Records of the Australian Museum, Supplement 29 (2004): 173–186 ISBN 0-9750476-3-9

Rethinking Regional Analyses of Western Pacific Rock-art

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ABSTRACT. Jim Specht has played a central role in the identification of two discrete bodies of rock-art in the western Pacific region, referred to in this paper as the "Austronesian engraving style" (AES) and the "Austronesian painting tradition" (APT). The aim of this paper is to explore the merits of the AES and the APT as analytical entities by determining how they articulate with one another across the region. This is achieved by conducting statistical analyses of western Pacific rock-art motifs. The results of these analyses are then compared with models founded on consideration of non-motif variables by previous authors, including Jim Specht.

WILSON, MEREDITH, 2004. Rethinking regional analyses of western Pacific rock-art. In *A Pacific Odyssey: Archaeology and Anthropology in the Western Pacific. Papers in Honour of Jim Specht*, ed. Val Attenbrow and Richard Fullagar, pp. 173–186. *Records of the Australian Museum, Supplement* 29. Sydney: Australian Museum.

Several efforts have been made to document Pacific rock-art but these studies have tended to be restricted in their geographical focus and thus in their ability to enhance our understanding of Pacific prehistory on a broad-scale. This can be attributed largely to the fact that Pacific rock-art studies remain in a "data procurement and reporting" stage. Inter-regional collaboration is in its infancy, with most researchers adopting rock-art recording methodologies appropriate to their own area of study. Examples of these local studies include Röder's (1956, 1959) analysis of the rock-art of the MacCluer Gulf (West Papua), Roe's (1992) study of the rock-art of Guadalcanal (Solomon Islands), Spriggs & Mumford's (1992) overview of sites in Southern Vanuatu, Frimigacci & Monnin's (1980) inventory of rock-art motifs for New Caledonia, Lee's (1992) analysis of the rock-art of Easter Island, Millerstrom's (1990, 2001) Masters and doctoral research on the rock-art of the Marquesas, Lee & Stasack's (1999) recent synthesis of the rock-art of Hawaii, and Trotter & McCulloch's (1971) summary of the rock-art of New Zealand.

Only a handful of attempts has been made to understand how the rock-art of each of these regions articulates with one another. Comparative analyses of *western* Pacific rock-art, for instance, have been seriously undertaken by only four researchers—Hugo (1974), Specht (1979), Rosenfeld (1988) and Ballard (1992). The task for each of these researchers, however, was invariably inhibited by a lack of comprehensively recorded and inter-regionally comparable data. As a result, none of the rock-art models constructed by these authors derive from a systematic comparison of regional *motifs*. David Hugo (1974) embarked on a brief analysis of motifs but employed a relatively limited data set (a total of 77 different motifs from PNG compared to over 600 from an area extending from PNG to Tonga used in this study). The two most comprehensive studies of western Pacific rock-art, by Specht (1979) and by Ballard (1992), relied almost exclusively on the analysis of *non-motif* data. These authors paid attention to the relative distributions of rock-art techniques, colouring agents, and the locational contexts in which rock-art sites were found.

One of the most significant outcomes of these previous comparative studies was the widespread assertion that the rock-art of the western Pacific is divisible into two broadly defined *styles* or *traditions* of painting and engraving (Ballard, 1992; Specht, 1979; Rosenfeld, 1988). It is this distinction between the techniques of painting and engraving through space that provides the point of departure for this paper. My aim here is to develop a preliminary spatial framework for the rock-art of the western Pacific by comparing both *motif* and *non-motif* data and, in turn, to better define the similarities and differences between painted and engraved rock-art in the region. First, however, two previous studies which have been strongly influential in defining the characteristics of painted and engraved rock-art in the western Pacific are briefly outlined.

Previous models of western Pacific rock-art

Jim Specht (1979). In 1979, Jim Specht published a major paper on western Pacific rock-art in which he examined similarities and differences between 383 sites between Torres Strait and Tonga. This was the first study to synthesize existing rock-art data on a regional scale and to attempt a systematic analysis. Due to the essentially ad hoc way in which rock-art sites had been recorded in the past, Specht was unable to analyse traits such as site extent, the accessibility of the art (height above ground level), motif form, composition, chronology, and style. He was, however, able to examine the distribution of features such as rock-art techniques, geology, pigment colours and site topography.

Echoing an earlier finding by David Hugo (1974: 51), one of the major outcomes of Specht's study concerned the spatial patterning of artistic techniques. Painted rock-art was found to predominate in the west (Torres Strait, Indonesia and Papua New Guinea) and to occur in both coastal and highland regions (i.e., the New Guinea Highlands), while engravings were shown to occur mainly in the east (Island Melanesia, Fiji, Samoa and Tonga) and to have a predominantly coastal distribution. The New Britain and New Ireland areas, and perhaps also Milne Bay, appeared to be "intermediate between the two areas of technique dominance." (Specht, 1979: 63). Overall, the distribution indicated an eastward reduction in the incidence of painted art and a corresponding increase in engraving.

Specht also drew attention to the cohesiveness of the *engraved* rock-art of the western Pacific, tentatively proposing the presence of a rock-art "style" for the region. This style was said to be based on similarities between motifs and other characteristics at various engraved sites at Goodenough Bay (Milne Bay Province, PNG), on New Hanover (New Ireland Province), and in New Caledonia, New Britain and Vanuatu. Motifs were said to consist of "generally curvilinear geometric forms such as spirals, concentric circles, face-like forms, and various other concentric forms" (Specht, 1979: 74). In addition to sharing common motif forms, Specht (1979: 74) noted that:

> these sites share other features: they are all on [igneous] boulders or open rock faces, never in caves or shelters; they are all situated by water courses or the sea; and they are all in areas where Austronesian languages are spoken today … To this group could, perhaps, be added several painted sites which seem to share in common certain designs.

While Specht acknowledged the scope for an overlap between painted and engraved rock-art motifs, his study was not focused on the degree of comparability between the two media or the precise nature of the motifs involved.

Chris Ballard (1992). Ballard (1992) extended Specht's (1979) analysis by examining painted rock-art in the western Pacific and its relationship to certain locational characteristics and language areas. Inspired by similarities in painted motifs across the region (from Timor in the west to Bougainville in the east), Ballard sought to understand the rock-art of Western Melanesia within a broader historical framework. He examined 187 sites in relation to the following four variables:

1 distance from the nearest current coastline;
2 topographic or physical context (e.g., cliff-faces; boulders);
3 the maximum height (in metres) of the location of the art at each site;
4 whether the art was located in Austronesian or non-Austronesian-speaking areas at the time of European contact.

Ballard augmented Specht's original sample of painted sites with an additional 63 sites, which boosted the total number of documented rock-art sites (including engraving sites) in the western Pacific to 446. It is important to note, however, that Ballard decided to exclude sites from the New Guinea Highlands. His study yielded the following findings:

1 Most western Pacific sites with painted art were found to occur within 1 km of the current coastline and in "cliffed" contexts (cliff faces and caves within cliffs).
2 Of the 92 sites with known distances from the coast, 92% were found to be sea-cliffs.
3 Twenty-four of 31 sites were found to display rock-art located 5 m or more above the base of cliffs.
4 "High visibility" was found to co-occur with "inaccessibility". Painted rock-art was noted in highly visible locations, such as on exposed cliff faces or at or near cave entrances often visible from the sea.
5 A high degree of correlation was found between painted sites and current Austronesian-speaking communities.

Ballard (1992: 96) drew several conclusions from his results. First, that the lack of an oral tradition for the rock-art provides a *terminus ante quem* for its production (at least prior to contact in most places). Second, that the geographical correlation of the art with the distribution of Austronesian-speaking communities provides a *terminus post quem* of c. 4,000 B.P. (now considered to be 3,500–3,300 B.P.) for the painted art. Third, that people deliberately selected inaccessible locations to produce painted rock-art. And lastly, that the cohesiveness of the motif range suggests that a tradition of painted art developed in tandem with a migration of Austronesian-speakers. The regional uniformity among painted motifs suggested to Ballard that the tradition may have begun after the initial spread of Austronesians into the region—perhaps closer to 2,000 B.P.—and that it moved via existing networks of communication between Austronesian-speaking enclaves. In further support of the idea that the tradition coincided with a later Austronesian movement, Ballard noted the presence of formal similarities between rock-art motifs and those found on bronze artefacts dating after 2,100 B.P. Red painted designs on pottery from Eriama rock-shelter (Papuan south-coast) found in contexts dating after c. 1,930 B.P. were also thought to bear a close

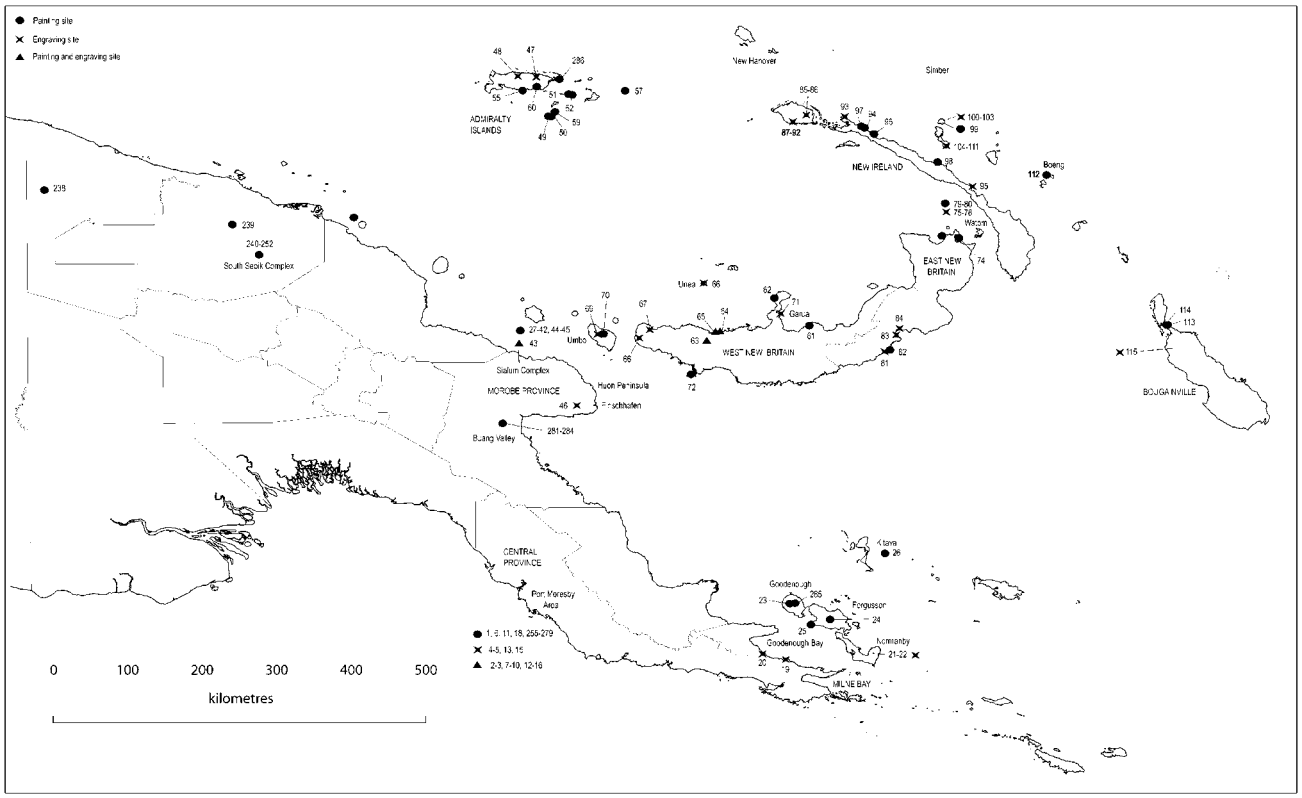

Fig. 1. The locations of rock-art sites in Papua New Guinea. Note: (*a*) Highland sites are not mapped; (*b*) symbols representing sites for which precise locations are unknown are located next to the numbered site code.

resemblance to red painted rock-art at the same site and elsewhere in the western Pacific (Ballard, 1992: 98).

Regional studies of western Pacific rock-art have relied primarily on non-motif variables to invoke the idea of two distinct spheres of rock-art, one defined by engravings and the other by paintings. A widespread engraving style referred to as the Austronesian engraving style (hereafter "AES") has been linked to Austronesian-speaking areas, and is described as being associated with boulders located in open locations, often within or beside water courses (Specht, 1979). The motif range affiliated with the AES is said to consist of curvilinear geometric forms, including spirals, concentric circles, face-like forms, and various other concentric forms (Specht, 1979: 74). Several painting assemblages bearing similar motifs are also regarded as possibly associated with the AES.

The "Austronesian painting tradition" (hereafter "APT") has been proposed as a collective description for a repertoire of painted sites found largely in Austronesian-speaking areas and associated with inaccessible coastal cliff locations often visible from the sea (Ballard, 1992). Red pigment has been noted as the primary colour represented at these sites, and inter-site homogeneity among the motifs has been observed—but not described (Ballard, 1992). The APT is thought to have emerged in conjunction with a late movement of Austronesian speakers around 2,000 B.P., although it may subsequently have influenced painting styles in non-Austronesian-speaking areas.

One of the problems that has emerged as a result of this dichotomized view of western Pacific rock-art is that it is unclear how these so-called traditions or styles of painting and engraving articulate with one another through time and space. This problem was exacerbated by Ballard's (1992) decision not to look at engravings, and because Specht (1979) had not identified Ballard's region-wide tradition of paintings—noting instead the occurrence of more localized painting styles.

As noted earlier in this paper, a further problem underlying this dichotomized view is the absence of an analysis of rock-art motifs. The AES is founded not only on a systematic study of locational variables but on an impressionistic link between motifs. The APT is also constructed on the basis of a systematic study of locational variables but an undemonstrated assertion that it is constrained by a cohesive set of motifs.

The second half of this paper offers a series of methods for systematically examining *motif* variability among sites within the western Pacific that might allow us to better explain Specht's (1979) finding that painted and engraved rock-art sites are essentially discrete "styles" geographically. This analysis forms a small part of a much larger and more complex study which examines the viability of the AES and the APT as analytical entities (Wilson, 2002).

Methods

Motifs. The analyses presented in this section compare rock-art motifs from a variety of different sources, including published and unpublished images, unpublished manuscripts and fieldnotes, and published papers in journals and books. Three analytical units have been used for the purposes of analysis: pictures, motif types, and motif categories. My definition of a "picture" corresponds with Clegg's (1978: 42, cited in Flood, 1997: 355) definition of a "mark" which, adopting his terminology, I take to refer to "any drawing, painting, engraving or other modification of nature which is probably a human artefact." The "picture"

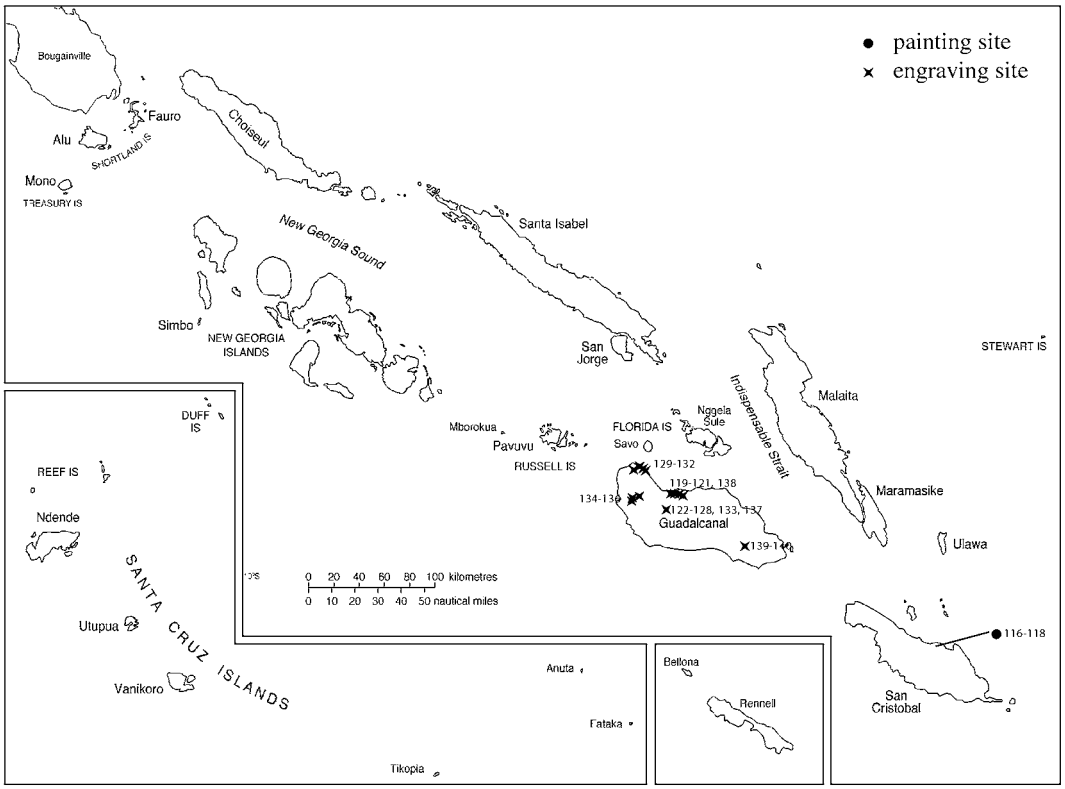

Fig. 2. The locations of rock-art sites in the Solomon Islands.

is the primary graphic unit. In defining a "motif" I follow Flood (1997: 355), who describes it as "a repeated form or recurrent type or class of [figure]". Thus, for example, a site may consist of two pictures (both circles with central crosses), but only one motif (a circle with a central cross). A picture cannot contain more than one motif. All motifs belong to a higher order "motif category". For instance, the motif described as a "circle with a central cross" belongs to the motif category "circles".

A total of 1232 individual pictures were available for analysis. These derived from 102 rock-art sites located in 16 different western Pacific regions (Table 1). The rock-art of Vanuatu is excluded from consideration as it forms part of a separate analysis that was undertaken after this paper was written. The selection of sites for analysis was contingent upon whether or not illustrations of motifs were available for classification. The geographic locations of each of these sites can be found in Figs. 1–4, each of which also indicates whether a site is represented by paintings, engravings, or a combination of both media.[1]

Each picture was assigned to one of 67 motif categories, and then to one of 614 individual motif types. Motif information was entered onto a spreadsheet as presence/absence (binary) data. The data were further subdivided into classes of non-figurative and figurative motifs (listed and illustrated in Wilson, 2002). One of the sites listed in Table 1 contains *both* paintings and engravings (site 7). All calculations are therefore based on a total of 103 analytical assemblages rather than 102 actual sites. There are 67 (65%) engraved assemblages and 36 (35%) painted assemblages. Of the 1232 motifs available for analysis, 894 (72.6%) derive from engraved assemblages and 338 (27.4%) from painted assemblages. The total for engravings is heavily weighted by New Caledonia which has a sample of 248 pictures (20.1%). The rock-art sites of New Caledonia were combined and treated as a single site due to site level data not being available at the time of the analysis.[2]

Before presenting the multivariate results, some comment on the way I interpret multivariate distributions is required. Archaeologists who use multivariate statistics often feel comfortable interpreting only those results which show clear statistical groupings, e.g., artefact *x* is always found in region *y*. The results which I present rarely show such discrete patterns, largely because the rock-art of the western Pacific manifests a high degree of homogeneity. However, within an essentially homogeneous pattern it is possible to discern more subtle variation by closely examining the relationships (statistical distances) between pairs of sites. The distance between two sites (or regions) on a multivariate graph provides a relative measure of the similarity between them. As I will show later in this paper, examining the graphs at this level of detail generates information which is useful in exploring a range of issues. The interpretation of each graph requires a continuous tacking between the observed patterns and my original data records. It is only by returning to the original data that it becomes possible to accurately assess which motifs cause sites to appear statistically similar.

Multivariate techniques. Two multivariate techniques were used to conduct the analyses: correspondence analysis (CA), and multi-dimensional scaling (MDS). All analyses were undertaken using the statistical program "S-Plus" (Venables & Ripley, 1999).

Correspondence analysis measures the chi-squared distance between variables (which in this case are regions and motifs). Unless otherwise specified, each of the data matrices examined using the CA method consists of the total counts of presence/absence data. Multi-dimensional

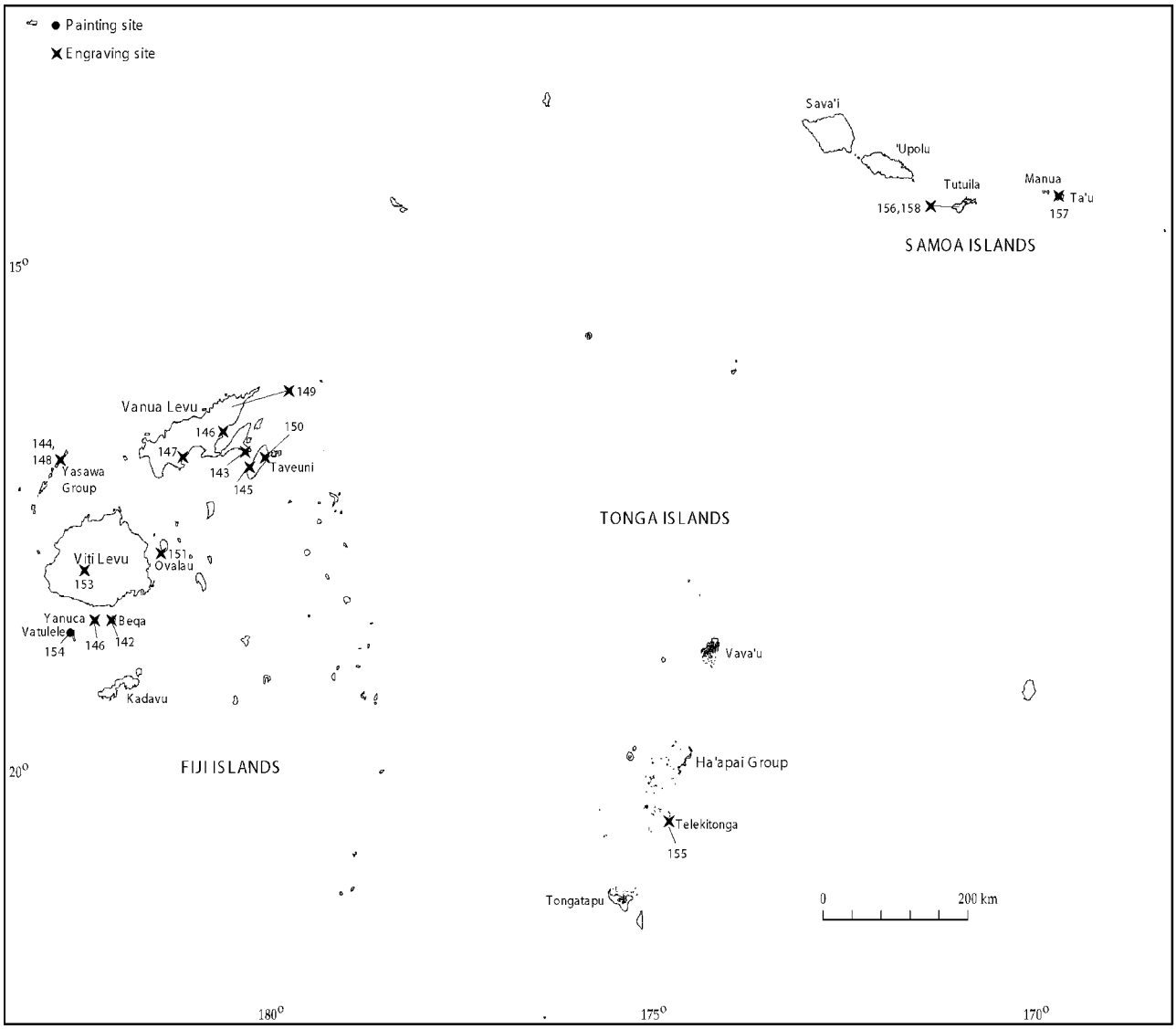

Fig. 3. The locations of rock-art sites in Fiji, Tonga and Samoa.

scaling (MDS) issues similar scores to sites with the same 1's in common and the same number of 1's in common. The MDS binary measure elicits similarities between pairs of sites, as shown in Fig. 5. The dissimilarity coefficient used for these analyses is often referred to as Jaccard's Coefficient.

Each of these techniques is potentially suited to the investigation of the types of data available for the analysis of motifs. The main reason for using more than one dissimilarity coefficient for examining variation within rock-art is to establish whether comparable patterns are produced by different methods, thus increasing the integrity of the result. Notably, dissimilarity coefficients differ in the weight that they accord to rare data (e.g., unique motifs). As demonstrated later in this paper, this has a significant bearing on the results and their interpretation.

Numerous statistical analyses have been performed on the dataset, each generating a comparable result (Wilson, 2002). For the purposes of this paper I have selected four analyses which most clearly illustrate the similarities and differences between painted and engraved rock-art at the motif level.

Results

Analysis 1: multi-dimensional scaling (MDS). In this first analysis I examine the body of non-figurative data only, which account for some 90% of the total number of rock-pictures (see Wilson [2002] for reasons for excluding figurative motifs). The result of a separate analysis in which figurative motifs were included was similar to that presented in this paper (Wilson, 2002: chapter 4, vol. 1, analysis 3).

One of the main problems with the data set analysed here is that it contains a high proportion of unique motifs. In earlier MV analyses this caused "outlier" responses and the graphed result displayed an inseparable cluster of points around the axes centroid (0,0) and one or two sites out on the margins of the graph. In an attempt to reduce the incidence of unique motifs, they have been aggregated into several large motif classes (Wilson, 2002: appendix 4.2). Omission of figurative motifs from the analysis required deletion of several sites (24, 28, 42, 47, 54, 63, 65, 66, 67, 85). Thus, an MDS binary metric analysis has been run on a matrix of 93 sites and 106 non-figurative motif classes. All motifs and motif classes are illustrated by Wilson (2002: appendix 4.2).

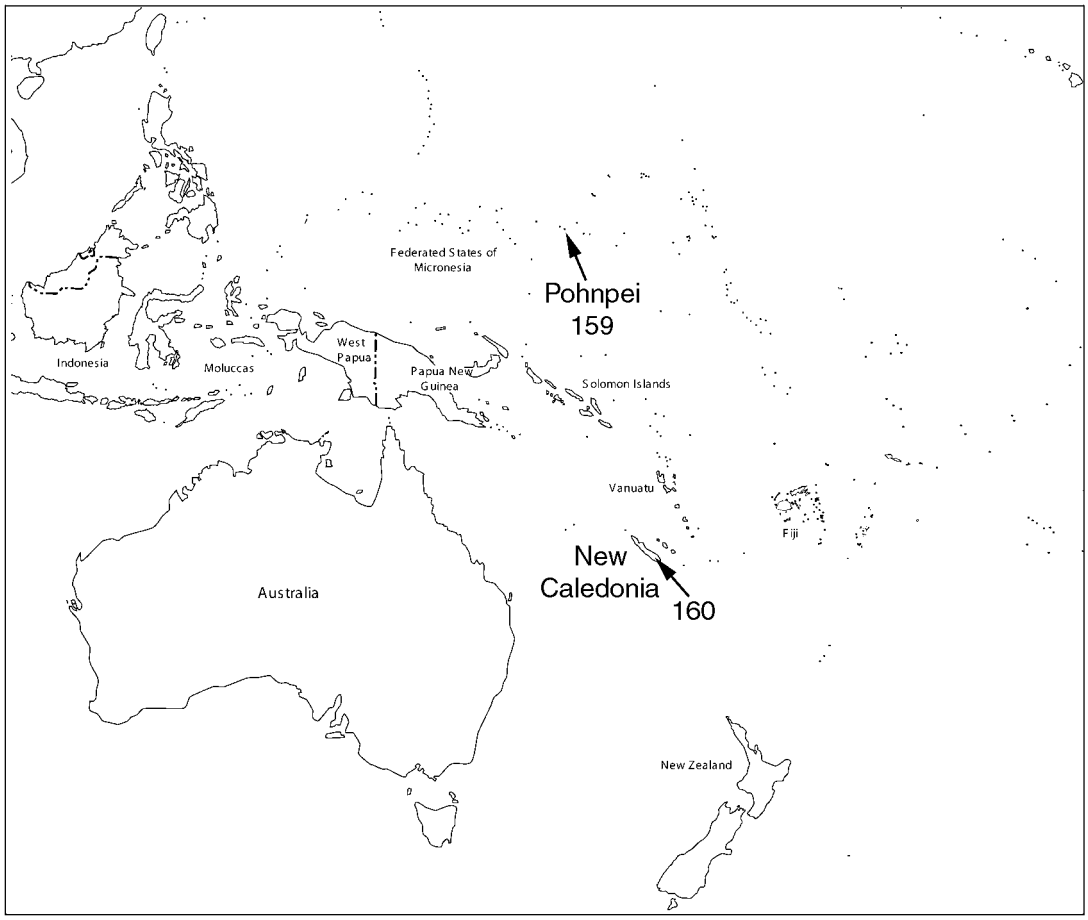

Fig. 4. Pacific Islands showing the locations of Pohnpei (159) and New Caledonia (160).

On first impression it would appear that the MDS analysis has generated a mass of points with no internal distinctions, suggesting that the rock-art regions of the western Pacific form a homogeneous group (Fig. 6). While "homogeneity" certainly is a feature of the rock-art of the region, closer inspection of the graph prompts a more complex interpretation. One of the most striking features of this distribution is that there is no perceptible overlap of points representing sites from Morobe and New Ireland, indicating that the rock-art of these two regions is very different from one another. The rock-art of New Ireland is largely engraved, and the rock-art of Morobe (with the exception of one site on the Gao River) consists entirely of paintings. Manus is most similar to Morobe, and Milne Bay has clustered with New Ireland. West and East New Britain, Fiji and Tonga share some similarities with New Ireland, while Central Province, Bougainville and Northwest Guadalcanal are more closely aligned with Morobe and Manus. The Sogeri area, New Caledonia and Micronesia are generally located in the centre of the graph, suggesting that each possesses motifs which are found throughout the western Pacific.

	Site *i*	
	+	–
Site *j* +	a	c
-	b	d

Fig. 5. Measures of similarity between pairs of sites using the MDS binary measure. Key: *a,b,c,d* = motifs; *a* = present at *i* and *j*; *b* = present at *i*; *c* = present at *j*; *d* = absent (the measure does not take account of absences).

Based on an assessment of the motifs seen to be causing this regional patterning, and for ease of analysis, I have divided the plot into four clusters (Fig. 6):

1 Cluster 1 includes three engraved boulder sites from West New Britain (Cao-go, Garua and Malapapua) located at the top of the distribution. The motifs which appear to be governing the close distances between these sites are circular forms, including circles with central cupules and contiguous circles. The only West New Britain (WNB) engraving site which falls just outside this cluster of the graph is Akono Sogo, which is also the only WNB assemblage associated with a limestone shelter instead of igneous boulders. On the graph margins but still within this cluster are three Fijian sites—Nacula, Dakuniba and Na Savusaru. Their location here is not easily explained in that the rock-art of two of these Fijian sites (Nacula and Dakuniba) is mainly rectilinear and quite unlike most engraved rock-art elsewhere in the western Pacific (which is mostly curvilinear). Na Savusaru possesses a few motifs which are more like those in the West New Britain assemblages (e.g., circles with central cupules) and has plotted closer to Cao-go than any other Fijian site. A couple of sites from the Sogeri area and Northwest Guadalcanal are also situated in this region of the graph. One of the sites from Northwest Guadalcanal (site 130) possesses several rectilinear motifs which are structurally similar to those seen at Nacula and Dakuniba in Fiji.

Table 1. The 103 assemblages at 102 sites included in the multivariate analyses (E and P in column 5 respectively indicate engraved and painted).

assemblage number	site number	region	number of motifs	technique
1	2	Sogeri	12	E
2	6	Sogeri	8	P
3	7	Sogeri	8	P
4	7	Sogeri	29	E
5	9	Sogeri	25	E
6	11	Sogeri	9	P
7	12	Sogeri	14	P
8	13	Sogeri	6	E
9	14	Sogeri	8	P
10	16	Sogeri	10	P
11	17	Sogeri	13	P
12	18	Central	5	P
13	19	Milne Bay	4	E
14	20	Milne Bay	9	E
15	21	Milne Bay	24	E
16	22	Milne Bay	5	E
17	26	Milne Bay	13	P
18	28	Sialum	5	P
19	29	Sialum	16	P
20	30	Sialum	18	P
21	31	Sialum	2	P
22	32	Sialum	8	P
23	33	Sialum	3	P
24	34	Sialum	1	P
25	35	Sialum	6	P
26	36	Sialum	1	P
27	37	Sialum	7	P
28	38	Sialum	1	P
29	39	Sialum	2	P
30	40	Sialum	7	P
31	42	Sialum	1	P
32	43	Sialum	12	P
33	45	Sialum	10	P
34	46	Morobe	26	E
35	49	Manus	32	P
36	50	Manus	1	P
37	51	Manus	48	P
38	52	Manus	13	P
39	65	West New Britain	41	E
40	66	West New Britain	21	E
41	67	West New Britain	46	E
42	68	West New Britain	1	E
43	71	West New Britain	27	E
44	75	East New Britain	1	E
45	76	East New Britain	1	E
46	77	East New Britain	2	E
47	78	East New Britain	1	E
48	85	New Hanover, NI	11	E
49	86	New Hanover, NI	15	E
50	87	New Hanover, NI	4	E
51	88	New Hanover, NI	1	E
52	89	New Hanover, NI	6	E
53	90	New Hanover, NI	10	E
54	91	New Hanover, NI	1	E
55	94	New Ireland	16	P
56	95	New Ireland	8	E
57	96	New Ireland	8	P
58	99	Tabar, NI	4	P
59	100	Tabar, NI	4	E
60	101	Tabar, NI	1	E
61	102	Tabar, NI	10	E
62	103	Tabar, NI	9	E
63	104	Tabar, NI	1	E
64	105	Tabar, NI	9	E
65	106	Tabar, NI	2	E
66	107	Tabar, NI	2	E
67	108	Tabar, NI	4	E
68	109	Tabar, NI	1	E
69	110	Tabar, NI	2	E
70	111	Tabar, NI	7	E
71	112	Boeng, NI	2	P
72	113	Bougainville	3	P
73	114	Bougainville	4	P
74	115	Bougainville	1	E
75	119	NW Guadalcanal	19	E
76	120	NW Guadalcanal	1	E
77	121	NW Guadalcanal	3	E
78	122	NW Guadalcanal	2	E
79	123	NW Guadalcanal	11	E
80	124	NW Guadalcanal	7	E
81	125	NW Guadalcanal	13	E
82	126	NW Guadalcanal	2	E
83	127	NW Guadalcanal	3	E
84	128	NW Guadalcanal	15	E
85	129	NW Guadalcanal	1	E
86	130	NW Guadalcanal	4	E
87	131	NW Guadalcanal	5	E
88	132	NW Guadalcanal	1	E
89	133	NW Guadalcanal	12	E
90	134	NW Guadalcanal	10	E
91	135	NW Guadalcanal	2	E
92	141	Fiji	1	E
93	143	Fiji	13	E
94	144	Fiji	7	E
95	146	Fiji	6	E
96	147	Fiji	5	E
97	148	Fiji	1	E
98	150	Fiji	8	E
99	153	Fiji	5	E
100	154	Fiji	19	P
101	155	Tonga	9	E
102	159	Micronesia	90	E
103	160	New Caledonia	248	E
Total number of motifs in sample:			1232	

2 Most of the rock-art in cluster 2 derives from Tabar and New Hanover (New Ireland Province), and Milne Bay. Sites from East New Britain and Northwest Guadalcanal are also found in this part of the graph. The motif category which appears to be governing the similarities between these regions is the spiral; a feature notably absent from the West New Britain engraved assemblages and most of the painted assemblages in the region. One exception is a painting site from New Ireland which includes a spiral among its corpus (site 96).

3 The third cluster is dominated by the painted rock-art sites of Morobe, Manus and Bougainville, with the painted sites of New Ireland also found in this area of the graph. The motifs which appear to be influencing this component of the distribution are simple “sun motifs”, diamonds, triangles, motifs with central axes, chevrons, wavy lines, crosses and leaf-shaped forms—all broadly linked by their rectilinear structure. Most of these motif categories are found in Northwest Guadalcanal which is also represented in this part of the graph.

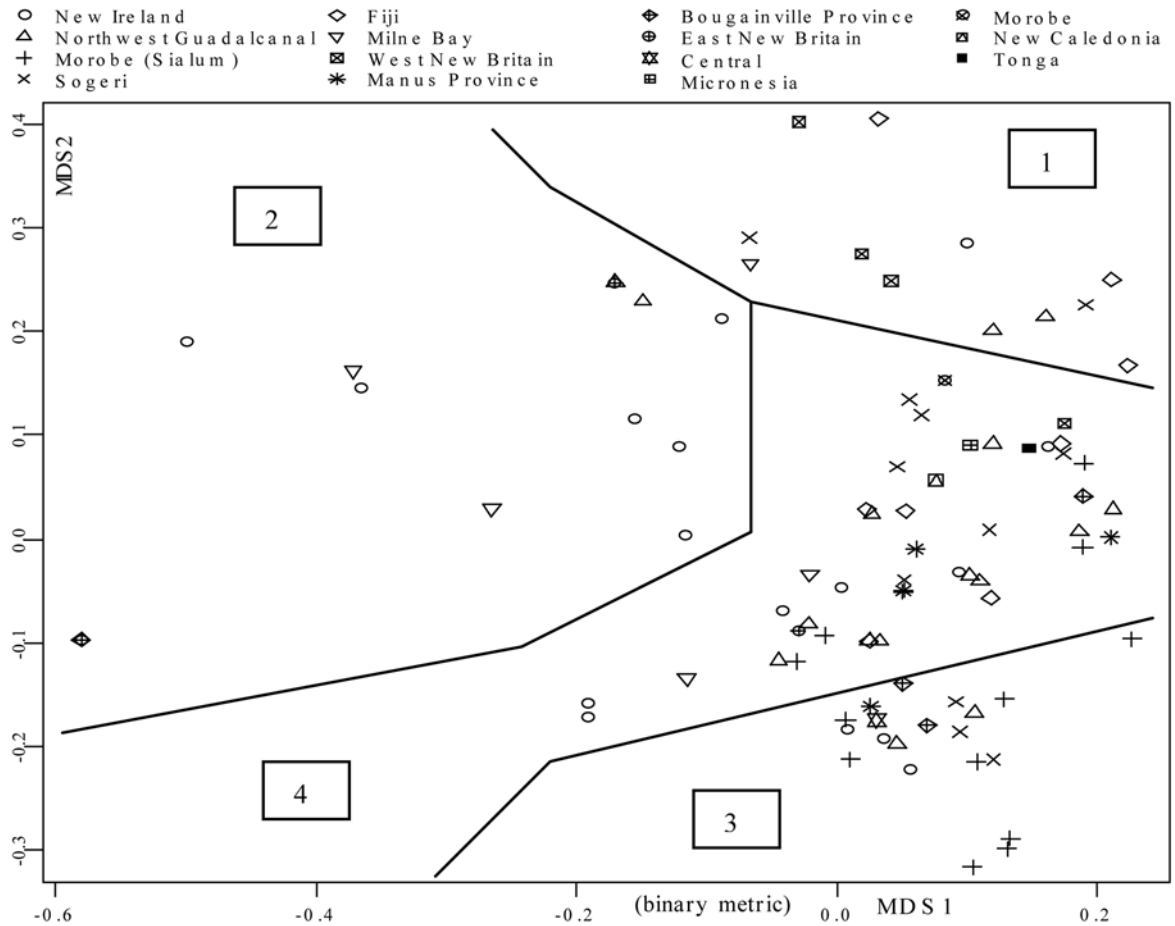

Fig. 6. Sammon binary measure result: Group 1 (106 non-figurative motif classes, 93 sites).

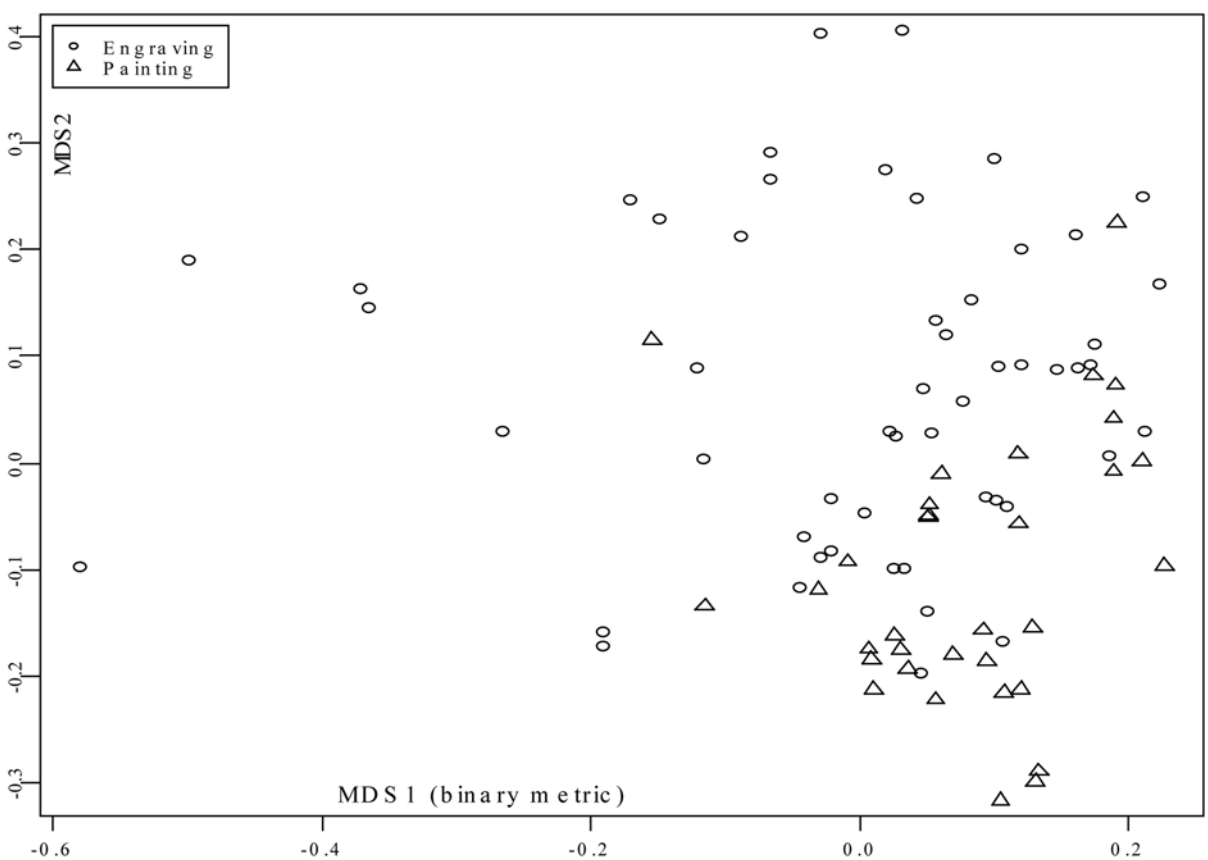

Fig. 7. Sammon binary metric result: Group 1 (paintings and engravings).

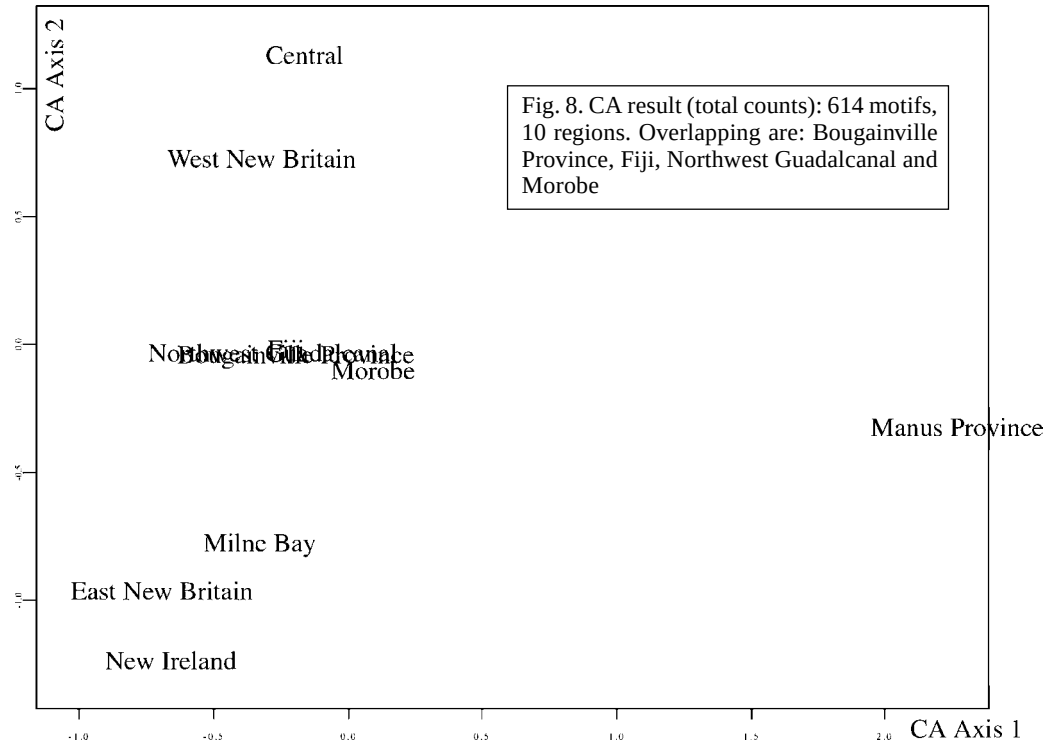

Fig. 8. CA result (total counts): 614 motifs, 10 regions. Overlapping are: Bougainville Province, Fiji, Northwest Guadalcanal and Morobe

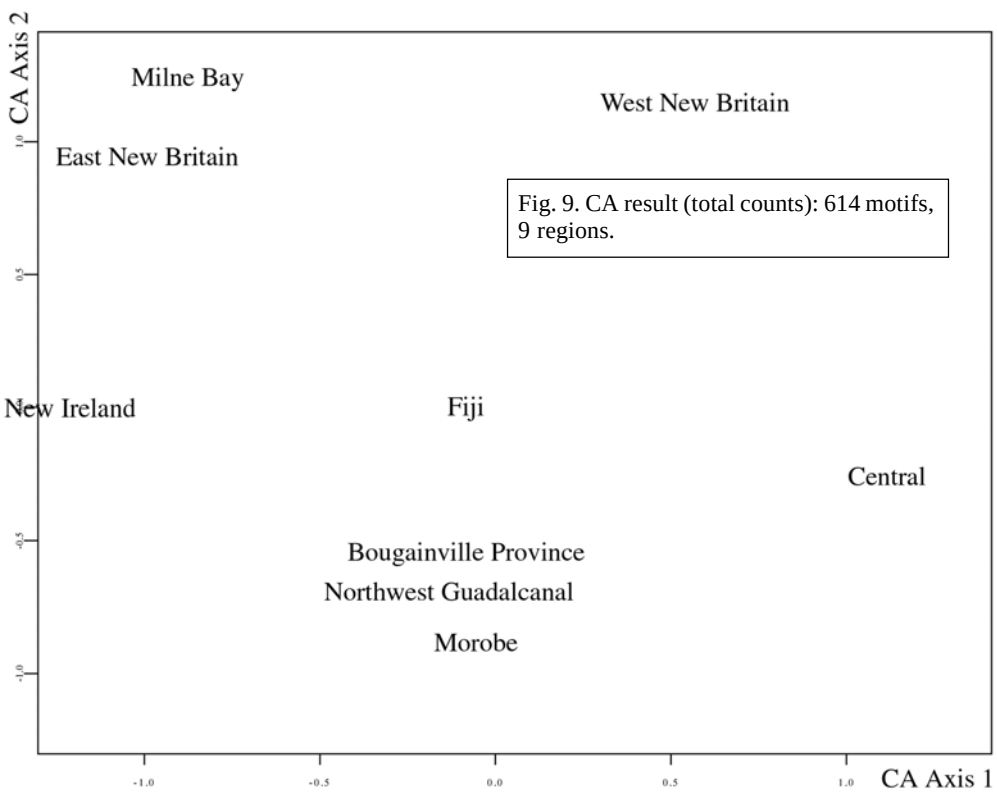

Fig. 9. CA result (total counts): 614 motifs, 9 regions.

4 The fourth cluster consists of sites located in the centre of the distribution. Most of the Remote Oceanic sites are found here, including those from Fiji, New Caledonia and Micronesia. Motifs common to these regions include enveloped crosses, scrolls, zigzags and circles with central spokes. Each of these motifs is also found in most other regions in the sample, consistent with the idea that motifs/sites located in the centre of a multivariate graph (close to 0,0) are least indicative of difference.

When the same distribution is re-coded according to the statistical relationships between painted and engraved assemblages, major differences can be observed between the two techniques (Fig. 7). Within a single regional group, such as New Ireland, painting sites share more in common with other painting sites in the western Pacific than they do with the engraving sites from New Ireland. There are two exceptions to this general pattern:

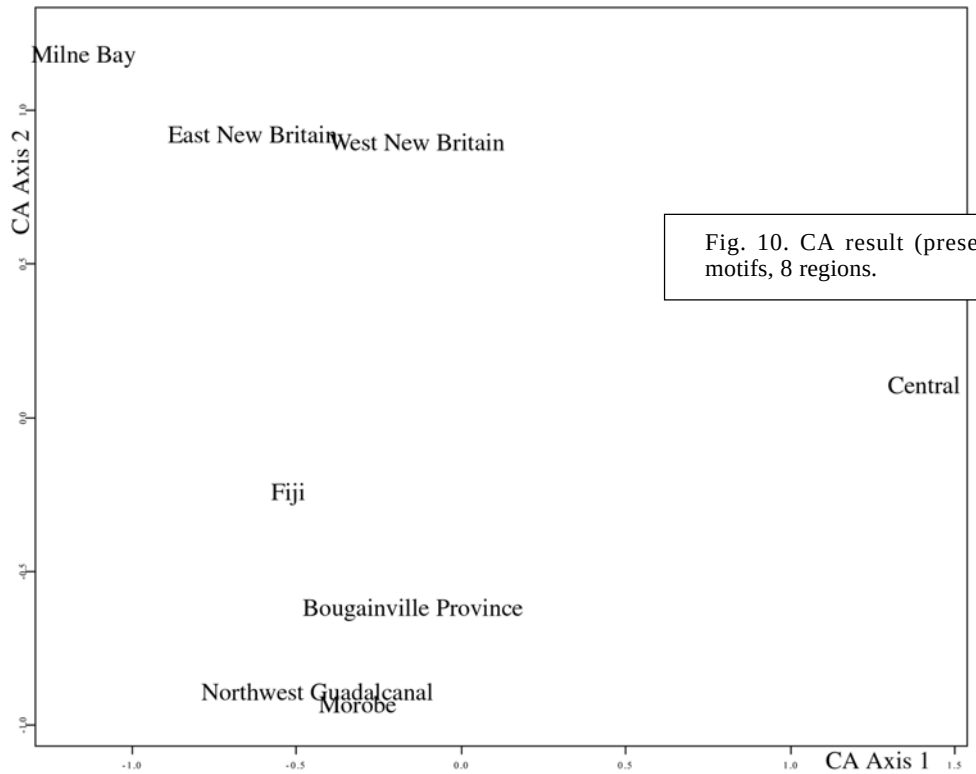

Fig. 10. CA result (presence/absence): 614 motifs, 8 regions.

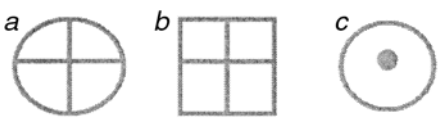

Fig. 11. An illustration of two ways in which motifs may be classified.

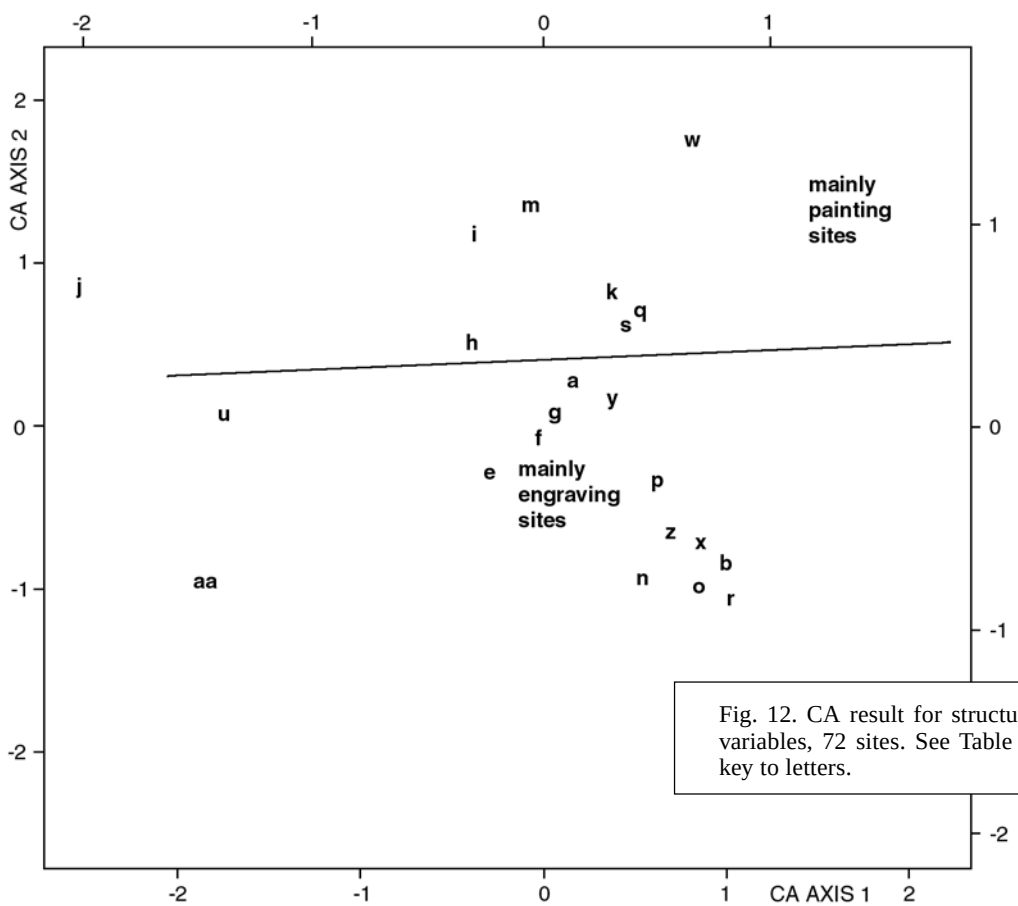

Fig. 12. CA result for structural elements: 25 variables, 72 sites. See Table 2 (opposite) for key to letters.

1 Several engraving sites from Northwest Guadalcanal are statistically similar to the main cluster of painting sites.

2 One engraving site from East New Britain (site 75) and another from New Hanover (site 85) are located within the main cluster of painting sites (these sites are not marked on Fig. 7). Site 75 contains only one motif; not a sufficient sample to allow it to be identified with the majority of engraved assemblages in the sample. Included among the motifs represented at Site 85 are enveloped crosses, a simple scroll motif, and some parallel lines—each of which have been recorded at a number of painting sites across the region.

Analysis 2: Correspondence Analysis (CA): total counts. This analysis uses CA to measure the chi-squared differences between regions (as opposed to sites). Calculations are based on "total counts"; that is, the total number of sites which possess a particular motif in a given region. The aim is to assess whether similar patterns to the MDS result described above are obtained when sites are combined into regional groups. A total of 12 regions and 614 figurative and non-figurative motifs have been defined for the analysis. The regions included in this analysis are: New Ireland, Northwest Guadalcanal, East New Britain, West New Britain, Morobe, Central, Fiji, Milne Bay, Manus, Bougainville, New Caledonia, and Micronesia. These regions differ slightly from those used in the MDS analysis. The Sogeri sites have been subsumed within the Central region, and Sialum has been combined with the rest of Morobe. Tonga is excluded from the analysis due to its small sample size.

An initial CA on the total counts produced a result which distinguished New Caledonia and Micronesia from other areas (the graph is not presented here). As with other CA analyses (described in Wilson, 2002), this outcome is probably due to the excessive number of unique motifs present in these two regions. When both regions were omitted, the results obtained from the remaining dataset show Central Province and West New Britain located close to one another at the top of the distribution (Fig. 8); Milne Bay, East New Britain and New Ireland form a second cluster at the base of the graph; Northwest Guadalcanal, Morobe, Fiji, and Bougainville form a third cluster in the centre of the graph; and Manus is located independently on the right hand side of the distribution.

When Manus was excluded from the analysis to allow for even greater separation between the remaining regions, similarities between Milne Bay and East New Britain, with distant links to New Ireland and West New Britain, are indicated (Fig. 9). Central Province, which includes material from the Sogeri area, is distinct from Milne Bay, East New Britain and New Ireland, but appears to share some similarities with Fiji, Bougainville, Northwest Guadalcanal and Morobe. Fiji, located in the centre of the graph, appears to manifest motifs common to all regions.

Analysis 3: CA: presence/absence. A second CA was conducted on presence/absence data producing a matrix which indicates whether a particular motif is present or absent in any given region. After running several initial analyses, New Caledonia, Micronesia, Manus and New Ireland were all deleted because they appeared as outliers. The result for the remaining data set (Fig. 10) resembles that obtained for total counts. Bougainville, Northwest Guadalcanal and Morobe are clustered together in the lower half of the graph. Milne Bay, East New Britain and West New Britain are grouped in the top left of the distribution. Central Province has distinguished itself from other regions on the right hand side of the graph. Fiji, once again, holds a relatively central position.

Together, the results of Analyses 2 and 3 suggest a broad similarity between the rock-art regions of New Britain and New Ireland and Milne Bay, with distant relationships to Central Province and Fiji. The result derived from the presence/absence data indicates a much closer relationship between the rock-art of East and West New Britain than the result from total counts. There is a relatively high degree of similarity between the painted assemblages of Bougainville and Morobe and the engravings of Northwest Guadalcanal.

Analysis 4: MDS: structural analysis. This analysis was designed to examine the internal structure of motifs. A common approach in rock-art research is to develop only *one* typology for classifying rock-art motifs. For instance, for each of the analyses presented so far I have grouped motifs initially according to motif categories (e.g., circles,

Table 2. Structural categories. In these definitions, the "main form" refers to the shape defined in the motif categories listed in Fig. 12 (e.g., circle).

a	main form with attached line
b	main form connected by a line
c	contiguous (touching)
d	main form (either single, in a sequence, or in a cluster; can be either a single line open, or a single line closed; occasionally has two or more lines attached to it)
e	line(s) (not touching the sides) within the main form
f	cupule or dot (or small circular gap) within the main form
g	line(s) (touching the sides) within the main form
h	internal cross (either touching or not touching the sides of the main form)
i	inner spokes
j	inner cluster of dots
k	contiguous main form with central linear axis
l	main form with outer inter-connected triangles
m	main form with outer rays or scalloping (may have a central cupule/dot or line)
n	concentricity: outer line of main form repeated twice or more
o	concentric (with inner spokes and/or cupule/dot)
p	concentric (with inner dots between lines of main form)
q	concentric with outer linear extensions [e.g., line(s) or rays, "scissor" or scroll shaped lines, other linear extensions] and inner cupule/dot or cross.
r	main form (concentric or not) with attached spiral(s)
s	concentric with spokes and rays
t	concentric with inner spiral, circle and dots and outer rays
u	inner bars
v	concentric with intersecting line(s)
w	mirror image of main form
x	main form surrounded by a circular or ovular shape (motif categories "C" and "O" excluded)
y	main form surrounded by a circle, oval, bean or heart-shape with inner cupule/dot and/or outer rays or other attachments
z	main form surrounded by a circle, oval, bean-shaped, or heart-shaped with attached spiral
aa	parallel

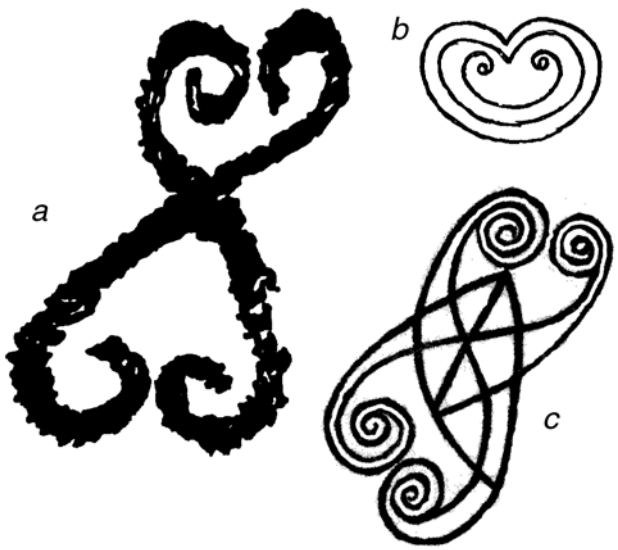

Fig. 13. Examples of scroll-like motifs. (*a*) Rock-painting from Timbinde Cliff (MSK), Jimi-Wahgi region, Western Highlands Province, PNG (after Gorecki & Dallas, 1989: 246, fig. 12.12). (*b*) Rock-engraving from Likding, New Hanover, New Ireland Povince (after Buhler, 1946–1949: 262, fig. 11). (*c*) Rock-painting from the MacCluer Gulf (after Roder, 1959: 124, fig. 2).

diamonds). In this analysis my aim is to reclassify all motifs according to their structural characteristics, such as the appendage lines and infill within the main form. Using the first typological approach (in Fig. 11), *a* would be grouped with *c*, as both are circles. In this analysis, *a* is grouped with *b*, as both share a central cross.

The objective is to test whether different typologies generate similar or different results. The data matrix includes all non-figurative motifs used for Analysis 1 which conform to one of the "structural categories" listed in Table 2. Category "d" has been disregarded because it does not include information about the structure of a motif. A matrix of 26 structural variables and 75 sites was analysed using CA. The most common variable is "n" (concentricity), and the least common variables are "y" and "z".

The first result showed a dense cluster of sites and three outliers (graph not presented). The outlier sites (and the corresponding variable "l") were deleted, and a CA was re-run on a matrix of 72 sites and 25 variables. The subsequent result—which shows a good separation of points—is extremely useful for identifying the structural properties which differentiate engraved and painted assemblages in the western Pacific (Fig. 12). Four main observations can be made in relation to this distribution:

1 Most of the painted sites of the western Pacific are distributed in the top half of the distribution and are characterized by rectilinear structural qualities, such as "outer rays", "inner spokes", "internal crosses" and "central axis lines". Compound motifs, which incorporate multiple triangles, diamonds and other geometric shapes within a single form, are also common.

2 In the centre of the distribution are most of the structural categories which define engraving assemblages from West New Britain, Sogeri, New Caledonia and Micronesia. The structural variables in this part of the graph (0,0) have very low scores and are therefore likely to be less indicative of regional or site differences than those located on the outskirts of the distribution. Included are central cupules or lines, contiguity, concentricity, and main forms surrounded by circles, ovals, bean-shaped and heart-shaped elements.

3 Motifs incorporating spirals and other relatively "complex" structural properties are located to the lower right of the distribution and are mostly associated with sites from New Ireland, East New Britain and Milne Bay. A few sites from Northwest Guadalcanal are located at the very base of this distribution and share the variable "o"; a concentric form with "inner spokes and/or a cupule/dot".

4 A few rare structural properties are associated with sites located on the left margin of the graph. These include "parallel" forms, "inner bars" and "inner dots". Most of these characteristics are associated with motifs from Northwest Guadalcanal.

This analysis has demonstrated that the differences between regions and between painted and engraved sites are replicated for both "motif types" and "structural categories". The structural categories which define the painted sites of the region include outer rays, inner spokes, internal crosses and other mostly rectilinear properties. Those which define the engraved sites of Milne Bay, East New Britain and New Ireland include spirals and several of the structural properties which have plotted in the centre of the distribution, such as concentricity. At the centre of the distribution are the more "simple" structural properties which define a number of engravings from West New Britain, Sogeri, New Caledonia and Micronesia. Each of these regions appears to contain elements which are common to both painted and engraved assemblages elsewhere. West New Britain is particularly interesting because, while it contains many of the elements characterizing sites elsewhere in the Bismarck Archipelago and in Milne Bay (spirals, scrolls, concentric circles), it is characterized by a prominent suite of motifs which incorporate cupules within their structure.

Discussion: centre or periphery?

Multivariate analyses have been employed in this paper to examine similarities and differences amongst rock-art motifs found throughout the western Pacific, excluding Vanuatu. One of the primary outcomes is the identification of a distinction between painted and engraved assemblages throughout the region, with some evidence of overlap between the two occurring in parts of Island Melanesia (e.g., Northwest Guadalcanal). Another important outcome is that, despite the use of different MV techniques (CA, MDS), the same overall patterns have emerged in each of the analyses. Both "motif-types" (figurative and non-figurative) and "structural categories" have been used to examine the relationships along two principal analytical axes: variation in rock-art techniques and between sites or regions. The regional analyses, particularly those derived from the use of MDS, generally demonstrated inter-regional *invariance*. That is, there are sufficient numbers of rock-art motifs shared by most regions to create a pattern of overall homogeneity. Most of the more subtle inter-regional differences are a by-product of distinctive differences between painted and engraved assemblages across the region. Thus, for instance, the painted rock-art of New Ireland is more similar to the painted rock-art of other western Pacific regions than it is to the engraved rock-art of New Ireland. This result does not sit easily with Specht's original observation that painted rock-art (dominant in the west of the study region) is geographically distinct from engraved rock-art (commonly found to the east, particularly in Island Melanesia).

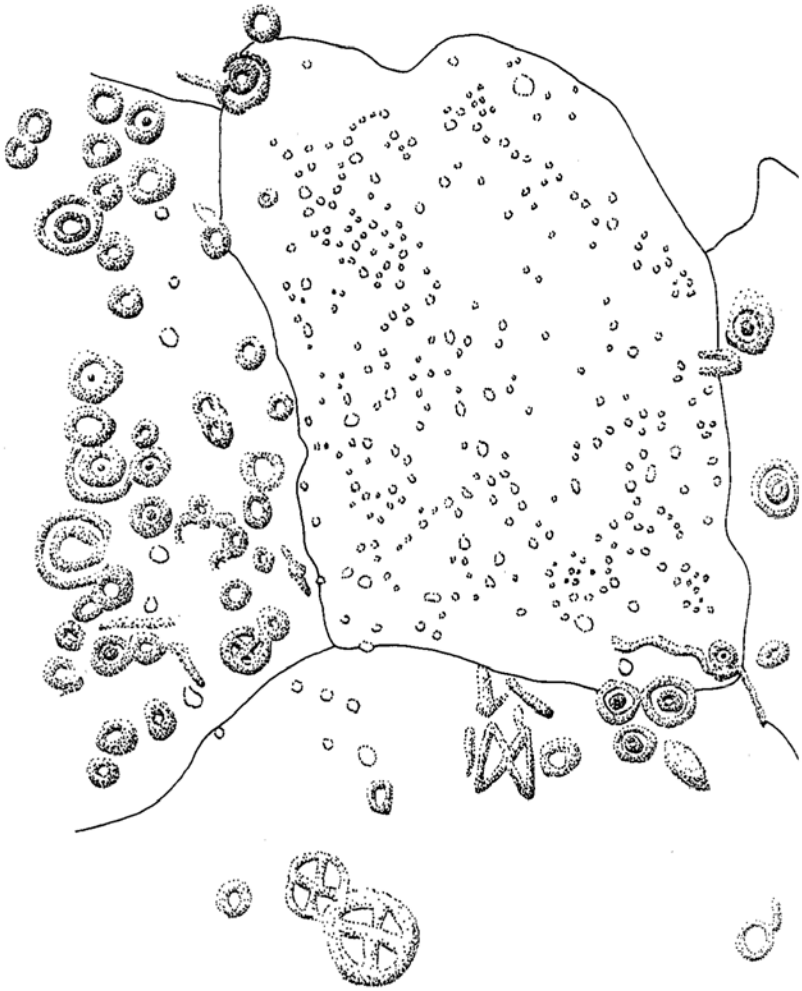

Fig. 14. Engravings at FAAS, Garua Island, West New Britain (Drawing courtesy of Robin Torrence).

Indeed, new data available since Specht's paper suggest that there are many more painted sites in Island Melanesia than originally supposed. In the Bismarck Archipelago, for example, the number of known painted sites has almost doubled. Matthew Spriggs (pers. comm., 2000) has also been informed of an unrecorded body of painted rock-art in northeast Bougainville (Teop language area), and Christophe Sand (pers. comm., 2000) has indicated the presence of several painting sites in New Caledonia which have not previously been published. In addition, my own data from Vanuatu raise Specht's (1979) figure of three painted sites for the archipelago to over 30. This more recent evidence indicates that the west/east division of painting and engraving sites may not be sustained by further intensive work, except perhaps in parts of Polynesia (e.g., the Marquesas, Hawaii, and Easter Island) where detailed recording has revealed relatively few painted sites.

On the basis of motif differences (both figurative and non-figurative) between painted and engraved assemblages in the western Pacific, the following inter-regional groups can be defined. Individual regions are linked together on the basis of specific combinations of motif and non-motif variables. Impressionistic comparisons are also made with rock-art regions located outside the area included in the MV analyses to demonstrate that interpretations vary quite substantially when different geographic scales are introduced.

1 Manus, Morobe (Sialum), Bougainville. These regions (as well as other painted assemblages elsewhere in the western Pacific) are defined by a primarily rectilinear painted rock-art associated with many of the non-motif variables that define the APT. A large number of these non-motif variables (such as "inaccessibility", "red pigment", "cliff-face locations") are also found immediately west of the region considered in this paper, such as in East Timor, the Moluccas (Eastern Indonesia) and the MacCluer Gulf in West Papua. There are also a few motif parallels found further west. For example, scrolls (which are found in small numbers in the painted rock-art of Sialum, Morobe Province, PNG) are present among *Manga* style rock-art in the painted assemblages of the MacCluer Gulf (Röder, 1956, 1959). The short distances between points representing painted sites on the MV graphs are suggestive of a high degree of graphic unity among painted assemblages across the region.

2 Milne Bay, East New Britain and New Ireland. These regions are defined primarily by curvilinear engraved rock-art assemblages which bear motif similarities to the painted Manga rock-art of the MacCluer Gulf, e.g., scrolls, and the painted rock-art of the New Guinea mainland (scrolls, enveloped crosses) (Fig. 13). One of the more distinctive motifs of Milne Bay, East New Britain and New Ireland is the spiral, or motifs which incorporate spirals in their overall structure. Faces and feet are also common. Notably, once the interpretation of the MV results extends beyond the regions included in the statistical analyses, overlaps between painted and engraved rock-art become more apparent.

3 West New Britain (with some links to Central Province, especially the Sogeri area). Many of the motifs characterizing West New Britain are also found in Milne Bay, East New Britain and New Ireland (e.g., the faces and scroll-like forms at Malapapua), but what differentiates this region from the former is the presence of motifs dominated by "cupules". Circles with central cupules, including unusual "contiguous circles" are particularly common. Two sites which are overwhelmingly dominated by these sorts of motifs are Akono Sogo (65) and Garua Island (71) (Fig. 14). These are distinctive sites because they are not characterized by any of the spiral, scroll or enveloped cross forms which feature in the Milne Bay, East New Britain and New Ireland assemblages. Cao-go is additionally characterized by a number of "cupule-based" motifs but it also contains a spiral form, linking it with the "Milne Bay" group. The similarities between West New Britain and the Sogeri area are based on the mutual occurrence of circles or ovals with either central cupules or a short central line (which does not touch the side). Circles with central cupules (often referred to as "cup and ring" in the literature) have also recently been found at a site in Mt Hagen in the New Guinea Highlands (Robin Torrence, pers. comm., 2001). These motifs, and the "non-motif" variables which define the contexts in which they are found, have a distribution which appears to be limited to mainland Papua New Guinea and Island Melanesia. Based on the density of their distribution, I would nominate West New Britain as the "centre" of this engraving group.

4 Northwest Guadalcanal, New Caledonia, Fiji, Tonga and Micronesia. On first impression it might seem difficult to assess the relationship between the rock-art of these regions and that found elsewhere because of the different ways they have been treated by the various MV algorithms. For example,

the CA algorithm often placed New Caledonia and Micronesia on the periphery of the distribution, whereas the MDS (Jaccard's coefficient) placed these regions in the centre of the distribution. The CA issued particularly high scores to the large numbers of unique motifs present in each of these regions, whereas the MDS algorithm preferenced those motifs which are held in common with other regions. What can be concluded from these seemingly different results is that, while a large number of the motifs in Northwest Guadalcanal, New Caledonia, Fiji, Tonga and Micronesia are probably the result of local innovation, a significant number are also found in all other regions in the sample. The motifs present in these regions are similar to both the curvilinear engraved rock-art of New Britain, New Ireland and Milne Bay, and the rectilinear painted rock-art of Manus, Sialum and Bougainville (i.e., all regions to the west). In other words, it is within the more easterly regions of the sample that we see a convergence of motifs associated with either engraved or painted assemblages in the west. This convergence can also be seen in relation to non-motif variables. For instance, painted motifs which are usually associated with the non-motif attributes of the APT (inaccessibility and cliff-faces) can be found as boulder engravings in Northwest Guadalcanal and regions in Remote Oceania.

Conclusion

This paper was written in response to Jim Specht's (1979) suggestion that painted and engraved rock-art in the western Pacific divides into two more or less geographically distinct groups. It was also designed to test the merits of Specht's (1979) "Austronesian engraving style" and Ballard's (1992) "Austronesian painting tradition" via a statistical analysis of motifs. While a more detailed appraisal of these two analytical entities has been undertaken (Wilson, 2002), the results presented above indicate that the relationships between painted and engraved rock-art, particularly through space, are more complex than previously thought. Painted and engraved rock-art does separate on the basis of motif differences but not according to the geographic distinction observed by Specht over 20 years ago. That is, the rock-art of the western Pacific can no longer be conceived in terms of "a western painting group" and an "eastern engraving group". Instead, the statistical comparisons between motifs demonstrate that painted and engraved rock-art sites in the western Pacific are associated with two distinct but homogeneous motif groups that overlap in the eastern parts of this wider region (e.g., Northwest Guadalcanal).

How might the differences between the motif ranges associated with painted and engraved rock-art be explained? Do these two media represent traces of two separate movements of people at different times? Or might they be indicative of function differences? Such questions, which cannot be critically assessed without some understanding of how painted and engraved rock-art articulate with one another through time and according to other social processes, are explored in a related but much larger study (Wilson, 2002).

Notes

[1] Note that Figs. 1–4 display more rock-art sites than are included in the MV analyses.

[2] Only after I completed my analyses did Matthew Spriggs draw my attention to the unpublished paper by Frimigacci & Monnin which contains site level information for New Caledonian rock-art.

ACKNOWLEDGMENTS. I would like to thank Val Attenbrow, Chris Ballard, Richard Fullagar, Steph Garling, Jack Golson, Paul Gorecki, Jean Kennedy, Paul Rainbird, Matthew Spriggs, Glenn Summerhayes, Paul Taçon, Peter White, Stephanie Wilson, and two anonymous referees for commenting on earlier versions of this work. I would also like to express my thanks to John Maindonald for statistical assistance, and a special debt of gratitude to Jim Specht who provided us with the first breakthrough study of the rock-art of the western Pacific region. Any errors and omissions are my own.

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