THE STRUCTURE OF THE CODEX COLOMBINO-BECKER

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The two fragmentary Mixtec manuscripts known now as the Colombino[1] and the Becker I[2] each present a lengthy series of painted scenes devoted principally to the conquests, rituals, and other significant activities of an important pre-Hispanic Mixtec warrior and ruler. Both came to light in Mexico somewhat after the middle of the 19th century, but apparently under different circumstances.[3] Although both manuscripts share certain striking similarities, the exact nature of their relationship has been a matter of discussion among specialists for a number of years. Most scholars have followed the opinion of Eduard Seler,[4] who considered that both were part of the same single codex. J. Cooper Clark,[5] however, was inclined towards considering them as two distinct codices, although reserving final judgment on the point. Karl Nowotny[6] discussed their similarities in a study of the Becker but did not state a conclusion on their relationship. The first attempt at a detailed synthesis of the pictorial contents of the two was made by Alfonso Caso[7] in a study centering upon the Colombino but also encompassing the Becker and portions of several other Mixtec codices. By comparing the pictorial data in the Colombino and Becker with that of similar Mixtec manuscripts, Caso[8] concluded that the two were indeed the parts of a single original codex, fragments of which were still missing.

This paper will not offer any interpretation or discussion of the pictorial information in the Colombino or the Becker but will instead examine the form and functioning of the physical structure of these manuscripts. These structural aspects, if treated at all, have usually been mentioned only tangentially in the

[1] Inventory number 35-30 in the Museo Nacional de Antropología, México, D. F.

[2] Inventory number 60306 in the Museum für Völkerkunde, Vienna. The Roman numeral designation of this manuscript will be omitted in the remainder of this paper.

[3] The histories of the manuscripts are briefly summarized in Caso, A., 1966, pp. 13-14.

[4] Seler, E., 1902-23, vol. 1, p. 155.

[5] Clark, J. C., 1912, pp. 5-6.

[6] Nowotny, K., 1961, p. 1.

[7] Caso, A., op. cit.

[8] Ib., pp. 14-17.

analysis of the pictorial content of the existing Colombino and Becker fragments. It will be shown here, however, that certain regularities in the physical design of the original codex continue to function in the surviving fragments completely independently of the pictorial content, and that these features govern the physical relationships of the extant fragments. As a consequence, all correlations between the pieces must be made within the framework of this system if the results are not to be in conflict with the form of the original codex.[9] Some of the structural features to be discussed have been recognized and used for many years by students of Mixtec codices, while others are expressed here for the first time; the ramifications of all these features have remained essentially unexplored to date, however. The present paper will first examine the complex interrelations of these various structural features and propose techniques for resolving the problems that arise from these relationships, then these data will be applied to detailed studies of correlations between specific Colombino and Becker fragments.

The Colombino is fragmented into four pieces and the Becker into three.[10] Pages 1-15 of the Colombino comprise its Fragment I; pages 16a-16-16A, Fragment II; pages 17a-19, Fragment III;[11] and pages 20-24, Fragment IV. In the Becker, pages 1-4A form Fragment 1; pages 5a-14, Fragment 2; and pages 15-16, Fragment 3. The overall reading direction for both manuscripts is from left to right; that is, the reading of each fragment begins on its left side and ends on its right side. Both manuscripts are painted on only the obverse face of long strips of skin that have been folded to form a screenfold.

In physical form a screenfold is a long, relatively narrow strip of skin or paper which has been folded accordion-fashion to a compact, book-like size. Folds in alternate directions and at equidistant intervals have been made across the strip at right angles to its length, and serve to divide the whole strip into a linear series of pages of uniform length. The regular, sequential alternation in the direction

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[9] This fact has obvious implications for content analysis, because the order of arrangement of the fragments determines the sequence in which the pictorial scenes are read and may also influence the interpretation of those scenes.

[10] For physical descriptions of these manuscripts see Nancy P. Troike, 1969 y 1970. All page references for the Colombino will be cited here in Arabic numbers equivalent to the Roman numerals used by Caso, A., *op. cit.*, and by Chavero, A., 1892, in their respective editions of this manuscript. The established pagination sequences of both the Colombino and the Becker exclude the small fragmentary pages that occur in each; such page remnants are designated here with the page number of the immediately adjacent numbered page plus either a lower-case *a* if the remnant precedes, or a capitalized *A* if it follows, this numbered page. The possibility that copies of some of the missing Colombino pages might be found in the "Codex Moguntiacus" has been suggested by Ernst Mengin in two brief papers, 1958a, pp. 585-91 and 1958b, pp. 455-57. However, Caso *(op. cit.,* pp. 17-18) has dismissed these pages (and similar ones in two other unpublished manuscripts) as falsifications, and they are excluded from consideration here.

[11] Page 17a is a small, irregularly-shaped piece of skin preceding page 17; for a full description see Troike, N. P., 1970. Since it does not form a part of the obverse face of the manuscript and has no bearing on the later correlations of Fragment III, its presence will be disregarded in the remainder of this paper and Fragment III will be treated as though it began with page 17.

of succesive folds creates the physical form of the screenfold and will be called the *fold sequence*. Because of it, successive pages along each side of a screenfold strip alternately face towards and away from each other when the codex is folded; this is illustrated in Figure 1, where (on the obverse side of the strip) pages 3 and 4 face towards one another while pages 2 and 3, or 4 and 5, face away from each other. A screenfold codex is normally opened for reading so that two pages are visible side by side, the pairs of pages seen together in this way being those that face towards one another when the manuscript is folded. The type of fold shared between such pairs of pages will be termed an *inside fold,* while that shared between the adjacent pages that face away from each other will be called an *outside fold.* The fold sequence in all screenfold manuscripts consists of the regular alternation of inside and outside folds. In Figure 1 there is an inside fold between the facing pages 1 and 2, an outside fold between the non-facing pages 2 and 3, an inside fold between pages 3 and 4, etc.

Because the direction of successive folds must alternate, determining the correct direction of even a single fold is sufficient to establish the proper fold sequence for the entire original strip in which it occurs. Any interruption in the regular order of the folds indicates a discontinuity in the codex; conversely, a disruption of the original fabric of a codex will interrupt its regularly alternating fold sequence. Due to this fold alternation, any two successive folds in a screenfold manuscript will always be in opposite directions and will mark off one page in the codex. Any three successive folds will define two consecutive pages, and the first and third of these folds will always be in the same direction; that is, both will be outside, or both will be inside, folds. The fold sequence that characterizes a single page will also hold true for any odd number of successive pages: the first and last folds in the sequence will always be in opposite directions. The fold series for two pages is also true for all even numbers of consecutive pages: the beginning and ending folds will always be in the same direction.

These simple physical facts allow for the determination of the minimum page loss between any of the separate pieces of a fragmentary screenfold codex. Between two fragments whose disjuncture is framed by folds in opposite directions, at
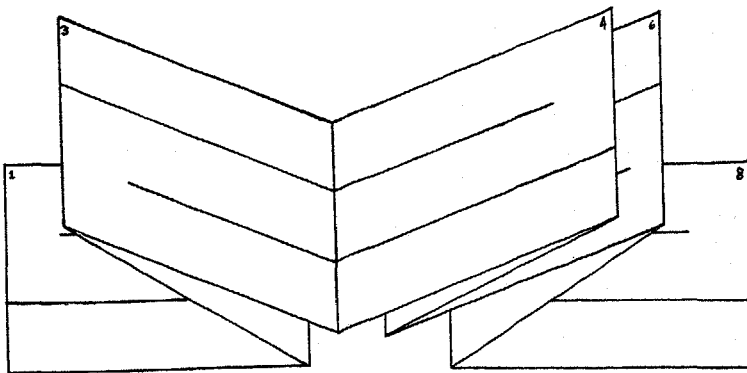

FIG. 1.—Form of a typical screenfold codex.

least one page must be lost, and the aggregate number of missing pages must total to an odd number. If the folds by the disjuncture are both in the same direction, then the minimum loss must be two pages, and the total of lost pages must be an even figure. It is necessary to emphasize very strongly that these structural data do not establish the *actual* number of pages lost between the fragments—only recovery of the missing part of the original manuscript can do that—but merely the *least* number that might be missing.

The Colombino and the Becker belong to a class of Mixtec codices in which all the scenes of the pictorial contents are normally intended to be read in one single stream of narration. In order to guide and control the sequence in which these scenes are read, the native artists painted sets of parallel red lines on the pages, dividing the space into a series of areas or bands within which the scenes were depicted. Each band was left open on its ends to both the proceding and following bands, in effect creating one continuous channel through the whole manuscript for all these pictorial data. Because the red guide lines framing this channel were drawn in a labyrinthine pattern, the channel winds in a boustrophedon fashion, the scenes in successive bands on a page being read in opposite directions.

Abstracting and analyzing the designs which the red guide lines form on the individual pages of a codex will reveal that a number of different patterns are present. If the placement of these lines in each different pattern is sketched within a separate outline form of a page, the result will be a set of models of guide line placement that will be called *page patterns*. Page patterns can be defined only in reference to a particular codex and so must be established separately for each different manuscript. Since the overall placement of the guide lines in each separate page pattern of a codex is different from that of all the other patterns in the same manuscript, each pattern as a result will also have a unique reading sequence; that is, the point at which the reading of the pictorial contents begins, the order and direction in which the bands are read, and the point at which the exit from the pattern occurs, will be different for each different pattern. The definition of a page pattern is the sum of its characteristic traits in a specific codex: the physical position of its red guide lines and the reading sequence of its bands.[12] Although this definition may be written out, it can usually be expressed more easily in a drawing, with arrows indicating the reading sequence within the pattern. Once a pattern has been studied and defined, it may then be assigned a letter designation; reference to it is greatly simplified by this, since the letter can serve in discussions in place of repeating the definitive characteristics of the pattern.

Figure 2 shows in outline form the seven extant fragments that now constitute the Colombino-Becker. Below each page is the page number it carries within its

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[12] That these red guide lines form different designs has of course long been obvious to students of Mixtec codices, but if the lines themselves are mentioned at all, it is only in the context of explaining their service as guides to the sequence in which the bands of scenes should be read. In this respect the lines of the Colombino or the Becker have been utilized, and their operations usually explained, by Henri de Saussure, 1891; Alfredo Chavero, *op. cit.*, p. X; Francisco del Paso y Troncoso, 1892, vol. 1, pp. 57-58; Clark, J. C., *op. cit.*, p. 5; Nowotny, K., *op. cit.*, p. 4 and Caso, A., *op. cit.*, p. 17. However, the various designs have never been discussed *per se*, nor have models been based upon them.

COLOMBINO

Fragment I (pages 1-15):

O A-I -B O C-I -D O A-I -B O C-I -D O A-I -B O C-I

1　2　3　4　5　6　7　8　9　10　11　12　13　14　15

Fragment II (pages 16a-16-16A):

(a) (A-) I -B O $\left(\dfrac{C-I}{E}\right)$

(b)　　I -B O $\left(\dfrac{C-I}{E}\right)$

(c) (A-) I -B O

16a　16　16A

Fragment III (pages 17a-19):

I -D O A- I -B O

17a　17　18　19

Fragment IV (pages 20-24):

O A- I -B O X I X O E

20　21　22　23　24

BECKER

Fragment 2 (pages 5a-14):

I X_2 O E I F O C- I -D O A_2- I -B_f O X I E O A- I

5a　5　6　7　8　9　10　11　12　13　14

Fragment I (pages 1-4A):

(a) I F O E O F I O X I

(b) O I E I F I O

1　2　3　4　4A

Fragment 3 (pages 15-16):

O C- I -D O

15　16

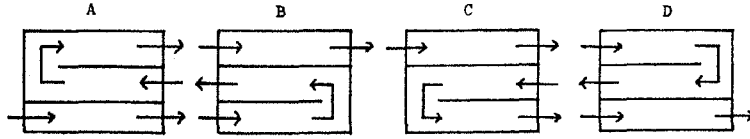FIG. 2.—Extant fragments of the Codex Colombino-Becker.

FIG. 3.—Page patterns A, B, C, and D.

respective manuscript.[13] Most pages are complete from fold to fold; the few that are not are indicated in the figure by a broken line at their incomplete side. Four of these latter are the very small remnant pages found at the beginning and end of Colombino Fragment II, at the end of Becker Fragment 1, and at the beginning of Becker Fragment 2; these remnants are omitted from the following discussions unless specifically noted as being included.

An examination of the sketches of Colombino Fragments I, II and III in Figure 2 will show that only four different page patterns are in use in these three fragments. These four patterns are defined in Figure 3, with arrows indicating the directions and sequences in which the bands of each are read, and are assigned the respective type letters A, B, C, and D. These arrows also reveal that in no case can all three of the bands in a single pattern be read in one continuous sequence; one band in each pattern is completely isolated from the others by a guide line which extends across the full width of the page. The result of such patterns would seem to be an interruption or discontinuity in the maintenance of a single channel for all the contents of the manuscript. However, if the A and B patterns are joined together, the A on the left and the B on the right, their combined patterns will be found to form a larger unit in which it is possible to read through all the bands of both pages in a single continuous stream merely by crossing back and forth between the two pages. Figure 4 shows the A and B patterns joined together, with arrows indicating how the path of reading winds across both pages. The C and D patterns function together in a similar manner and are also shown joined together in Figure 4, the C on the left and the D on the right. Two page patterns which are so intrinsically linked together that all their bands can be read in a single continuous sequence only when each pattern is joined in a particular position to a specific companion pattern, may be said to constitute a *dual-page set*. In order to express the mutually dependent relationship of these patterns, their letter designations will be connected with a hyphen: A-B,
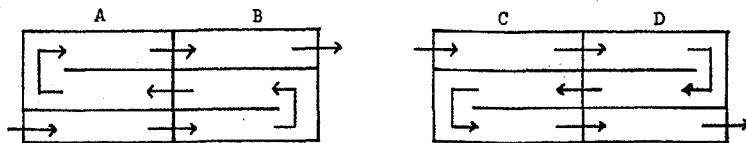

FIG. 4.—Dual-page sets A-B and C-D.

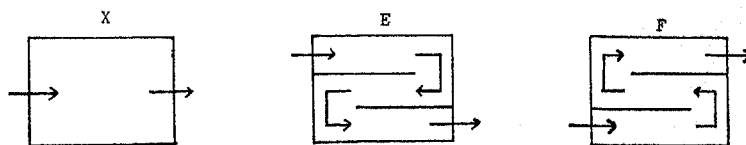13 The letters marked above the pages will be explained later.

FIG. 5.—Page patterns X, E and F.

C-D. References to the individual patterns of such sets will be written with this hypen in its appropriate position: A-, -B, C-, -D.

Three different designs will be found in the latter pages of Colombino Fragment IV and in Becker Fragment 1; the page patterns of these are defined in Figure 5, where they are designated as X, E and F. The X pattern is unique in that it contains no internal red guide lines, the whole page in effect functioning as a single band. There are guide lines in both the E and F patterns, but, in contrast to dual-page sets, these lines are so placed that all the bands in each pattern may be read through in a continuous stream without recourse to another page. Since none of these three patterns contains any internal structural impediment to the complete reading of all its pictorial content, they may be called *single-page* patterns. The type letters of these patterns will remain separate to indicate their structural independence: X, E, F.

Becker Fragments 2 and 3 contain the same page patterns previously identified in the Colombino and in Becker Fragment 1, with the exception of the designs found on pages 5 and 10 in Fragment 2. Page 5 is divided by a jagged line into two unequal bands; it is sketched in Figure 6, with arrows indicating its reading sequence. Of these two bands, the lower one is only cul-de-sac terminating at the right fold of the page, while the upper band maintains the necessary continuity of reading with the following page. Since in this design the reading continuity of the manuscript is maintained only through a single band, in function the design is similar to an X pattern; but because the actual physical form here is not that of the standard unbanded X defined in Figure 5, if this design is classified as an X it must necessarily be qualified. The design on page 5 will therefore be designated as an X_2 pattern, the presence of the subscript indicating that a functional subtype of the specified X pattern is involved, and the subscript number itself indicating the number of bands found in the actual design. The X_2 will be classed as a single-page pattern, as is the normal X.

Page 10 of Fragment 2 is divided into two completely separate bands by a single guide line. An examination of this design and that of the following page
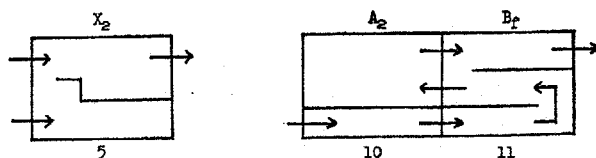
FIG. 6.—Page pattern subtypes X_2 and A_2-B_f.

11, which is marked with an apparently normal F pattern, will show that these two pages are actually functioning together as a dual-page A-B set. Their designs are sketched in Figure 6, with arrows showing the reading sequence. The design on page 10 is functionally an A- pattern even though the page is only partially banded in the standard A- form; it will therefore be written as A_2-, the subscript number again qualifying the pattern letter and indicating the number of bands physically present. Page 11 functions as the necessary -B companion page and will be written as -B_f, the qualifying subscript (written with a lower-case letter to avoid confusion) in this case indicating that the page is physically banded as an F pattern.

These seven different page patterns—A-, -B, C-, -D, X, E, F—exhaust the inventory of the basic patterns found in the Colombino and the Becker. The three unique designs found in Becker Fragment 2—X_2, A_2-, -B_f—are all functional subtypes of one of these seven standard patterns. The letter designation of the appropriate pattern type (or subtype) is given above each of the complete pages in the fragments sketched in Figure 2.

It has been demonstrated previously that the reading of a dual-page set involves crossing several times between its two pages, as illustrated in Figure 4. Neither of the patterns comprising such a set may be read in a continuous sequence if taken alone; it is only when each is accompanied by the proper companion pattern that all the pictorial contents of both may be read completely and without interruption. These facts form the basis for the following series of structural deductions. First: since each pattern in a dual-page set can function correctly only in association with its proper companion pattern, the presence of one member of such a set allows for the prediction of the other member, even though the latter may no longer be extant. Second: since both pages of a dual-page set must be read together, they must therefore be seen together, and so must face one another in the fold sequence of the codex, for it is these facing pages which are seen together when a screenfold manuscript is opened for reading. Third: since the facing pages in a screenfold always share an inside fold between them, each dual-page set will have an inside fold between its two pages. Fourth: since establishing the direction of one fold is sufficient to establish the fold sequence for the entire piece in which it appears, the predictable occurrence of an inside fold between the pages of each dual-page set supplies a structural basis for determining the fold sequence of every strip containing such a set or portion of a set.

The situation in regard to single-page patterns is considerably different. As the arrows in Figure 5 demonstrated, the reading of all the pictorial contents in a single-page pattern is complete within the individual page. Beyond the essential constraint of maintaining a continuous channel from one page to the next for the pictorial data, such a pattern does not otherwise affect the pattern used in the pages adjacent to it. There is no necessity for a consistent structural relationship between a single-page pattern and a particular fold sequence because the respective directions of the folds framing the pattern do not impinge upon its internal continuity. In actual practice, the directions of the folds for any single-page pattern in a codex are determined by the fold sequence already in use in that manuscript,

and consequently the fold sequence for such patterns cannot be specified apart from their context within a particular codex. As a result, single-page patterns do not contribute any independent structural information towards the determination of the fold sequence of the manuscripts in which they are found.

Colombino Fragments I, III, and IV, and Becker Fragments 2 and 3, each contain one or more dual-page sets which provide the structural basis for determining their fold sequences. The directions of all the folds in these five fragments have been marked in Figure 2 by the use of the letter I or O (for inside and outside, respectively) above each fold. The fold sequences of the two remaining pieces, Colombino Fragment II and Becker Fragment 1, cannot be determined on structural grounds, although for different reasons. The Becker fragment is the only one of the seven pieces to be composed entirely of single-page patterns, and since these do not furnish the structural data necessary to establish an exact fold sequence, both of the ways in which this fragment may be folded must be considered equally possible: Fragment 1 might begin with either *(a)* an inside fold or *(b)* an outside fold. Both these fold sequences are marked in Figure 2 above the folds of this fragment. The problem of determining the fold sequence for Colombino Fragment II is more complex and is based upon the published measurements of this fragment.[14] Physically, this small fragment consists of the three page areas labeled in Figure 2 as pages 16*a*, 16, and 16*A*. Page 16 comprises the bulk of the piece and shares a fold with each of the two small fragmentary pages; however, these two folds do not necessarily mean that the fragment contains three separate pages, since pages with "extra" internal folds across them are found elsewhere in both the Colombino and the Becker.[15] The total length of the fragment indicates that it must contain more than one page, but whether one of the two remnant pages should be combined into page 16—and if so, which one—or whether both should be considered the remnants of separate pages, are not questions that may be resolved structurally. The various possible fold sequences for Fragment II will be discussed below in more detail in conjunction with determining the page patterns of these remnant pages.

The maintenance of continuity in the stream of pictorial data in a manuscript is dependent upon the sequence in which the page patterns follow one another. The patterns on adjacent pages must be such that the reading can continue without structural interruption from one page into the next; consequently, patterns may not directly adjoin one another *if such a continuous reading is not structurally possible between them.* Figure 7 shows the number and sequence in which the patterns occur in the 40 substantially complete pages of the Colombino-Becker. Each of the seven basic patterns of the codex is listed by pattern letter (the X_2-, A_2-, and $-B_t$ subtypes are included with the respective appropriate standard patterns), and an eighth symbol, ϕ (zero), is included to show the lack of an

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[14] Troike, N. P., 1970.

[15] "Extra" folds have been described by Troike, 1969 and 1970, as occurring in all the pages of Colombino Fragment IV and in the first page of Becker Fragment I. There is no apparent function for these "extra" folds in the completed codex and they have therefore been omitted from Figure 2, except for the folds mentioned in Colombino Fragment II.

	A-	-B	C-	-D	X	E	F	∅
A-		7						1
-B			4		2	0		2
C-				5				1
-D	5				0		0	1
X	0		0		1	3	0	1
E	1				0		2	1
F			1		1	1		0
∅	2	1	1	1	1	0	1	

FIG. 7.—Sequences of preceding and following page patterns.

adjoining pattern for those pages falling at the beginning and end of each frag-ment. Selecting a pattern letter in the column at the left side of the figure and reading across the row beside it will indicate the number of times it is followed by each of the patterns listed at the top of the figure. By reversing this procedure and locating a pattern letter in the row at the top, reading down the column under it will show the number of times it is preceded by each of the patterns in the left column. A blank in the chart signifies that such a sequence is not possible because the forms of the two patterns do not allow a continuous reading. In addition to the sequences which are found in the extant pages, these seven basic patterns may also be combined to form still other sequences which do not occur in the preserved pages. These structurally possible pattern combinations are indicate in Figure 7 by a small circle (o) in lieu of a number. There is at present no way of determining whether the absence of these sequences from the extant fragments is simply the result of historical accident in that certain pages of the original codex were preserved while others were lost, whether it might arise from the personal preferences of the artists, or whether it perhaps reflects the normal practice or even a "rule" in the permissible sequence of patterns. However, the implications of this latter possibility suggest that those sequences found in the ex-tant fragments should be kept distinct from the other structurrally possible but unattested combinations for which an actual example is lacking in the present codex.

Figure 8 also shows the sequences in which the patterns may follow one another. The letters of the seven basic patterns are arranged in a circle, with X ocurring twice in the circle because it is the only pattern that may succeed itself (see Figure 7). All patterns directly connected by an arrow may follow one another, but only in the direction of the arrow; the solid arrows connect attested sequences and the broken arrows connect unattested but structurally possible sequences. This figure may be used to make a rapid test of the structural plausibility of any given sequence of page patterns.

There are four fragmentary pages which are too small for their page patterns to be directly determined: pages 16a and 16A, found respectively at the beginning and end of Colombino Fragment II; page 4A, at the end of Becker Fragment 1; and page 5a, at the start of Becker Fragment 2. Figures 7 and 8 furnish the bases for determining the range of patterns that each remnant might have, based on the sequences of patterns that are structurally permissible for the complete page still adjacent to each remnant. As indicated above, the number of pages in Colombino Fragment II is open to question. The pattern on page 16 is that of a -B, and the upper guide line of the pattern is continued unbroken across both remnants; consequently, if either page 16a or 16A is interpreted as a separate page, each must have a pattern that contains an upper guide line. Figure 7 reveals that the
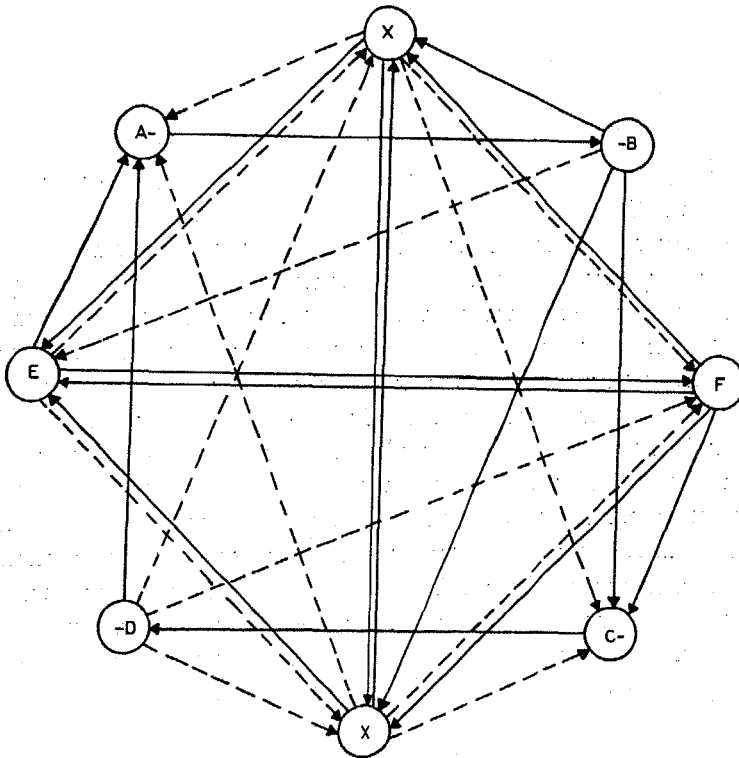

FIG. 8.—Sequences of following page patterns.

only page pattern that can precede -B is its companion A-, which also contains such an upper guide line; therefore if page 16*a* is a separate page, it must have an A- pattern. Figures 7 and 8 show that -B may be followed by C- and X, and by the unattested E; the presence of an upper guide line would eliminate the unbanded X from consideration here. Both the two remaining patterns have an upper guide line; C- is attested after -B while E is not, but both are structurally possible and one of them must appear on page 16*A* if it is interpreted as an independent page. Three different versions of Fragment II result: as consisting of *(a)* three pages, page 16*a* being considered the remnant of the A- companion to the -B of page 16, and page 16*A* a portion of either a C- or an E; *(b)* two pages, pages 16*a* and 16 being taken together to form a single -B page, and page 16*A* being a fragmentary C- or E; or *(c)* two pages, page 16*a* being considered an A- remnant while pages 16 and 16*A* are combined to form a single -B page. Structurally, each of these three versions is equally possible. Although each results in a different set of page patterns and a different placement of the folds, the -B page allows for the structural establishment of the old sequence of each interpretation. These three fold series and pattern sequences are listed separately in Figure 2 above Fragment II.

There are two page remnants in the Becker, one at the end of Fragment 1 and the other at the beginning of Fragment 2. No band lines are visible on either remnant, which would seem to indicate that each had an X patterns, but such a tiny portion of each page is now preserved[16] that no interpretation of the original pattern can be made with any certainty. The last complete page in Fragment 1 preceding its remnant is an X, while the first page of Fragment 2 following the remnant there is the X_2. Figures 7 and 8 show that X patterns are known to be followed by X and E, and might perhaps be followed by the unattested A-, C-, and F; they may be preceded by -B, X, and F, and possibly by -D and E. The patterns that may follow the X at the end of Fragment 1 will vary with the fold sequence in use for that fragment. In the *(a)* fold sequence of Fragment I the X pattern ends with an inside fold that would prevent the A- and C- patterns from following it, but in the *(b)* fold series the page ends in an outside fold that would present no structural obstacle to the occurrence of any of the five patterns that may follow an X. For Fragment 2, the reading continuity of the unique X_2 begins at the left side of its upper band so that a preceding banded page would need to have a reading sequence that terminates at its upper right band. This would eliminate E, which terminates at its lower right side, and since the X_2 has an inside fold at its left side, the fold sequence would eliminate -B and -D. X is thus one of the possible patterns that may occur on each of these two remnants, but in no case is it structurally the only pattern that might so occur. Consequently, the most advisable course in regard to these two fragmentary Becker pages seems to be to leave their patterns unspecified but to recognize X as the most probable design of each.

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[16] See Troike, N. P., 1969, for exact measurements.

The structural features of the page patterns and fold sequences in the Colombino and Becker may now be expressed simply and succinctly by a notational system in which each page is represented by its appropriate patterns letter and the position of the outside folds among these is indicated by a diagonal line (/). Each two successive diagonals would therefore define a pair of facing, adjacent pages which would be seen together when the codex was opened. The predictable alternation in fold direction makes it unnecessary to mark the inside folds, which should be understood to occur between any two successive pattern letters where an outside fold is not explicitly marked. A plus-sign (+) will be used to indicate the presence of the small remnant pages of unspecified pattern in Becker Fragments 1 and 2. Utilizing these various conventions, the structure of the seven extant fragments of the Colombino-Becker is summed up in Figure 9. Both of the possible fold series for Becker Fragment 1 are given, along with the three different interpretations of the form of Colombino Fragment II. All the remnant pages are written within parentheses since only a tiny part of each such page is now preserved; the two alternate patterns for page 16A of Colombino Fragment II are written one above the other to indicate that only one of them can occupy that position.

Figure 9 clearly reveals the present fragmentary nature of the Colombino-Becker; the two pieces that have multiple interpretations emphasize the difficulties of restoring these fragments to the form and order which they occupied in the original codex. The structural data that have been previously presented furnish the physical bases for correlating the fragments, however.

Since the sequence of pages in each fragment is linear, the initial and final pages of each piece form the only points of potential contact between the fragments, and correlations of the separate fragments are therefore necessarily primarily

COLOMBINO

Fragment 1   /A-B/C-D/A-B/C-D/A-B/C-D/A-B/C-

Fragment II (a)   (/A-)-B/$\left(\dfrac{C-}{E}\right)$

(b)   -B/$\left(\dfrac{C-}{E}\right)$

(c)   (/A-)-B/

Fragment III   -D/A-B/

Fragment IV   /A-B/X X/E

BECKER

Fragment 1 (a)   F/E F/X (+)

(b)   /F E/F X/(+)

Fragment 2   (+) X$_2$/E F/C-D/A$_2$-B$_1$/X E/A-

Fragment 3   /C-D/

FIG. 9.—Page patterns and fold sequences of extant Colombino-Becker fragments.

correlations of such terminal pages. Between any two fragments of the same codex, one of two structural relationships must exist: either it is, or it is not, structurally possible for the two pieces to be joined directly together. For a direct connection to be possible, the fold series and page patterns of the terminal pages of both pieces must be in accord; that is, the pages must end in folds in the same direction and must have patterns between which a continuous reading is possible. Although it is usually sufficiently obvious when the designs of two patterns do not permit a continuous reading, the maintenance of a properly alternating fold sequence is equal in importance to the pattern sequence in determining whether or not two fragments may be fitted together. A conflict in either of these features means that a direct connection is not possible and that consequently pages must be missing between the pieces.

In establishing the structural relationship of any two fragments it is therefore first necessary to determine whether their fold sequence and page patterns allow them to be directly connected; if so, the interpreter may then accept or reject that connection. But if the pieces cannot be joined together (or should a possible direct connection be rejected), the next step is to determine from the fold sequences of the two fragments the minimum number of pages missing between them. Since the minimum loss will be either one or two pages, this figure must be tested to confirm that the gap between the pieces can be closed structurally in such a limited number of pages. This test consists of attempts to construct, with the various patterns available in the codex and in the appropriate number of pages indicated by the fold sequences, one or more hypothetical page sequences that could be joined to the ends of the two fragments to bridge between them. These postulated sequences must of course maintain the fold alternation and the continuity of the channel for the pictorial data between the two extant pieces. At least one such set of patterns must be established in order to confirm that the loss figure indicated by the fold sequences is the least possible number of pages that could have occurred between the fragments. If no such page sequence can be found after all the structurally possible co-occurring pattern combinations of the manuscript have been explored, then a greater number of pages than this must be missing between the pieces. Consequently the next larger appropriate odd or even figure must be tested to see if it allows a workable page sequence to be created; progressively higher figures are tested as necessary until such a sequence is achieved. The smallest number of pages required for completion of at least one pattern sequence between the two fragments is then the structural minimum of pages that may be lost between those pieces. For example, should the fold sequences of two fragments indicate that an even number of pages is missing between them, tests would first be made for the minimum possible even loss, two pages; only if it proved structurally impossible within the space of two pages to coordinate the permissible pattern sequence and the established fold sequence, would a larger even number of pages need to be explored, first four and then if necessary six.

The series of page patterns used in these hypothetical test pages may be composed of attested or unattested pattern sequences or a combination of both. Sequences which utilize a mixture of attested and unattested co-occurrences, as

well as those that are composed entirely of unattested patterns, should both be considered as unattested, and contrasted with those composed entirely of attested pattern sequences. Because the status of unattested sequences is uncertain, it is preferable to test known sequences first and to resort to an unattested series only after all the possible attested patterns have been exhausted without success. However, some instances may be found in which the use of an unattested sequence will allow two fragments to be bridged in fewer pages than are required by attested patterns; sequences should then be worked out for both types.

In discussing the application of these structural features to the correlation of fragments, two points have been mentioned that are of a different nature from the other data; these occur in relation to decisions on whether to accept or reject the physically possible direct connections, and whether to utilize unattested page pattern sequences or to rely exclusively on attested sequences. The alternatives that occur in each case are equally plausible structurally so that a decision to select one in preference to the other cannot be based on the structural data alone. Another related point which has not yet been discussed in this paper is the question of how to select the sequence of fragments that best re-creates the form of the original codex. Physically, the fragments may be arranged in any desired order without there being any structural reason to prefer one arrangement to another. Although it is obvious that only one sequence can duplicate the original, this order cannot be determined solely on the basis of structural data. For all three of these points, the decisions that must be made are interpretative choices which can be made only on the basis of a wide range of knowledge gained through previous experience with the codex under study and with other manuscripts of a similar nature. Each choice is an interpretation that reflects both the interpreter's judgment of the individual situation and his concept of the form of the original codex; although the physical data remain unchanged, it should be expected that the interpretative choices from among them may vary with different specialists. There is nothing wrong *per se* with imposing interpretations upon the data.[17] Interpretations are an essential part of the analytic process; in order for the available structural information to be utilized for the three sets of circumstances mentioned above, one solution must be singled out from among the possibilities as the "correct" or at least the "preferable" one, and all others rejected as "incorrect" or "less desirable." Although non-structural information must form the basis for the decisions on these structural problems, the interpretations themselves must always remain within the physical framework of the manuscript. A conflict cannot arise between the physical structure and a proposed interpretation except when the interpretation is offered without first having been checked for structural validity; should such a conflict be found, the interpretation is in error and should be corrected.

The extant Colombino-Becker fragments will be interpreted in this paper as occurring in the sequence: Colombino Fragments I, III, IV, Becker Fragments 1, 2, 3. The position of Colombino Fragment II in this series will receive separate

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[17] However, all interpretations should be explicitly characterized as such; failure to differentiate them unequivocally from the data on which they are based may result later in confusion between fact and conjecture.

attention because of the problems surrounding its various possible correlations. The procedure outlined above of suggesting hypothetical but structurally possible sequences of page patterns to bridge between fragments will be followed here in order to determine the least number of pages that might have been lost between the extant fragments. It must be stressed that no implication is made or intended that any of these postulated page sequences represent the actual patterns or the actual numbers of pages that originally occurred in the undivided codex; the sequences function solely as test devices for exploring the structural conditions of each particular correlation. The analyses which follow will be concerned exclusively with the physical interrelations of the fragments; no consideration will be given to the compatibility of their pictorial contents. The basic structural data to be used in these correlations have been summed up previously in the co-occurring pattern sequences shown in Figures 7 and 8, and in the page patterns and fold sequences of the individual fragments given in Figures 2 and 9. Because the fold sequences of the fragments are a necessary part of the information needed in making correlations, the positions of the outside folds are indicated in the discussions when relevant.

The first two extant fragments of the original codex to be considered are Colombino Fragments I and III. Fragment I ends with an inside fold and the /C- half of a dual-page set; Fragment III begins with an inside fold and the -D/ half of a dual-page set. Each partial dual-page set must be completed by the necessary companion page, a requirement that could be satisfied by joining the two fragments directly together. Since both pieces terminate in inside folds, their fold sequences are compatible, and there is therefore no structural barrier to their being joined together to form a single strip 18 pages in length: /A-B/C-D/A-B/C-D/A-B/C-D/A-B/C-D/A-B/. Should such a direct connection of these pieces be rejected, however, the fact that both terminate in inside folds indicates the loss of an even number of pages between them, two pages being the fewest that could be missing. Each of the fragmentary dual-page sets must be completed by the appropriate companion page, a follownig -D for the final /C- of Fragment I and a preceding C- for the initial -D/ of Fragment III. These two missing but predictable companion pages are equal to the minimum number of lost pages indicated by the fold sequences of the two fragments, but Figures 7 and 8 show that -D may not be immediately followed by C- because no continuous reading is possible between their patterns. Since there is no option in the choice of these -D and C- patterns to complete their respective dual-page sets, the fact that reading continuity cannot be maintained between them means that these two patterns are structurally insufficient to bridge between the fragments; therefore the next greater even number of pages, four, must be tested. Figures 7 and 8 show that following the predictable -D companion at the end of Fragment I, A- is the only page form attested, although the unattested X or F might perhaps occur. Preceding the predicted C- at the start of Fragment III, -B and F are the only attested patterns, with X as an unattested possibility. To construct a page sequence utilizing only attested patterns, the predicted -D must be followed by A-, which in turn then demands its companion -B; -B is known to be followed

by C-, and there is a predicted C- at the start of Fragment III. An attested sequence of -D/A-B/C- could therefore close the gap between the fragments in four pages, as could structurally possible but unattested sequences such as -D/X X/C- or -D/F X/C-.

Colombino Fragment III ends with a -B/ page while Fragment IV opens with an /A- page. These fragments cannot be joined together because -B may not immediately precede A-; both pieces terminate in outside folds, indicating the loss of an even number of pages between them. A study of Figures 7 and 8 will show that such attested sequences as /C-D/ or /X E/ could span this gap in two pages, while an unattested sequence such as /E X/ would also serve.

The study of the relationship between Colombino Fragment IV and Becker Fragment 1 is complicated by the lack of a structurally definable fold series for the Becker fragment. Fragment IV ends with an inside fold and an /E page. E is known to be followed by A- and F, and might be followed by X; A- is barred by the fold sequence of Fragment IV from occurring, however. Fragment 1 begins with an F pattern, which is known to be preceded only by E, although -D and X are also possible. It will be necessary to make separate correlations for each of the two ways in which Fragment 1 may be folded.

(a) This fold series for Fragment 1 is F/E F/X (+), the fragment opening with an inside fold and an F/ page. Since Colombino Fragment IV closes with an inside fold and an /E pattern, their fold sequences are compatible and their page patterns may be read continuously, thereby allowing the two fragments to be joined directly together to form a strip of slightly more than nine pages in length: /A-B/X X/E F/E F/X (+). Should such a direct joining not be accepted, however, the fold sequences would show the loss of an even number of pages. Due to the fold sequence in use here for Fragment 1, -D could not precede the initial F/ page, leaving as possible preceding patterns only the attested E and the unattested X. As a consequence, the only attested sequence which can bridge between the fragments in two pages is F/E, although unattested sequences such as X/E or X/X are also structurally possible.

(b) This fold sequence is /F E/F X/(+). Fragment 1 begins with an outside fold, indicating that an odd number of pages is missing between it and Fragment IV; one page is therefore the minimum possible loss. However, X/ is the only pattern which could span this gap in one page, and although structurally possible, it is unattested in this environment. A study of the pattern sequences in Figures 7 and 8 will show that if only attested sequences are utilized, at least three pages would be needed between these fragments, and that even then this could be accomplished only by the sequence F/X E/.

The correlation of Becker Fragments 1 and 2 not only necessitates calculations for both of the ways in which Fragment 1 may be folded, but is further complicated by the presence of the small remnant pages at the end of Fragment 1 and at the beginning of Fragment 2, Fragment 1 ending with X (+) and Fragment 2 beginning with (+) X_2/. Only pattern sequences utilizing X will be postulated here for these remnant pages. The number of pages lost between Fragments 1 and 2 will be calculated from the terminal folds of the last complete page adjacent

to each remnant, so that these two small remnants will actualy by treated as being among the missing pages.

(a) The fold series F/E F/X (+) for Fragment 1 has an inside fold at the right side of the final /X page, the fold sequences of the two fragments thus indicating the loss between them of an even number of pages. The attested sequence X/X would suffice to span between the fragments in two pages.

(b) The /F E/F X/(+) fold sequence of Fragment 1 ends with an X/ page and an outside fold; an odd number of pages would then be missing between it and Fragment 2. An attested /X would bridge this gap in a single page.

Becker Fragment 2 ends with an /A- page and an inside fold; Fragment 3 opens with a slightly incomplete /C- page and an outside fold. These fold series show an odd number of pages to be missing. The final /A- of Fragment 2 requires a following -B companion, which could also serve to close the gap between the pieces in a single page.

One last fragment remains to be discussed—Colombino Fragment II, the smallest of those still extant. Retaining the six other Colombino and Becker fragments in the same order as that in which they have been discussed above, structurally Fragment II in any one of its three possible forms might fall anywhere in this sequence; i.e., prior to the start of the Colombino, between any two fragments, or following the end of the Becker.[18] A complete study of the fragment would therefore necessitate correlating all three of its forms in all possible positions with all the other fragments. Although only six other pieces are extant, the two alternate fold sequences of Becker Fragment 1 mean that correlations would actually have to be made with seven structurally differing pieces. Since the beginning and end of Fragment II would need to be correlated respectively with the end and the beginning of each of the other fragments, calculations would be needed for 14 different positions. But the three different forms of Fragment II itself would result in three different sets of these 14 correlations, so that a complete inventory of possible positions for the fragment would call for a total of 42 positional correlations. Such a detailed consideration of this fragment would not be practicable here, so the *(b)* interpretation, $-B/\left(\dfrac{C-}{E}\right)$, has been selected for analysis. In this interpretation pages 16*a* and 16 are combined into a single -B/ page, and page 16*A* is considered the remnant of either a /C- or an /E pattern. Consequently, all page sequences preceding page 16*a*-16 must end in the necessary A- companion

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[18] Clark, J. C., *op. cit.,* p. 26, suggested that Fragment II be placed as "the next page but one" following the end of Colombino Fragment IV, which would indicate that he interpreted Fragment II as beginning with a—B pattern and intended that the single intervening page be an A—. Such a placement is not physically possible, however, because it violates the fold sequence of Fragment IV; since that fragment ends with an inside fold, a minimum of two pages must intervene before the occurrence of another inside fold such as is found at the left side of the—B pattern. Caso, A., *op. cit.,* pp. 12, 16, 17, 45, figure following p. 18, has suggested various positions for Fragment II, principally as falling after the end of Becker Fragment 3 or perhaps following Becker Fragment 2, but he stresses that the placement of this piece remains very uncertain.

to this -B, while those following it can open only with the C- or E pattern that begins on page 16*A*.

Figure 10 has been drawn up to show the set of 14 relationships between this *(b)* interpretation and the remaining fragments of the Colombino-Becker. The two outside columns of the chart give the form of Fragment II *(b)* as it precedes and follows each of the other fragments, these latter appearing in the center column abbreviated to the page patterns and folds of their opening and closing pages. Because the form -B/(E) of Fragment II *(b)* contains in itself the unattested sequence of E following -B, all page sequences postulated after this form of the fragment must be considered unattested. The minimum number of pages missing at each correlation has been determined from the interactions of the fold series and the possible pattern sequences that might be used to span between the two fragments being correlated; the smallest number that may be lost structurally is given in the chart in each case. More than one sequence of patterns in suggested

Colombino Frag. II (b) Preceding	Examples of Unattested Sequences	Examples of Attested Sequences	Minimum No. Lost Pages	Other Fragments	Minimum No. Lost Pages	Examples of Attested Sequences	Examples of Unattested Sequences	Colombino Frag. II (b) Following
-B/(C-)		-D/	1	**Col. I:**				-B/(C-/E)
-B/(E)	X/		1	/A-.../C-	2	-D/A-		
-B/(C-)	....	....	0	**Col. III:**	3	/C-D/A-, /X E/A-	/E X/A-	-B/(C-/E)
	-D/X F/C-	-D/A-B/C-	4	-D/...-B/				
-B/(E)	F/C-		2					
-B/(C-)		-D/	1	**Col. IV:**	2	F/C-D/A-, F/X E/A-	X/A-	-B/(C-/E)
-B/(E)	X/		1	/A-.../E				
-B/(C-)	-D/X	-D/A-B/X X/E	2	**Beck. 1 (a):**	2	X/X E/A-	X/A-	-B/(C-/E)
-B/(E)	....	....	0	F/.../X (+)				
	F/E, X/X		2					
-B/(C-)	-D/	-D/A-B/X E/	1	**Beck. 1 (b):**	3	/X E/A-	/X X/A-	-B/(C-/E)
-B/(E)	X/		1	/F...X/(+)				
-B/(C-)	-D/X	-D/A-B/X	2	**Beck. 2:**	0	....	....	-B/(C-/E)
-B/(E)	F/X, X/X		2	(+) X₂/.../A-	4	-B/C-D/A-, -B/X E/A-	-B/E X/A-	
-B/(C-)	....	....	0	**Beck. 3:**	1	A-		-B/(C-/E)
	-D/X F/	-D/A-B/	3	/C-D/				
-B/(E)	F/, X/		1					

FIG. 10.—Correlations between Colombino Fragment II *(b)* and all other Colombino Becker fragments.

for some correlations but no attempt has been made to be exhaustive. For those correlations in which a direct connection is one of the structural possibilities, separate calculations are made for the acceptance and rejection of such a joining. The small page remnants at the end of Becker Fragment 1 and the beginning of Becker Fragment 2 are both included among the missing pages, but because X is the most probable pattern of each, all page sequences listed in the chart have the positions of these remnants filled by X patterns.

Since a discussion of all the correlations in Figure 10 would become redundant, the positioning of Fragment II *(b)* between Becker Fragments 2 and 3 may be singled out for illustrative purposes. There are four possible ways this Colombino fragment and the two Becker pieces may be correlated: Fragment II *(b)* may be directly connected *(1)* both to the end of Fragment 2 and to the beginning of Fragment 3, or *(2)* to the end of Fragment 2 but not to the beginning of Fragment 3, or *(3)* to the beginning of Fragment 3 but not to the end of Fragment 2; or *(4)* it may not be attached directly to either fragment but still lie between them. Each of these alternative correlations results in a different set of structural possibilities.

(1) The structurally possible direct connection between the end of Becker Fragment 2 and the beginning of Fragment II *(b)* is a simple one. Fragment 2 ends with an /A- page and an inside fold while Fragment II *(b)* opens with a -B/ page and an inside fold; these complementary fold series and page patterns allow the two pieces to be joined, the connected pages forming a dual-page set. The direct connection that is possible between the end of Fragment II *(b)* and the beginning of Fragment 3 is somewhat more complex. All that now remains of the final page 16A of Fragment II *(b)* is a small part of its left side which has a pattern that may be interpreted as a /C-, while Fragment 3 opens with a /C- page which is slightly incomplete at its left side. It is structurally possible, in terms of their respective page widths, for these two incomplete C- pages to be combined into one single page; the width of both when combined totals to slightly more than 25 cm., well within the normal range of page size in the Colombino and in the Becker.[19] With Fragment II *(b)* connected to Fragments 2 and 3, a single strip of some 13 pages would be formed (page 16A disappearing as a separate page): $(+)$ X_2/E F/C-D/A_2-B$_f$/X E/A-B/C-D/.

(2) In this set of correlations, Fragment II *(b)* is connected to Fragment 2 but not to Fragment 3. The final /A- page at the end of Fragment 2 and the initial -B/ of Fragment II *(b)* are joined directly together as explained in *(1)* above. Between page 16A of Fragment II *(b)*, which ends in an inside and has either a /C- or an /E pattern, and the beginning /C- of Fragment 3, an odd number of pages is lost. If page 16A is interpreted as an /E, then an F/ or X/ will bridge between it and Fragment 3, and the minimum loss is one page. If page 16A is thought to be a /C-, however, at least three pages would have to be missing. This /C- must be followed by its companion -D; -D cannot directly precede the

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[19] See Troike, N. P., 1970, Table 1, for Colombino page measurements, and 1969, Table 1, for Becker measurements.

/C- that opens Fragment 3, so that an attested sequence such as -D/A-B/ or an unattested one such as -D/X F/ would be necessary to reach Fragment 3.

(3) In this set, Fragment II (b) is attached to the beginning of Fragment 3 but not to the end of Fragment 2. The direct connection of Fragment II (b) and 3 has been discussed in (1) above. Between the final /A- of Fragment 2 and the opening -B/ of Fragment II (b) at least four pages must be lost, the two predictable companion pages that complete these dual-page sets being structurally insufficient to bridge between the fragments. Attested sequences such as -B/C-D/A- or -B/X E/A-, or an unattested sequence such as -B/E X/A-, could close the gap.

(4) If Fragment II (b) lies between Fragments 2 and 3 without being directly connected to either of them, then between it and Fragment 2 at least four pages would be missing, as explained in (3) above. Between it and Fragment 3, one page would be lost if page 16A was interpreted as an E pattern, or three pages would be gone if the remnant were thought to be a C-, as described in (2) above.

The sequence in which the fragments of the Colombino-Becker have been interpreted as occurring in this paper may now be expanded to include the (b) form of Colombino Fragment II in the position in which it has been discussed above, between Becker Fragments 2 and 3. All the foregoing correlations have indicated the minimum numbers of pages that may be lost between the various fragments of the Colombino-Becker in one particular sequencing of these extant fragments. But as the attendant discussions have revealed, the fewest pages lost between two fragments may vary depending upon whether attested or unattested sequences are considered, or whether possible direct connections are adopted or rejected. Since the selection of one particular type of correlation from among those structurally possible at a given point is a matter of interpretation, the criteria upon which such a choice is based need to be stated plainly. These criteria might be unique for each correlation, or they might be applicable to all the correlations in a manuscript, such as a decision to rely entirely upon attested page sequences. Whatever the criteria, it is essential that they be made explicit so that other workers may evaluate the conclusions based upon them.

If to this sequence of the Colombino-Becker fragments the single criterion is applied of selecting those correlations that result in the fewest possible number of missing pages, using unattested page sequences if necessary as well as any structurally possible direct connections, the following would result: Colombino Fragments I and III would be directly connected; at least two pages would be lost between Fragments III and IV; Fragment IV would be directly attached to the (a) form [20] of Becker Fragment 1; at least two pages would be missing between Fragments 1 (a) and 2; Fragment 2 would be joined directly to the (b)

[20] Correlations of either the (a) or (b) forms of Fragment 1 in this position will show the loss of a minimum of two pages from the original codex. For the (b) form, at least one page is lost between it and Fragment IV, and another between it and Fragment 2. In the (a), a direct connection can be made with Fragment IV, but at least two pages are missing before Fragment 2. The (a) form is preferred under the stated criterion of economy because the direct joining which it permits will then allow the seven fragments to be combined into three strips, whereas the use of the (b) would result in four strips.

interpretation of Colombino Fragment II, which in turn would be directly attached to Fragment 3. Such a sequence would combine the seven present fragments into three strips, the first containing Colombino Fragments I and III; the second, Colombino Fragment IV and Becker Fragment 1 *(a);* and the third, Becker Fragment 2, Colombino Fragment II *(b),* and Becker Fragment 3. Using question marks to indicate the least possible number of pages missing between the unjoined pieces, this interpretation of the minimum form of the original codex may be represented as: /A-B/C-D/A-B/C-D/A-B/C-D/A-B/C-D/A-B/? ?/A-B/X X/ E F/E F/X ?/? X₂/E F/C-D/A₂-Bf/X E/A-B/C-D/. (The page remnants at the end of Becker Fragment 1 *(a)* and the beginning of Fragment 2 are included as a part of the two pages missing between those fragments. Page 16*A* of Colombino Fragment II *(b)* disappears as a separate entity since it forms the left side of the first page of Becker Fragment 3.) In this sequence there are 40 extant pages and at least four lost pages, two of which are still represented in the Becker by small remnants. Therefore if the original codex was in this form, it could not have contained fewer than 44 pages.

Retaining this same sequence without altering the relative positions or forms of any of the fragments, but merely changing the interpretive criteria so that all direct connections are rejected and only attested page sequences are used to bridge between the fragments, will cause the minimum number of lost pages to rise to 17: /A-B/C-D/A-B/C-D/A-B/C-D/A-B/C-?/? ?/?-D/A-B/? ?/A-B /X X/E ?/? F/E F/X ?/? X₂/E F/C-D/A₂-Bf/X E/A-?/? ?/?-B/(C-)?/? ?/ C-D/. (The two Becker page remnants are again included among the pages missing between Fragments 1 *(a)* and 2.) Because page 16*A* of Colombino Fragment II *(b)* is retained as an independent page, there are 41 pages extant in this sequence; of the 17 missing pages, only two are represented by remnant pages. If the original codex was in this form it must consequently have contained at least 58 pages.

The discrepancies in the results of these two sets of correlations are quite obvious, yet the physical forms and positions of all the fragments are exactly the same in both cases: the differences between the correlations are entirely the result of the differences in the interpretive criteria applied. Such results point up the crucial role of interpretation in the reconstruction of fragmentary manuscripts and emphasize again the necessity of stating the criteria used in making all correlations.

These same forms and sequences of the fragments may be made to yield other figures by varying the general criteria from one correlation to the next, and by accepting and rejecting various combinations of the structurally possible direct connections. Still other figures will result if Becker Fragment 1 and Colombino Fragment II are kept in their present positions but interpreted in different forms. Quite different overall results will be obtained should the placement of the individual fragments be changed in any way from the specific sequence which has been analyzed here. A complete inventory of all the ways the seven extant fragments may be correlated would call for nine additional charts similar to Figure 10, each of which would focus upon the postulated correlations structurally

possible between one fragment (or one of the forms of a fragment) and the other remaining pieces.

The problem of whether pages may have been lost preceding the present beginning of the Colombino or following the present end of the Becker has not been discussed because such questions cannot be resolved structurally. The existence of additional pages at these points is a matter of interpretation, and even if they are thought to have occurred, there is no structural way to determine their number. At present, Colombino Fragment I opens with an outside fold and Becker Fragment 3 closes with an outside fold, so that the unused reverse faces of the initial page of the former and the final page of the latter would form the two outer surface of the folded manuscript. Any even number of pages attached directly to the beginning of Fragment I or to the end of Fragment 3 would place the unpainted reverse face of the new terminal page on the outside of the folded codex. An odd number of pages at either location would result in the obverse face of the terminal page being outermost; although this is the face on which the pictorial contents of the codex are painted, such pages would be quite serviceable as covers if they were simply left unpainted.

Any consideration of the total length of the original codex from which the seven extant fragments have survived must now involve both interpretation and speculation. The present Colombino-Becker contains 40 pages that are either complete or practically complete, plus remnants that may represent from one to four additional pages.[21] For any particular arrangement of the fragments, an interpreter may determine structurally the least number of pages missing between the various pieces; these figures and those for the number of extant pages will yield the minimum provable size of the original codex under the applied interpretations. However, widely differing figures may result because of different interpretations of the proper sequence for the fragments or of the criteria for their correlation. In addition, an interpreter may consider that more pages are lost between some of these fragments than the structural minimum, or that pages are missing before the start or following the end of the codex. Any figures given in relation to such circumstances, whether stated in concrete terms or as estimates, are entirely a matter of speculation. Although speculative, such figures are useful because they allow an interpreter to present a fuller idea of the possible size of the original codex, in comparison with the more exact, but also more restricted, size based only upon the structural data. Considering the present condition of the Codex Colombino-Becker and the problems associated with the sequencing of its fragments, it does not seem unreasonable to suggest that the original codex may have reached or even exceeded 60 pages in length.

[21] Page 16 of Colombino Fragment II is included among the 40 complete pages. There are four additional pages if pages 16a and 16A of Fragment II, 4A of Becker Fragment 1, and 5a of Fragment 2, are each considered to represent separate pages. There is evidence of only one additional page if the two Becker remnants are considered to be the two sides of the same single page, and Fragment II is interpreted in its *(b)* form, with page 16a forming the left side of page 16, and page 16A becoming the left side of the first page of Becker Fragment 3. The data for the page remants may be combined in various other ways to yield evidence for there having been only two or three additional pages.

While all the structural information in this paper has been derived directly or indirectly from two very simple physical features in the Colombino-Becker—the fold sequence and the page patterns—the analytical techniques by which these data were obtained and utilized may also be applied to a wide range of other manuscripts. For example, the data pertaining to the fold sequence are typical of screenfold manuscripts in general and may be utilized in any screenfold manuscript regardless of its place of origin or the nature of its contents. The information concerning the page patterns, and the functioning of these patterns in combination with the fold sequence, may be employed in the study of screenfold manuscripts having pages banded in the fashion of the Colombino-Becker. For these latter manuscripts, following a system similar to that introduced here of the use of symbols to represent the patterns and folds will simplify the analysis of these manuscripts and allow their structure to be studied more exactly.

It has not been the purpose of this study to attempt the resolution of specific correlation problems in the Colombino-Becker, but only to indicate the nature of these problems, the types of decisions that must be made about them, and the results that must follow from these choices. Since each sequencing of the extant fragments and their subsequent correlations represent interpretations, these may well be the source of legitimate differences of opinion concerning the original form of the codex. However, the structural analyses which have been presented here provide the framework within which all interpretations of the physical form of this codex must be made. Although structural analysis is only one of the tools necessary for the study of codices such as the Colombino-Becker, it can make a useful contribution towards the goal of all research work on these manuscripts: the reconstruction of their original content so that it may be used in modern attempts to understand the past.

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