

## 1. Background

A quipu is an arrangement of knotted, colored, cotton cords. As a vehicle for expression, the quipu is the single most important artifact to come out of the pre-conquest New World. In particular, quipus were brought to the height of their development during the period 1438 to 1525 on the Western calendar when Inca influence spread through the Andes. Europeans who heard about quipus early in the sixteenth century discussed them with limited understanding; then they burned quipus in the belief that they were ungodly; next they dug them out of graves and put them in museum drawers. This is considerable attention to devote to an object that resembles a worn out mop. Now, in this Databook, we give detailed descriptions of quipus as a necessary co-requisite to study, analysis, interpretation, and appreciation.

A rather long time ago, in 1897 to be precise, Max Uhle pleaded for what the reader will at last find here, namely the publication of specimens that are housed in museums and private collections. In his words: "the matter is so important that we are not justified in neglecting the last opportunities of saving all possible knowledge of the ancient kipu. . . ." Quipus are highly perishable; Uhle knew that even under good conditions the then available specimens were decomposing. Gradually the colors fade, the attachment of string to string is loosened, and the specimens dry out. We had the experience of touching part of a quipu string only to withdraw quickly as it collapsed in a small heap of dust. It is good that not all quipus are in such poor condition. In any case, when part of a string disappears,

information goes with it unless the quipu has been described in some other format.

The description of quipus is important because both the media itself and the information it stores are important. For us, the quipu is the icon of late Andean Civilization; the interpretation of quipu information leads to knowledge of mathematics and logic that developed apart from other great and more familiar traditions; further, the quipu is a significant landmark in the intellectual achievements of man (Ascher and Ascher 1975).

Quipus are very much like puzzles; they are coded in the sense that no matter how clear they may have been to long dead quipu makers, they are not clear to us. Others will want to use the quipu descriptions to try out ideas of their own. Therefore, the descriptive phase of our work is guided with this principle in mind: that interested persons should be able to search for their own solutions to the code of the quipu independent of our ideas on the subject.

Prior to this report, at least seventy-one quipus were published including nine done by us (Ascher and Ascher 1972). These appear in sixteen separate sources, written in Spanish, English, German, French, or Italian. With this Databook in hand, the publicly available corpus increases to two hundred and sixty-two.

We set out to increase the size of the quipu corpus in the belief that more information would enable us to further our earlier analysis and interpretations (Ascher and Ascher 1969), and to test the tenability of our initial generalizations. At the start, we had no idea that we would locate as many specimens as we did. The presentation of

a large new corpus of detailed, accurate, and full quipu descriptions--useful to others as well as ourselves--unexpectedly became a major task in itself. Clearly, this task could not have been accomplished without the cooperation of the many people who permitted us access to the surviving quipus. A preliminary treatment using a small portion of this information has appeared; our overall analysis and interpretation is now in progress (A Piece of String, in preparation).

## 2. When and Where the Work was Done

The activity that resulted in our Databook began in 1970 and extends into the present. In order to describe quipus, we often went to places where they are located. This involved travel on three continents. Table 1 shows the location and numbers of the quipus we have personally examined, and those that we have examined and are published here. An explanation of the tags (e.g., AS10), appearing on the far right of Table 1, is found in section 3 below.

In our search, we found the whereabouts of more quipus than we have been able to examine, publish, or discuss. Table 2 shows where these quipus are, and how many remain to be studied and published.

## 3. Tag System and Published Quipus

Our first paper on quipus (1969) introduced a system to refer to published descriptions of specimens. The aim of the system is clarity and brevity. We continue the system here.

In the system, each published quipu is tagged with a letter (or letters), and a number. The letter is derived from the last name of the person or people who first published a specimen. The number

follows, and it refers to the order of publication. For example, AS1 is the first quipu we published; AS2 is the second quipu published in the same paper, and so on through AS9, all nine appearing in the same publication. In the present publication, we continue the series; note that the first quipu in this Databook is AS10. In a few cases, we describe a quipu that previously appeared elsewhere in a form not entirely adequate for our purposes. The tag in these instances follows the AS series, but attaches a notation to indicate prior publication. For example, AS87/N3 is our quipu 87 and Nordenskiöld's quipu 3. We do not tag quipus that are merely mentioned in passing; nor do we tag those specimens that are described in such a way as to be inadequate for purposes of interpretation. In many cases, authors of quipu descriptions assigned numbers to the specimens they studied. In these cases, we do not change the numbers they used; indeed, they fit neatly with the tag system. Table 3 lists all the literature known to us where adequate quipu descriptions are published, along with the number of specimens and their tags. This is followed by a bibliography of published quipus.

TABLE 1

## QUIPU LOCATIONS AND NUMBERS

<u>Collection</u>	<u>Location</u>	<u>Number Examined</u>	<u>Number Described Here</u>	<u>Tags</u>
<u>Europe:</u>				
Musée d' L'Homme	Paris, France	15	11	AS74-AS84
Musée d'Ethnographie	Geneva, Switzerland	2	1	AS85
Museum Voor Landen Volkerkunde	Rotterdam, Netherlands	1	1	AS29
British Museum	London, England	1	1	AS14
Niedersächsisches Landesmuseum	Hannover, W. Germany	4	4	AS10-AS13
Museum Für Völkerkunde	Basel, Switzerland	4	1	AS86
Museum Für Völkerkunde	Munich, W. Germany	21	10	AS87/N3, AS88/N6, AS89, AS90/N2, AS91-AS94, AS95/N4, AS96
Museum Für Völkerkunde	Berlin, W. Germany	253	93	AS97-AS102, AS103/N12, AS104/N11, AS105/N16, AS106-AS139, AS140/N9, AS141-AS145, AS146/N10, AS147-AS166, AS167/N15, AS168-AS189
<u>North America:</u>				
American Museum of Natural History	New York, N.Y.	48	8	AS190-200
Brooklyn Museum	New York, N.Y.	3	1	AS35

TABLE 1 (continued)

<u>Collection</u>	<u>Location</u>	<u>Number Examined</u>	<u>Number Described Here</u>	<u>Tags</u>
National Museum-- Smithsonian	Washington, D.C.	1	1	AS34
Peabody Museum, Harvard University	Cambridge, Mass.	4	4	AS30-AS33
The University Museum, University of Pennsylvania	Philadelphia, Penn.	14	14	AS15-AS28
<u>South America:</u>				
Museo "Jijon y Caamaño," Universidad Catolica del Ecuador	Quito, Ecuador	2	2	AS36-AS37
Museo Nacional de Anthropología y Anqueología	Lima, Peru	35	10	AS38-AS47
Ana Maria Soldi	Lima, Peru	1	1	AS50
Museo Amano	Lima, Peru	4	2	AS48-AS49
Oscar Núñez del Prado	Cuzco, Peru	9	9	AS59-AS60, AS61/MA36, AS62-AS66, AS67/MA29
Museo de Ica	Ica, Peru	22	8	AS51-AS58
Rancho San Juan	Ica Valley, Peru	2	2	AS72-AS73
Percy Dauelsberg	Arica, Chile	4	3	AS69-AS71

TABLE 2

## UNEXAMINED QUIPUS

<u>Collection</u>	<u>Location</u>	<u>Number</u>
<u>Europe:</u>		
Museum Für Völkerkunde	Leipzig, E. Germany	10
Museum Für Völkerkunde	Hamburg, W. Germany	2
Deutsche Museum	Munich, W. Germany	1
Linden Museum	Stuttgart, W. Germany	1
Museum Für Völkerkunde	Freiburg-Im-Breisgau, W. Germany	1
Museum Für Völkerkunde	Vienna, Austria	1
Ethnografiska Museum	Göteborgs, Sweden	15
Ethnografiska Museum	Stockholm, Sweden	1
National Museum	Copenhagen, Denmark	1
<u>North America:</u>		
Field Museum of Natural History	Chicago, Illinois	1
Textile Museum	Washington, D.C.	2
Newark Museum	Newark, N.J.	1
Charles Llewellyn	Durham, North Carolina	1
Christopher B. Donan	Los Angeles, California	1
Milwaukee Public Museum	Milwaukee, Wisconsin	4
Peabody Museum, Yale University	New Haven, Conn.	1
Buffalo Museum of Science	Buffalo, N.Y.	1

TABLE 2 (continued)

<u>Collection</u>	<u>Location</u>	<u>Number</u>
Dartmouth College	Hanover, N.H.	2
Haffenreffer Museum, Brown University	Bristol, R.I.	1
Lowie Museum, University of California	Berkeley, California	3
<u>South America:</u>		
Universidad Nacional de La Plata	La Plata, Argentina	2
Museo de Puruchuco	Lima, Peru	20



TABLE 3

## PUBLISHED QUIPU DESCRIPTIONS

<u>Author and Date</u>	<u>Number</u>	<u>Tag</u>
Altieri, 1939	1	AL12
Altieri, 1941	11	AL1-11
Ascher and Ascher, 1972	9	AS1-AS9
Ascher and Ascher, 1978	191	AS10-AS200
Barthel, 1951	1	B1
Cipriani, 1928	2	C1,2
Locke, 1912	1	L1
Locke, 1923	1	L2
Locke, 1927	1	L46
Locke, 1928	15	L3-10, 27-29, 47-50
Muntó, 1966	1	M1
Mackey, 1970	7	MA2,3,9,14,29,36,44
Nordenskiöld, 1925a	7	N1-4, 6-8
Nordenskiöld, 1925b	7	N9-12, 14-16
Nordenskiöld, 1931	1	N17
Radicati, 1949-1950	2	R1,2
Radicati, 1965	4	R3-6

The complete citation for all tagged quipus is given below:

Altieri, Radamés A.

- 1939 Sobre un Kipu Peruano. Universidad Nacional de Tucumán,  
Publication No. 248, Pp. 7-12.
- 1941 Sobre 11 Antiguos Kipu Peruanos. Revista del Instituto de  
Anthropologia, Vol. 2, Tucumán, Pp. 177-211.

Ascher, Marcia, and Robert Ascher

- 1972 Numbers and Relations from Ancient Andean Quipus. Archive  
for History of Exact Sciences, Vol. 8, Pp. 288-320.
- 1978 Code of the Quipu: Databook

Barthel, Thomas S.

- 1951 Bemerkungen zu einem Astronomischen Quipu aus Südperu.  
Ethnos, Vol. 16, Pp. 153-170.

Cipriani, Lidio

- 1928 Su due "quipus" del Museo Nazionale de Anthropologia e  
Etnologia di Firenze. Congresso Internacional de Ameri-  
canistas, 22, Rome. Pp. 471-480.

Locke, L. Leland

- 1912 The Ancient Quipu, A Peruvian Knot Record. American  
Anthropologist, Vol. 14, Pp. 325-332.
- 1923 The Ancient Quipu or Peruvian Knot Record. The American  
Museum of Natural History, New York.
- 1927 A Peruvian Quipu. Contributions from the Museum of the  
American Indian, Heye Foundation, Vol. 7, Pp. 3-6.
- 1928 Supplementary Notes on the Quipus of the American Museum  
of Natural History. Anthropological Papers, The American  
Museum of Natural History, Vol. 30, Pp. 39-73.

Mackey, C. J.

- 1970 Knot Records in Ancient and Modern Peru. Ph.D. Dissertation.  
University Microfilms, Ann Arbor, Michigan.

Muntó, Antonia Molina

- 1966 El Quipu de Madrid. Actas y Memorias, Congreso Internacional  
de Americanistas, 36, Sevilla. Pp. 521-527.

Nordenskiöld, Erland

- 1925a The Secret of the Peruvian Quipus. Comparative Ethnographical Studies, 6, Pt. 1, Pp. 1-37.
- 1925b Calculations with Years and Months in the Peruvian Quipus. Comparative Ethnographical Studies, 6, Pt. 2, Pp. 1-35.
- 1931 Le Quipu Péruvien du Musée du Trocadéro. Bulletin du Musée d'Ethnographie du Trocadéro, No. 1, Paris, Pp. 16-20.

Radicati di Primeglio, Carlos

- 1949-50 Introduccion al Estudio de los Quipus. Documenta: Revista de la Sociedad Peruana de Historia, Vol. 2, Pp. 244-339.
- 1965 La "Seriación" como posible Clave para Descifrar los Quipus Extanumerales. Documenta: Revista de La Sociedad Peruana de Historia, Vol. 4, Pp. 112-215.

#### 4. Definitions and Symbols

This section is presented in three parts: cord usages, knots and knot clusters, and color.

##### Cord Usages

A quipu is made up of cords that vary in length and color. In preparing a single quipu cord, one or more strands were doubled, then twisted together, and finished with an end knot. Thus, the two ends differ; one has a twisted end and the other a knotted end which usually tapers off.



Fig. 1

We identify five basic cord usages. There is a horizontal main cord; cords suspended from the main cord are referred to as pendant cords; cords attached to the main cord but which fall in the direction opposite to pendant cords are called top cords; and cords attached to pendant or top cords are called subsidiary cords. Markers also are attached to the main cord.

Main Cord. Usually the main cord has both ends free and the ends are finished differently. All our measurements begin at the twisted end and proceed to the knotted end. The twisted end is identified by \$, and the knotted end by ç. (See Fig. 2).

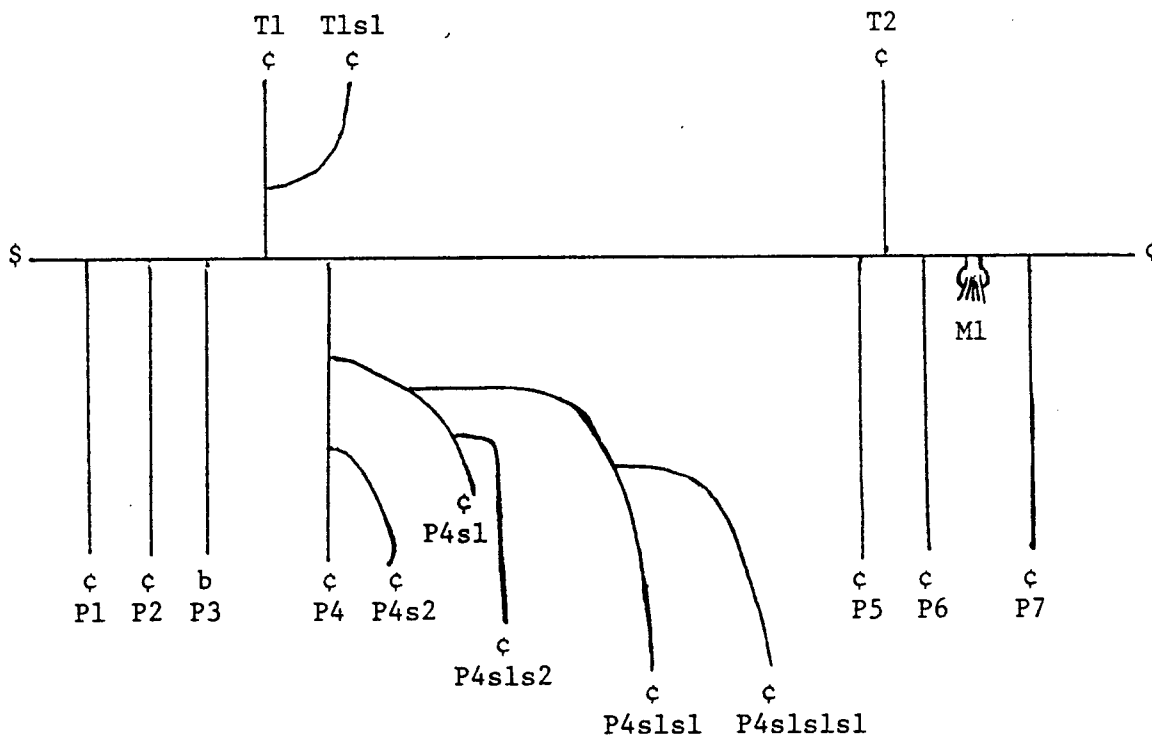


Fig. 2

On some quipus, the twisted end of the main cord is also knotted. This is identified by ç\$, but it still remains the starting point. On

some, the end of the main cord is formed into a loop. Where this or any other peculiar main cord construction occurs, it is specially noted and diagrammed in the Observations section following each quipu description.

Pendant Cord. A pendant cord is usually attached to the main cord by having been passed over the main cord, and then passed through its own twisted end. After being positioned, it was pulled taut so that it is fixed in place. Unless otherwise noted, this is the means of pendant attachment. The free end of the pendant is marked ç when the

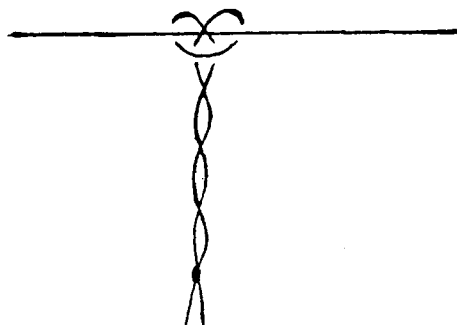


Fig. 3

finishing knot is present. If the pendant has been broken, it is marked b to indicate that it is not complete. When neither ç nor b appears, the pendant end is tapered but it has no end knot, and no obvious break in the cord. In our descriptions, the pendant cords are numbered consecutively along the main cord (see Fig. 2). All measurements on a pendant cord begin at its attachment to the main cord and proceed to its free end.

On some quipus, a cord is linked to the end of the main cord through its twisted end. When this or other special forms of attachment occur, they are described individually.

Top Cord. There are two common forms of top cord attachment. The first is exactly the same as the pendant attachment described above, but due to the way the cord was fixed in place, it is directed upward as compared to a pendant which is directed downward (see Fig. 4A). In the second form, the top cord is attached through the pendant cords rather than directly to the main cord. Here the free end of the top cord was passed through the twisted ends of several pendant cords and then through its own twisted end before the cords were pulled taut (see Fig. 4B). Both arrangements are referred to as top cords (T) and numbered consecutively along the main cord (see Fig. 2); in the latter arrangement, the pendants it unites are also indicated. All measurements on a top cord begin at its attached end and proceed to its free end.

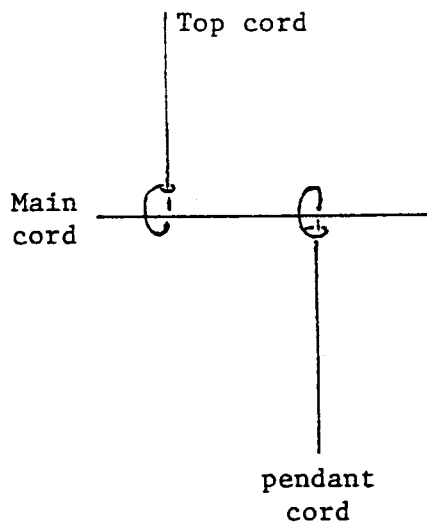


Fig. 4A

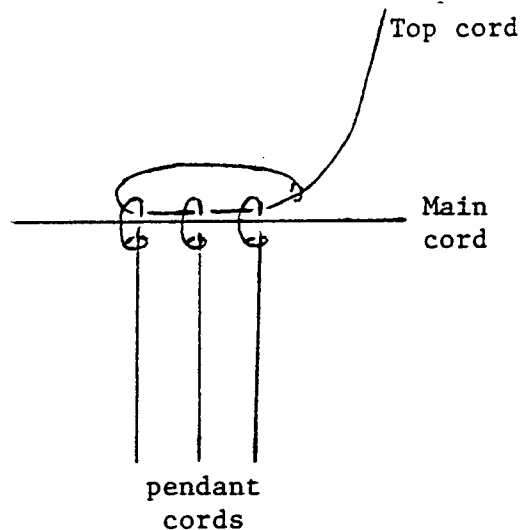


Fig. 4B

Subsidiary Cord. Subsidiary cords are cords attached to pendant cords, top cords, or other subsidiary cords. They are usually attached in the same manner as described above for pendants attached to the main cord (see Fig. 5A). Another less usual form is where the subsidiary is attached through the host cord (see Fig. 5B). The first method is considered usual and carries no special indication; the latter is distinguished by the symbol +.

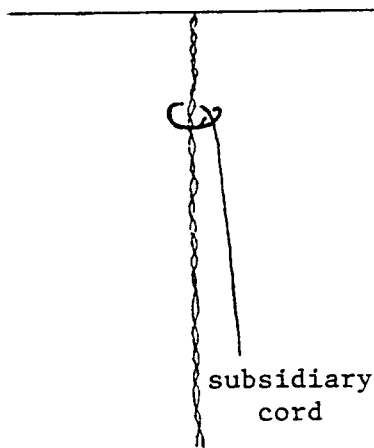


Fig. 5A

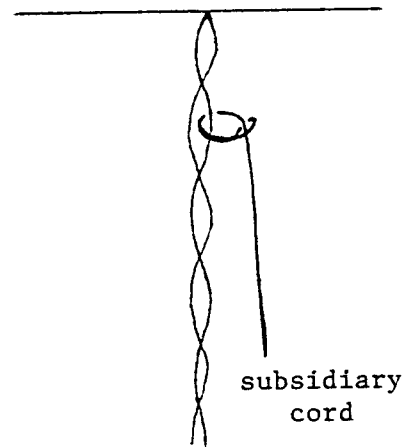


Fig. 5B

Subsidiaries are numbered consecutively along a pendant or top cord (see P4s1 and P4s2, in Fig. 2). Subsidiaries attached to another subsidiary are numbered consecutively along that host (see P4s1s1 and P4s1s2 in Fig. 2), and so on (see P4s1s1s1 in Fig. 2). All measurements on a subsidiary begin at its attached end and proceed to its free end.

Markers. Markers are attachments to the main cord that are noticeably different from pendants or top cords. They are distinctive either by

length, color, or elaborate construction. They are identified by M, numbered consecutively along the main cord, and described in detail with the quipu on which they appear. (See Fig. 2).

### Knots and Knot Clusters

Most of the cords of the quipus have knots spaced along them. We identify three basic knot types on the cords: single knots; long knots; and figure eight knots. When other knots occur they are specially described.

Single Knots. A single knot is an overhand knot formed as in Fig. 6A. Several single knots are considered a cluster when they are close together and, if other single knots are on the cord, they are sufficiently far away to be distinct from them. The cluster of single knots is identified by s preceded by the number of knots (see Fig. 6B).



Fig. 6A

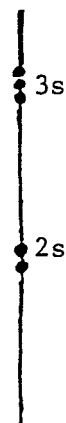


Fig. 6B

Long Knots. Long knots vary in the number of turns used in their construction. Fig. 7 shows a long knot with four turns. When pulled taut, the turns can still be counted and so each is symbolized by an



L preceded by the number of turns. A long knot of one turn (1L) is not possible.



Fig. 7

Figure Eight Knots. A figure eight knot is constructed as shown in Fig. 8A and is designated by E. In some few cases, a similar knot with an extra turn appears (see Fig. 8B). This is designated EE.



Fig. 8A



Fig. 8B

Color

In all previous quipu descriptions (including our earlier work), colors have been described by statements such as "light brown" or "bluish green." Although these descriptors may have been consistent on a given quipu, they are inadequate when discussing quipus that are now located in different places or for conveying colors to others. Since color is an important physical property of the cords, we have standardized the method of description.

We note, however, that the color that we now see is only an approximation of the original color. There is no way of determining the original color although, theoretically, there are ways of determining the original colorants. Two similar but different techniques have been applied to early textiles. Both methods depend on the availability of assumed or hypothesized colorants, are expensive, time-consuming, and most important, destructive. The original colorants cannot, therefore, be obtained in general, and so the color that we now see is described.

Single Color. The Inter-Society Color Council-National Bureau of Standards method of designating colors is used (ISCC-NBS Color-Name Charts Illustrated with Centroid Colors--Supplement to NBS Circular 533). As discussed in Kelly (1965), this is the third level of accuracy of a six-level system. It has two hundred and sixty-seven color-name blocks. Each has a specific number as well as a descriptive name. We use, instead, single or double letter mnemonics for simplicity and to avoid confusion with the other numbers associated with each cord. A complete list, relating our mnemonics to the ISCC-NBS

numbers, is given in Table 5; Table 6 contains the numbers and their complete descriptive names. Single colored cords, therefore, are designated in this Databook by one or two letters.

Multicolor. Many cords are multicolored. They were made by combining strands or cords of two or more colors. Three types of multicolor combinations are clearly distinguishable from each other because of their distinctly different appearances. In order to have unique descriptors that retain the standard designation of the individual colors involved and yet record these differences in appearance, three symbols -, :, / are used as follows: (1) Two colors, say B and G, twisted together resulting in a peppermint stick or barber pole appearance, are designated B-G. (2) When two colors are interspersed so that they give a mottled effect, they are designated B:G. (The color with the lower valued ISCC-NBS number is always listed first in these multicolor designations.) (3) In some cases, colors have been joined such that one begins where the other ends; this is designated by B/G followed by the position on the cord where each color ends.

The same manner of combination is extendable to several colors. For example, B:G:LC means that B and G and LC are interspersed to give a mottled effect; B/LC/G (4.5/8.5/22.0) means that the first 4.5 cm of the cord is color B, the next 4.0 cm (ending at 8.5 cm) is color LC, and the last part of the cord (ending at 22.0 cm) is color G; and (B-G)/LC (8.5/22.0) means that the first 8.5 cm of the cord is B and G twisted to give a "barber-pole" appearance and that the rest of the cord is color LC.

## 5. Format of Descriptions

The description of each quipu is in four parts.

First, the heading identifies the quipu. This has the tag, the present location (museum or private collection), and the identification number that the owner uses within the collection.

The next part is a description of the main cord. Starting at one end, the finishing of the end is described (e.g., twisted, knotted, broken, etc.). Then there is a measurement of the distance along the main cord until the first attached cord is encountered. A cord or cord group is noted and named, then any space until the next cord or cord group is given. Thus, each line in the main cord description begins with a position and describes what occurs until the next position is noted. For example, the quipu in Fig. 9 would have the following main cord description:

§ 3.5 cm:group of 4 pendant cords (1-4), then space of 2.0 cm.

6.5 cm:group of 3 pendant cords united by top cord (5-7,T1), then  
space of 3.0 cm.

10.5 cm:end c

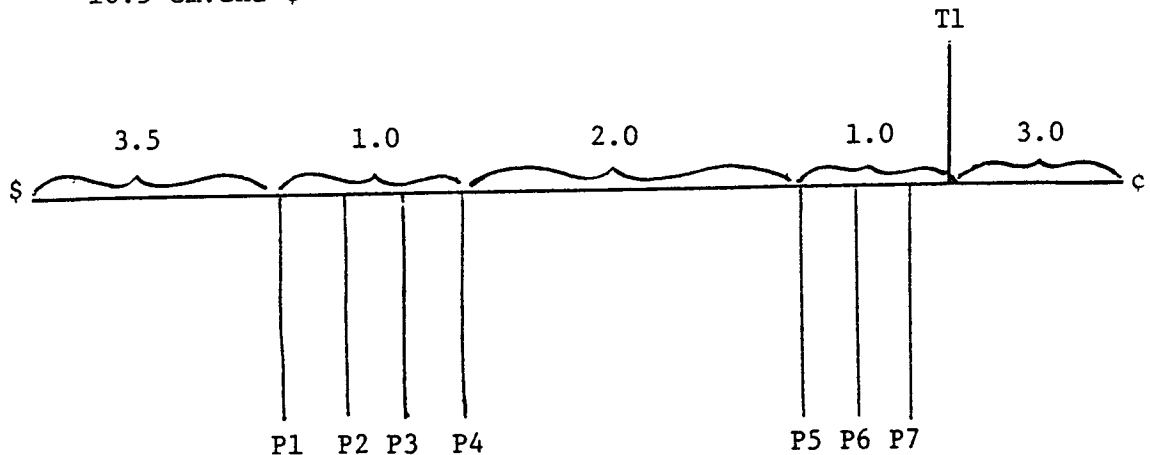


Fig. 9

## TABLE 4

## SYMBOLS

\$	Twisted end of cord - see discussion under Main Cord.
ç	Knotted end of cord - see discussion under Main Cord.
b	Broken end of cord - see discussion under Pendant Cord.
+	Subsidiary attachment - see discussion under Subsidiary Cord.
P2	Pendant cord - see discussion under Pendant Cord.
T2	Top cord - see discussion under Top Cord.
P2s3	Subsidiary cord - see discussion under Subsidiary Cord.
T2s3	Subsidiary cord - see discussion under Subsidiary Cord.
M2	Marker - see discussion under Markers.
3s	Three single knots - see discussion under Single Knots.
4L	Long knot of 4 - see discussion under Long Knots.
1E	Figure-eight knot - see discussion under Figure-eight Knot.
1EE	Figure-eight knot - see discussion under Figure-eight Knot.
X	Color mnemonic - see discussion under Single Color.
XY	Color mnemonic - see discussion under Single Color.
X:Y	Color mnemonic - see discussion under Multicolor.
X-Y	Color mnemonic - see discussion under Multicolor.
X/Y	Color mnemonic - see discussion under Multicolor.

TABLE 5

CORRESPONDENCE OF SINGLE COLOR MNEUMONICS TO  
ISCC-NBS NUMBERS--ALPHABETICAL LISTING

<u>A</u>	AB	57	<u>H</u>	HB	61	<u>R</u>	R	38
<u>B</u>	B	77	<u>K</u>	KB	59		RB	43
	BB	78		KG	156		RD	46
	BD	81	<u>L</u>	LA	191		RG	155
	BG	186		LB	75		RL	42
	BL	185		LC	187		RM	15
	BS	55		LD	192		RØ	39
	BY	79		LG	154	<u>S</u>	SB	54
<u>C</u>	CB	62		LK	267		SR	12
<u>D</u>	DB	56	<u>M</u>	MB	58		SY	84
	DG	126		MG	265	<u>V</u>	VB	175
	DØ	108	<u>N</u>	NB	74		VG	147
<u>E</u>	EB	80	<u>Ø</u>	ØB	95		VR	14
<u>F</u>	FB	65		ØD	128	<u>W</u>	W	Neutral- uncolored
	FR	40		ØG	109	<u>Y</u>	YB	76
<u>G</u>	G	127		ØK	114		YG	151
	GA	64		ØL	111		YY	89
	GB	45		ØR	51			
	GG	150		ØY	72			
	GL	173	<u>P</u>	PB	179			
	GØ	110		PG	149			
	GR	266		PR	41			
	GY	113						

TABLE 6

CORRESPONDENCE OF SINGLE COLOR MNEUMONICS TO  
ISCC-NBS NUMBERS AND DESCRIPTIVE NAMES--NUMERICAL LISTING

12	(SR)	strong Red
14	(VR)	vivid deep Red
15	(RM)	moderate Red
38	(R)	dark reddish Orange
39	(R $\emptyset$ )	gray reddish Orange
40	(FR)	strong reddish Brown
41	(PR)	deep reddish Brown
42	(RL)	light reddish Brown
43	(RB)	moderate reddish Brown
45	(GB)	light grayish reddish Brown
46	(RD)	grayish reddish Brown
51	( $\emptyset$ R)	deep Orange
54	(SB)	brownish Orange
55	(BS)	strong Brown
56	(DB)	deep Brown
57	(AB)	light Brown
58	(MB)	moderate Brown
59	(KB)	dark Brown
61	(HB)	grayish Brown
62	(CB)	dark grayish Brown

64	(GA)	brownish Gray
65	(FB)	brownish Black
72	(ØY)	dark Orange Yellow
74	(NB)	strong yellowish Brown
75	(LB)	deep yellowish Brown
76	(YB)	light yellowish Brown
77	(B)	moderate yellowish Brown
78	(BB)	dark yellowish Brown
79	(BY)	light grayish yellowish Brown
80	(EB)	grayish yellowish Brown
81	(BD)	dark grayish yellowish Brown
84	(SY)	strong Yellow
89	(YY)	pale Yellow
95	(ØB)	moderate Olive Brown
108	(DØ)	dark Olive
109	(ØG)	light grayish Olive
110	(GØ)	grayish Olive
111	(ØL)	dark grayish Olive
113	(GY)	Olive Gray
114	(ØK)	Olive Black
126	(DG)	dark Olive Green
127	(G)	grayish Olive Green
128	(ØD)	dark grayish Olive Green
147	(VG)	vivid dark Green



149	(PG)	pale Green
150	(GG)	grayish Green
151	(YG)	dark grayish Green
154	(LG)	light greenish Gray
155	(RG)	greenish Gray
156	(KG)	dark greenish Gray
173	(GL)	moderate greenish Blue
175	(VB)	vivid dark greenish Blue
179	(PB)	deep Blue
185	(BL)	pale Blue
186	(BG)	grayish Blue
187	(LC)	dark grayish Blue
191	(LA)	bluish Gray
192	(LD)	dark bluish Gray
265	(MG)	medium Gray
266	(GR)	dark Green
267	(LK)	Black

All measurements are to 0.5 cm and so no spaces less than that are recorded. Pendants are identified as a group when they are united by a top cord or when they are sufficiently close together and separated from other cords to be a visual unit. Such a case is seen in the illustration (Fig. 9) where the space of 1.0 cm for four pendants is followed by a space with no cords for 2.0 cm. When visualizing cords and spaces between them, it is important to keep in mind that cords have width. The accuracy of 0.5 cm thus suffices and, in the illustration above, corroborates that the four pendants are a group as the space between them is unmeasurable.

The third part of the description focuses on the individual cords in the order that they are encountered along the main cord. Thus, the first column headed Cord designates the cord (i.e., P3, T1, M2). As you read across the row, this cord is described: the knots (number, type, position on cord); overall length and type of end finish; color; value; subsidiaries (number and position on cord). The subsidiaries are described individually on the lines following the host cord. For example, if pendant P4 has three subsidiaries as shown in Fig. 10, the entries are:

<u>Cord</u>	. . .	<u>Subsidiaries</u> (no., position)
P4		2:2.5-3.0;1:5.5
P4s1		1:3.5
P4s1s1		
P4s2		
P4s3		

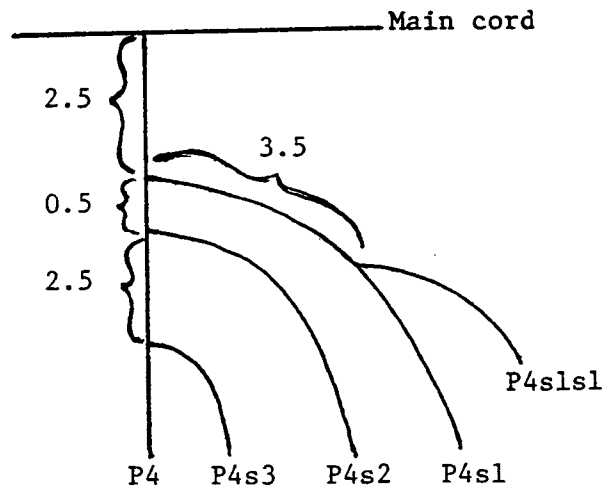


Fig. 10

The column headed Value carries our numerical interpretation of the knots. The interpretation assumes that the knot clusters represent digits in a base ten positional system. A complete discussion of this is found in earlier works (Ascher and Ascher 1975). In the interpretation of knots as numbers, the relative position of clusters along the cord is of paramount importance. The positions are recorded with the knot types so that others can make their own interpretations. However, assigned values have also been included as it is frequently easier to identify relative position along a cord, and from cord to cord, when actually seeing the knot clusters in context of the entire quipu. Some symbols are used that are special to this column and related to the problems of interpretation. Sometimes, when a cord is broken, no value can be assigned. In this case, the value is designated the symbol ?. If some part of the cord remains, partial interpretation is often possible. If, for example, the cord is broken between the first and second digits of a three digit number and the

first digit is 5, the value assigned would be 5?? meaning that the value is at least 500 and at most 599. If the same cord were broken higher so that 4 knots in the first cluster remained, but it is not clear if originally there were additional knots, the value assigned would be (4+)?? meaning that the value is at least 400 and at most 999. Finally, where the assignment of a value is dubious due to inconsistent knot placement or some other peculiarity, the value is followed by (?). In some cases, the type of knot associated with the units position appears both in the units position and then again just after that. This is designated by, for example, 4 & 2, in order to relate both knot clusters to the same position without merging the values. Hence,

Entire Value Unknown	?
Specific Digits Unknown	X??
Digit Possibly Incomplete	(X+)
Value Assigned is Dubious	XX(?)
Double Units Position	XX&X

The last section of each quipu description contains Observations about the quipu. These are of several types: (i) Any information that the owner gave on provenance, associated artifacts, and any other helpful references about the quipu are noted. (ii) Any particular construction features of the quipu that are not amenable to inclusion in the standard format are noted and described in detail. (iii) If two or more quipus were associated with each other--for example, if they were found in a basket or a bag--that is noted and observations

about the quipus as a collection are included with the first specimen encountered in the listings. (iv) Finally, there are observations about regularities and relations found on the quipu. They include, for example, color patterning, subsidiary placement, and relative order of magnitude of cord values. They also include numerical relationships between values such as some being sums or products of others. These observations are of the type discussed in (Ascher and Ascher 1972). The observations are not exhaustive, but are included as a step toward the accumulation of ideas that make up the logical-numerical system expressed on quipus. Further interpretations will be found in our forthcoming general treatment of quipus (A Piece of String: in preparation).

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