-de-Lama and samples from the oldest section of Griffoul were found to be "virtually identical" with the reliefs.

Since the remains of these two quarries south of Sarlat are less than 2½ kilometers apart, it can be assumed that this particular stone was once quarried extensively in the immediate area. It can be best studied at Combe-de-Lama where the unquarried limestone is utilized as part of the foundation wall of a small twelfth-century



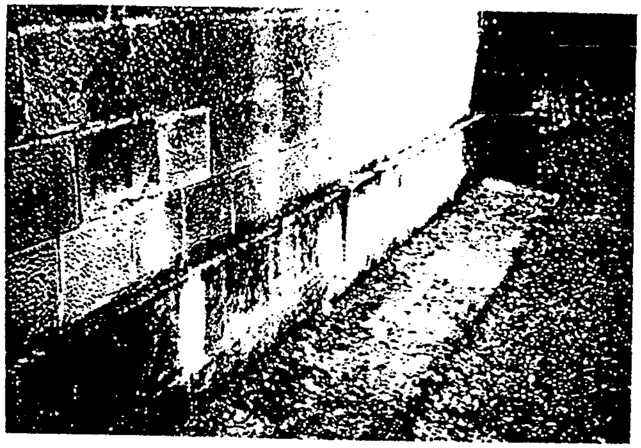


Fig. 15. (a) Mounting holes in the facade of the chapel of a local chateau. (b) Marks left on the side wall of the chapel.

church. Since the chemical composition of both quarries has been shown to be quite consistent with that of the reliefs, it may be possible to conclude that, through a combination of chemical and petrographic analysis, the source rock of the United States reliefs has been localized to a particular formation in the southeastern section of the Dordogne and, within that formation, tentatively to the immediate region south of Sarlat—the lower part of the Sarlat-Vezac-Vitrac triangle.

Possible corroboration of this source area came quite recently with the discovery of information regarding a large group of apostle reliefs, presumably from a local church, which was located until the early part of this century in the immediate vicinity of the Griffoul and Combe-de-Lama quarries. Two of the reliefs—a St. Peter and another apostle—were mounted on the facade of a small nineteenth-century chapel in the garden of a local chateau; the other rested on bases along the side of the chapel. The reliefs were bought by a French dealer and it is known that they were destined for the United States. The approximate date of the sale of the reliefs, the measurements of the mountings on the facade, and the measurements of traces from the reliefs along the side wall of the chapel suggest that this group of reliefs is the same as that which forms the basis of this study (fig. 15).

Finally, an analysis of two sculptures from the same geographic area provides another interesting illustration of the potential of trace element characterization in provenance studies of limestone objects.

There are very few objects in United States collections with a clear provenance to the Dordogne. However, a number of pieces in this country (at the Fogg Art Museum, Cambridge, Mass.; the Philadelphia Museum of Art; and at Williams College, Williamstown, Mass.) have been attributed to the church of Saint-Raphael near Excideuil in the Dordogne; of these a capital in the Williams College Museum of Art appears to have a firm provenance.[9] A second Williams College piece, a fragment of the torso of an apostle purchased two years before the capital, had been attributed to Saint-Raphael but with no further substantiating evidence.

Analysis of samples from the capital and torso demonstrates the virtually identical composition of the stone of the two Williams College pieces, which, however, is pronouncedly different from that of the apostle reliefs of the Sarlat formation to the southeast (fig. 16).

In this last example, trace element analysis has confirmed the previous assumptions of art historians and has helped to pave the way for further study of the monument. In the case of the larger apostle group, it has resulted in a previously unknown attribution: the localization to the immediate region of Sarlat of a monument with important links, stylistically, iconographically, and formally, to major sculptural complexes in south central and western France.

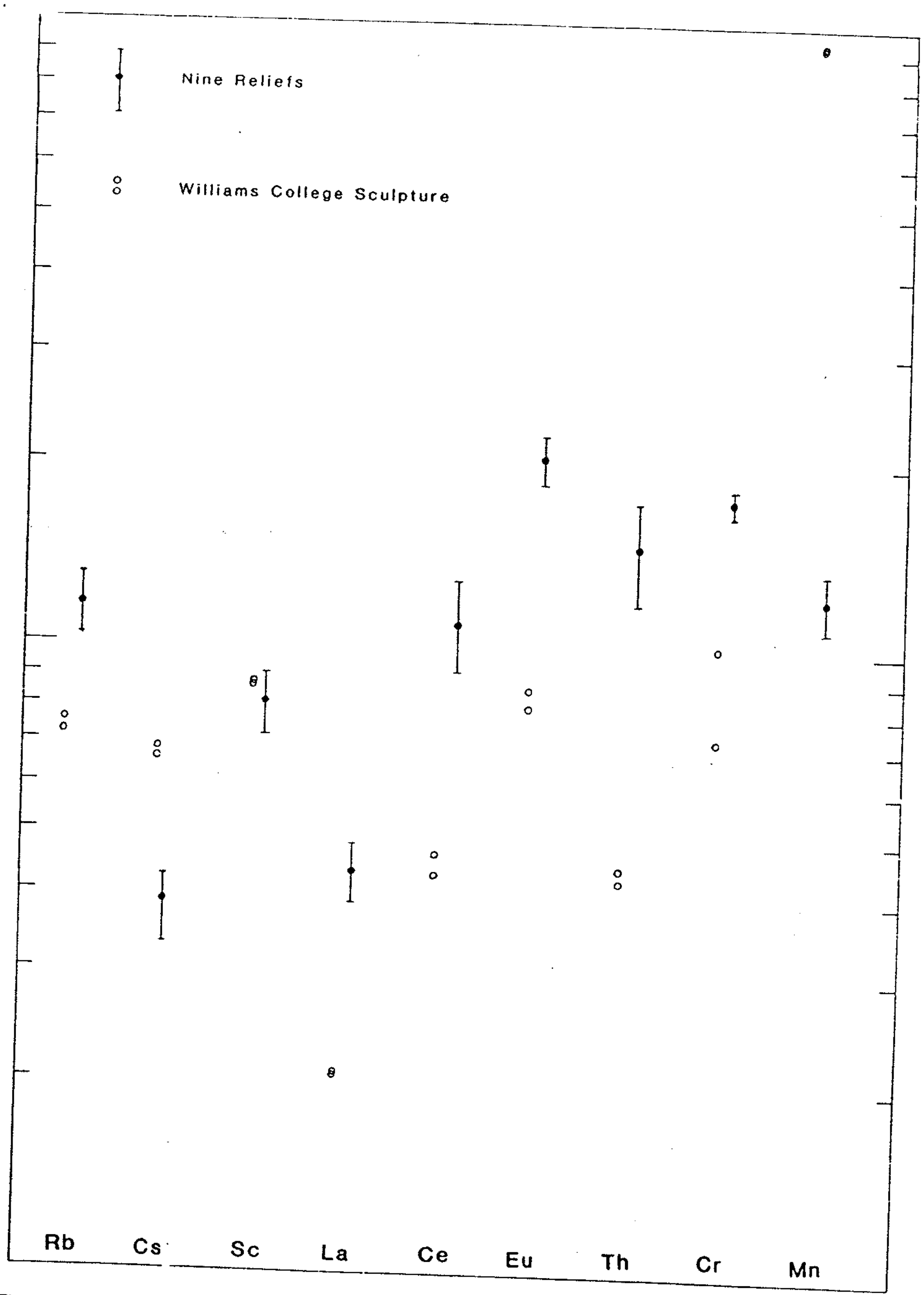


Fig. 16. Means and standard deviations for the group of nine reliefs, compared to two sculptures from Williams College, attributed to Saint-Raphael.

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