EARLY OLMEC WRITING: READING FORMAT AND READING ORDER

David F. Mora-Marín

This paper analyzes the reading format and reading order of the recently described Cascajal Block, an artifact with an Olmec-style inscription. The analysis, based not on the iconicity of the signs and their orientation, but solely on the formal and organizational characteristics of the text as a whole, and the patterns of repeated sign sequences, suggests that the text was written from left-to-right, bottom-to-top—if one assumes the orientation assigned to the block by Rodríguez Martínez et al. (2006). However, a simple 90-degree rotation of the block would render the text in left-to-right, top-to-bottom reading format and order—the same as that of later Mesoamerican scripts. It is suggested that the San Andres roller stamp and the La Venta obsidian core, both of which exhibit a pictorial image and an accompanying text, allow for a determination of the relative orientation of text and image with respect to each other, and support the hypothesis for the reading format proposed here. Also, preliminary structural analysis of the text reveals several patterns that are possibly indicative of linguistic structuring, and steps for future work on decipherment are outlined. Finally, the findings are placed within a broader context of previous studies of Olmec writing.

El presente artículo constituye un análisis del formato y dirección de lectura del recién descubierto Bloque de Cascajal, un artefacto con una inscripción de estilo olmeca. El análisis se basa exclusivamente en los rasgos formales y composicionales del texto en sí, además de los patrones de repetición de secuencias de signos, y no en la presunta orientación e iconicidad de los signos, rasgos utilizados por Rodríguez Martínez et al. (2006). El análisis sugiere que el texto fue escrito en columnas—y no en hileras horizontales—de izquierda a derecha, de arriba hacia abajo, una vez que el texto es reorientado noventa grados a la derecha con respecto a la orientación propuesta por dichos autores. Los resultados concuerdan con las características de los sistemas de escritura más antiguos de Mesoamérica ya conocidos—zapoteca, epi-olmeca, maya. También se sugiere que el sello cilíndrico de San Andrés y el taladro de obsidiana de La Venta, ambos caracterizados por una imagen pictórica acompañada por un posible texto, permiten la tarea de determinar la orientación relativa de texto e imagen, apoyando los resultados basados en el Bloque de Cascajal. Además, un análisis estructural preliminar del texto provee varios patrones que podrían ser indicativos de una organización lingüística, y varios pasos para una futura labor de desciframiento son esbozados. Finalmente, los resultados de este artículo son contextualizados dentro de un marco análitico de estudios previos sobre la escritura olmeca.

Recently, a group of scholars (Rodríguez Martínez et al. 2006) published a description and analysis of a unique document for the study of prehispanic history, the Cascajal Block (Figure 1), named after the archaeological site in Veracruz, Mexico, where it was recovered. The discovery represents a potential flashflood of insights and discoveries for many years to come, not unlike that made possible by the discovery of La Mojarra Stela 1 (Winfield Capitaine 1988), which has led to significant progress in the decipherment of the Isthmian or Epi-Olmec script (Justeson and Kaufman 1993, 1997; Kaufman and Justeson 2001, 2004), and facilitated the interpretation of thematically related pictorial art (Guernsey Kappelman 1997). The goal of the present paper is to contribute to the investigation of this newly discovered document with an assessment of its reading format and reading order, as well as a preliminary structural analysis of portions of the text necessary to make inferences about the reading format and reading order. In addition, after the analysis is conducted and the results presented, a discussion of its implications in light of previous research on Olmec writing, including the description of the San Andres Stamp (Pohl et al. 2002), is provided.

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Figure 1. The Cascajal Block. (Rodríguez Martínez et al. 2006: Figure 4).

The Discovery and Its Context

Olmec scholarship began with the archaeological investigations by Matthew Stirling (1940, 1943) and the art historical investigations by Miguel Covarrubias (1942, 1957). The original archaeological discoveries took place at the site of La Venta and San Lorenzo in Veracruz, Mexico, not far from the site of Cascajal, an area nowadays referred to as the southern Gulf lowlands. However, "Olmec" sites, defined as such stylistically, are known from a much broader area, including Central Mexico, Guerrero, and the Pacific coast of Chiapas and Guatemala. The stylistic unity evident throughout these areas has led to much debate about the ethnolinguistic nature of the "Olmec" and about the origin of Olmec civilization (e.g., Clark 1990). Debate continues, and in fact, a series of recent studies of pottery exchange (Blomster 2002; Blomster et al. 2005; Neff et al. 2006) could support previous suggestions that the Olmec style, and the political ideology it expressed, were diffused from the Southern Gulf lowlands region outward, although differing views exist (Diehl and Coe 1995; Flannery and Marcus 2000; Grove 1989, 1993, 1997).

Until recently the evidence for hieroglyphic

writing, one of the most salient of all Mesoamerican traits (Kirchhoff 1952), has been rather limited: did the Olmecs invent writing and then spread it throughout Mesoamerica along with other cultural products and ideas, or was writing the result of multiregional developments, with relatively little mutual influences? The Cascajal discovery suggests that Olmec writing did exist, as claimed by a variety of authors for the past five decades (Gay 1973; Kelley 1966; Méluzin 1987, 1995; Pohl et al. 2002), and possibly much earlier than writing elsewhere in Mesoamerica, as Rodríguez Martínez et al. (2006) argue. However, the dating of the Cascajal block, placed at ca. 900 B.C. by Rodríguez Martínez et al. (2006), must be regarded as tentative, given reservations expressed by David Grove and John Clark (Lawler 2006:1551). These reservations highlight the circumstantial association of the block to other remains, and the vicinity to the site of San Lorenzo. Such reservations are valid, pending future archaeologically contextualized findings of similar inscriptions.

Methodological Notes and Assumptions

The goals of this paper are primarily methodological ones. The first is to test to what extent it is possible to study the reading format and reading order of the Cascajal text without simply assuming a pattern of left-to-right, top-to-bottom columns and rows typical of several Mesoamerican scripts: is there evidence internal to the text itself—assuming for now that it is analyzable as a coherent whole—that would allow one to make such a determination? And the second goal is to attempt a structural analysis of sign sequences in order to assess whether the text is internally consistent in a way that could possibly suggest linguistic structure. This paper does not have decipherment as one of its goals. Nor does it assume that writing can only be a representation of a natural (spoken or signed) language. Writing can be of a semasiographic or glottographic type, the former defined as the use of graphic conventions to represent specific ideas through nonlinguistic organizational principles, and the latter as the use of graphic conventions to represent specific ideas through linguistic organizational principles (Haas 1976). Mesoamerican scripts developed both principles (Boone 1994), and thus it cannot be assumed a priori that evidence

of internal structure is the same as evidence of linguistic structure. In fact, Rodríguez Martínez et al. (2006:1612) suggest that the text meets the "criteria" for writing, and in doing so they implicitly assume a definition of writing as a representation of spoken language: "The text deploys: (1) a signary of about 28 distinct elements, each an autonomous, codified glyphic entity, (2) a few in repeated, short, isolable sequences within larger groupings, (3) a pattern of linear sequencing of variable length, with (4) a consistent reading order. As products of a writing system, the sequences would by definition reflect patterns of language, with the probable presence of syntax and language-dependent word order."

Nevertheless, to test whether a writing system represents a spoken language it is necessary to first "try it out" as a representation of a specific language, in order to determine whether it matches the grammatical structure—phonology, morphology, syntax—of such language. It is simply too soon to make such an assertion, particularly because the criteria mentioned by those authors, even when considered together, are not unique to glottographic scripts. Nevertheless, it is a necessary methodological step toward decipherment to make a linguistic assumption as a basis for hypothesis-testing. With this in mind, Campbell and Kaufman (1976) have made a very strong argument in favor of some form of Mije-Sokean as the language of the Olmecs, and thus, Mije-Sokean should be the first hypothesis to be tested in this regard. But for now, the first step is simply to examine the signary defined by Rodríguez Martínez et al. (2006) more closely.

Analysis of Formal Characteristics

The Signary

The original description of the Cascajal Block was accompanied by a preliminary sign catalog that displayed the frequency of each sign attested (Rodríguez Martínez et al. 2006:Figure 5). Upon close inspection of the text and the sign catalog the present author considers it necessary to make three revisions. Two signs, C(ascajal) S(ign) 10 and CS 20 (Figures 2a–b), share a common component, a triangular, downward-pointing element. This is quite possibly a distinct sign, not just a graphic ele-
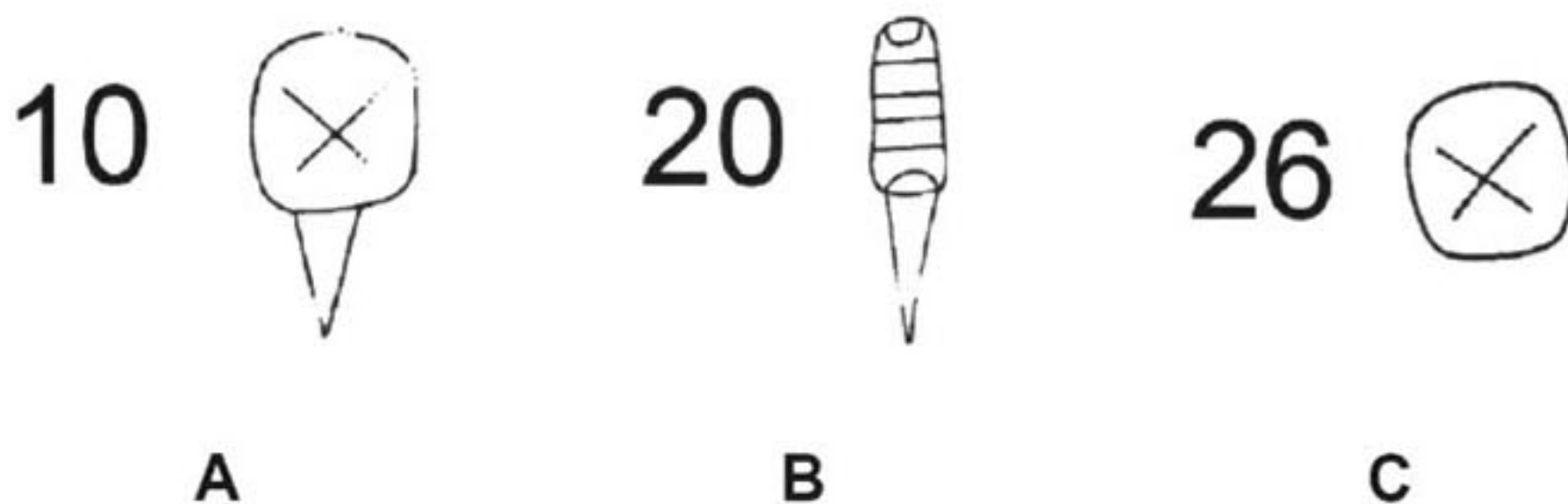
Figure 2. Three signs from Cascajal Signary (Rodríguez Martínez et al. 2006: Figure 5).

ment that is part of CS 10 and CS 20, given that the circular, cross-banded component of CS 10 can occur freely, as CS 26. Thus, for now, it is useful to split CS 10 and CS 20 into two components each, each of which can occur on its own or combined with signs that can occur on their own. The revised signary, organized according to frequency of distribution, the principle used by the scholars who first studied it, is seen in Figure 3. It is possible that future research may show that such revision is ultimately unnecessary, and that it erred on the side of over-splitting, but for now it is a reasonable minimalist assumption, one that places the burden of analysis on demonstrating that CS 10 and CS 20 are in fact equivalent, a task that must be regarded as pending, for it was not carried out by Rodríguez Martínez et al. (2006), nor is it carried out here. Nevertheless, it is certainly worth noting, as a referee of this paper has done, that "other signs [in this text] [appear to be] separated from one another and not glued together." This is a point well taken, but it is simply indicative of a lumping approach, and therefore, one that assumes too much—rather than too little, as my splitting approach does—and is not clearly better from a methodological standpoint.

Reading Format and Reading Direction

Rodríguez et al. (2006: 1614) state: "Text orientation is clear. Olmec imagery consistently displays vegetal icons, which sprout to the top. The appearance of such signs in the text demonstrates that the inscription is horizontal. This orientation is further supported by the disposition of 'sky-band' elements much like those on Olmec thrones and later regional

iconography." This statement justifies the enumeration of the signs in the text, starting with #1 and ending with #62, from what those authors consider the top-most left corner of the block, as in Figure 4. In their illustration they hypothesize about the text orientation, reading format (rows), and reading order (top-to-bottom, left-to-right).

Yet iconically motivated grapheme orientation is not always a reliable guide to the orientation of the text. In Epi-Olmec writing some signs are oriented horizontally, even when their actual pictorial orientation was vertical (e.g., MS 81 and iconographically related signs). Similarly, in Mayan writing some signs could be oriented "standing up" or "on their side," depending solely on the arrangement of the sign in question with respect to other signs in the same glyph block— the organizational unit of representation in the script. I agree that all or most of the signs in the Cascajal Block text are consistently oriented with their upward end in the same direction, regardless of whether they were meant to be read "standing up" or not. Skidmore (2006:4), in fact, has also discussed the reading format of the text, stating the following: "The direction of the reading order, and even the orientation of the text, is not entirely certain. With regard to the latter point, a horizontal orientation of the block [see Figure 6c of this paper] would have the advantage of creating a roughly columnar layout, in the manner of more than one subsequent Mesoamerican writing system. And the apparent 'insect' [see Figure 4 of this paper], which appears at the beginning (or the end) of a number of the sequences, would be in a more naturalistic position."
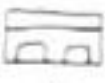
4x	3x	2x	1x
1	5	11	22
2	6	12	23
3	7	13	24
4	8	14	25
	9	15	27
	10	16	28
		17	
		18	
		19	
		20	
		21	
		26	

Figure 3. Revised signary of Cascajal Block text (based on Rodríguez Martínez et al. 2006: Figure 5).

Skidmore, however, chose to accept the criterion of the orientation of the vegetal motifs in the text as indicators of the reading format of the text, following Rodríguez Martínez et al. (2006). I think it is worth pursuing the hypothesis that a different reading format is possible. Hence, the question that I ask here is whether text orientation could be determined by other lines of evidence—such as the organization of the text itself, or possibly the relationship between other known texts and any accompanying pictorial images—rather than on the iconicity of signs.

Before proceeding, it is useful to address another matter: the scholars in question do not discuss their method for determining the rows (rather than columns, given their assumption of a horizontal organization). They in fact state the following of their study (Rodríguez Martínez et al. 2006:1612): "Yet, there is no strong evidence of overall organization. The sequences appear to be conceived as independent units of information, although to judge from shared details of carving they were recorded by the same hand."

Here I agree with their choice of selection of rows or columns; the term "line" is perhaps more neutral, and thus I use it whenever it is appropriate to express neutrality. However, it is necessary to provide some means of testing and justifying such

Figure 4. Cascajal Block text showing enumeration of signs according to previously published reading format and reading order (Rodríguez Martínez et al. 2006: Figure 4).

Figure 5. Cascajal Block text showing empty spaces or gaps presumably left after the scribe finished writing a line (gaps 1 and 2), or as a result of the scribe attempting to partly fill in some of the previous gaps while writing the following line (gaps 3 and 4).

an assessment. A principle that works sufficiently well to this end is the height of the signs in each line. Indeed, within each line it seems that the scribe attempted to maintain a certain average height for the signs in general, and this height varied slightly from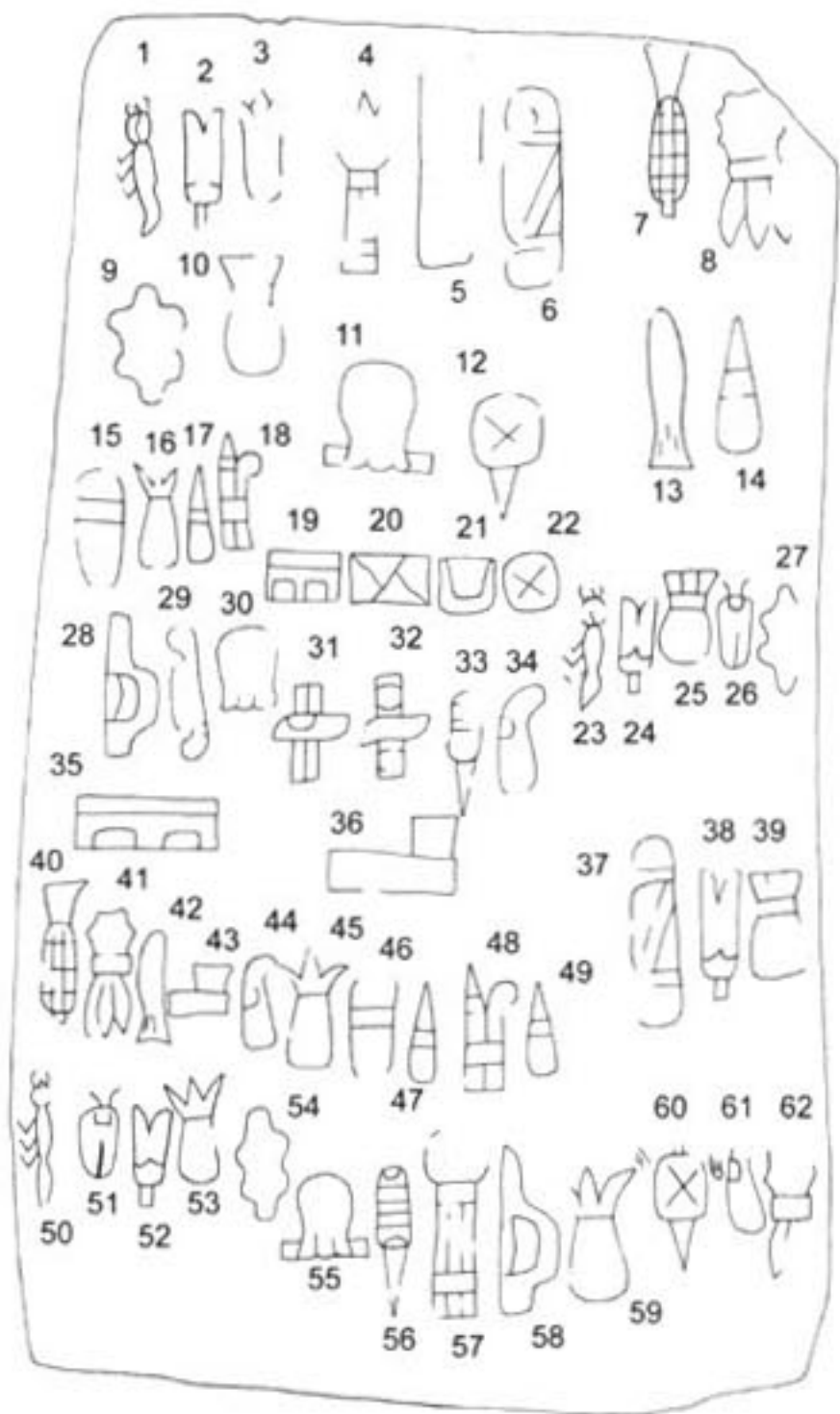 line to line. In two of the lines, those labeled in Figure 4 as including signs 9–14 and 35–39, it is apparently not just height but overall scale (height and width) that clarifies which signs belong in each line.

Having established this, it is possible to return now to the question of reading format and reading order more generally. There are, in fact, clues to the text orientation problem that do not relate to sign iconicity. The first clue lies in assessing where each line most likely started and ended. It is very common for a writer to start a line on the lateral or vertical margin of a medium (paper, tablet, wall, celt) and end before reaching the other margin, leaving a gap in the process, if that is where the sentence ended. Thus, the location of such gaps

would tell us, with significant confidence, where the writing began and where it ended.

As seen in Figure 5, lines B and D must have started on the left side, or else it would be hard to explain the empty spaces present on the right side of the text (cf. gaps 1 and 2). At this point the question is whether the text begins on the bottom left corner, or the top left corner. To answer this question it is necessary to pay attention to all the empty spaces: 1, 2, 3, and 4. These gaps suggest that the text started at the bottom line A, with sign #50, then moving to the right all the way to sign #62, and then restarting on the next line up, line B, with sign #40, again from the left, moving to the right, ending with sign #49 and leaving behind a gap represented here as gap 1. Line C is uneven because the scribe attempted to fill in some of the empty space left at the end of the second line with the last signs of this line, namely, the signs at positions #37–39. Line D is even and ends leaving a significant empty space, gap 2. Line E, is again uneven as the scribe
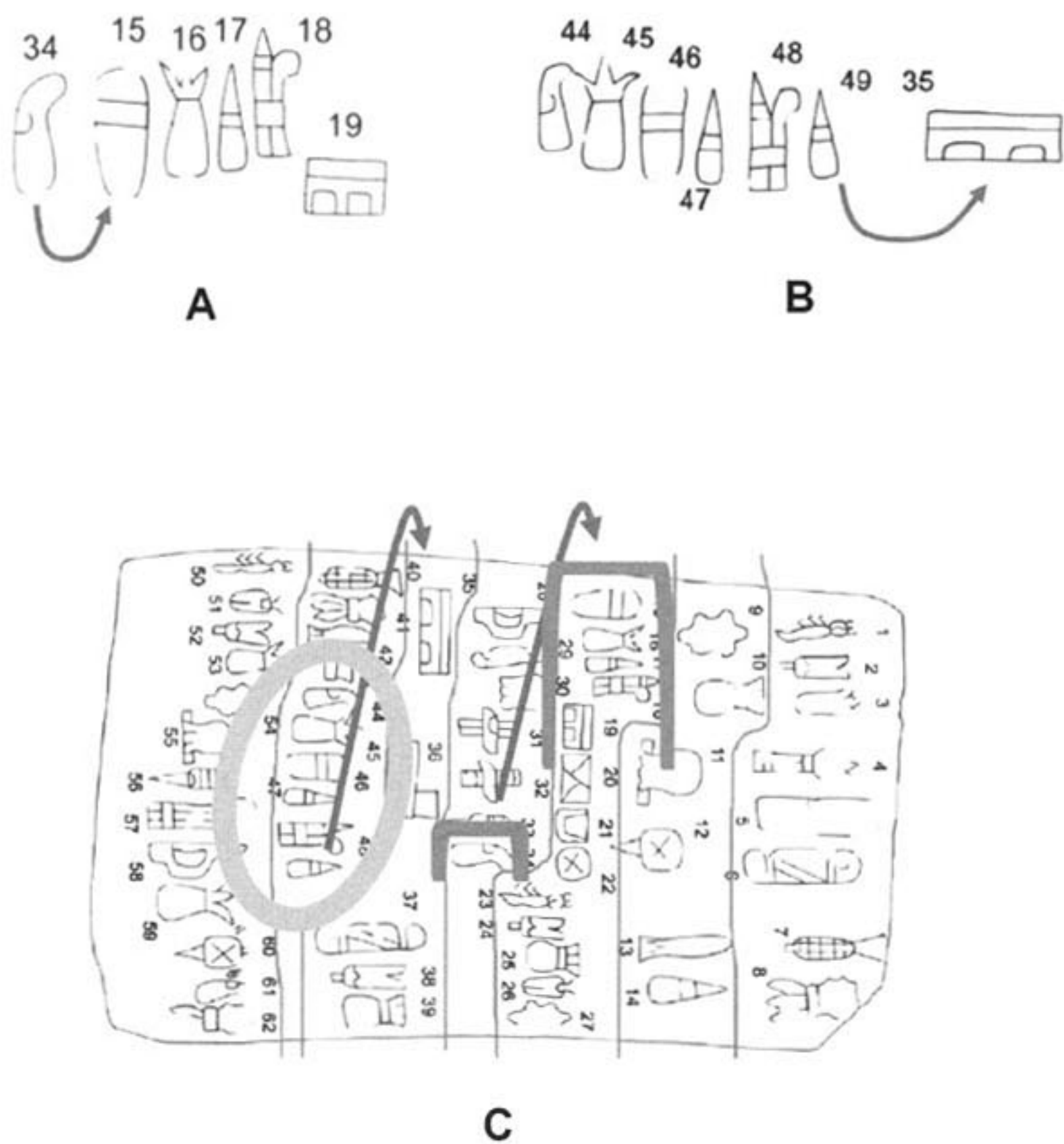
Figure 6. Repeated sequences indicative of reading order. (a) Sign sequence at positions 34.15.16.17.18.19. (b) Sign sequence at positions 44.45.46.47.48.49.35. (c) Illustration of necessary reading order in order to preserve integrity of sign sequence.

attempted to fill in some of the empty space left at the end of the preceding line. The sixth line, F, parallels the fifth one closely, generally showing the same uneveness. The seventh and final line, G, is generally even. Interestingly, a cumulative effect appears at work: after the second line, line B, the third line became uneven when the scribe tried to partly fill in some of the empty space left behind, and from then on each succeeding line preserved, for the most part, the uneven pattern begun by the third line, C. These two lines of evidence—the gaps left at the end of lines, and the pattern of increasing unevenness of lines—suggest a left-to-right, and a bottom-to-top reading order. The former is consistent with the results by the scholars cited above, while the latter is in direct opposition, and more importantly, it would seem to be in direct opposition with the early Mesoamerican top-to-bottom reading order. Nevertheless, below it is sug-

gested that the Cascajal Block text is in fact read in a top-to-bottom order if one allows for the text to be rotated 90 degrees to the right with respect to the orientation assumed by Rodríguez et al. (2006), a procedure that would make it consistent with the format of the text on the San Andres stamp and on an obsidian core from La Venta. Thus, the appearance of a bottom-to-top reading order is just that, an appearance, for the external evidence adduced below indicates that what Rodríguez et al. (2006) suggest to be the top of the block is actually the right side.

Another question worth asking at this point is whether there is any evidence from the signs in the text, particularly from repeated sequences of signs, which would support one of these reading orders but not the other (i.e., top-to-bottom vs. bottom-to-top). Again, it is necessary first to review what the authors of the original study state (Rodríguez
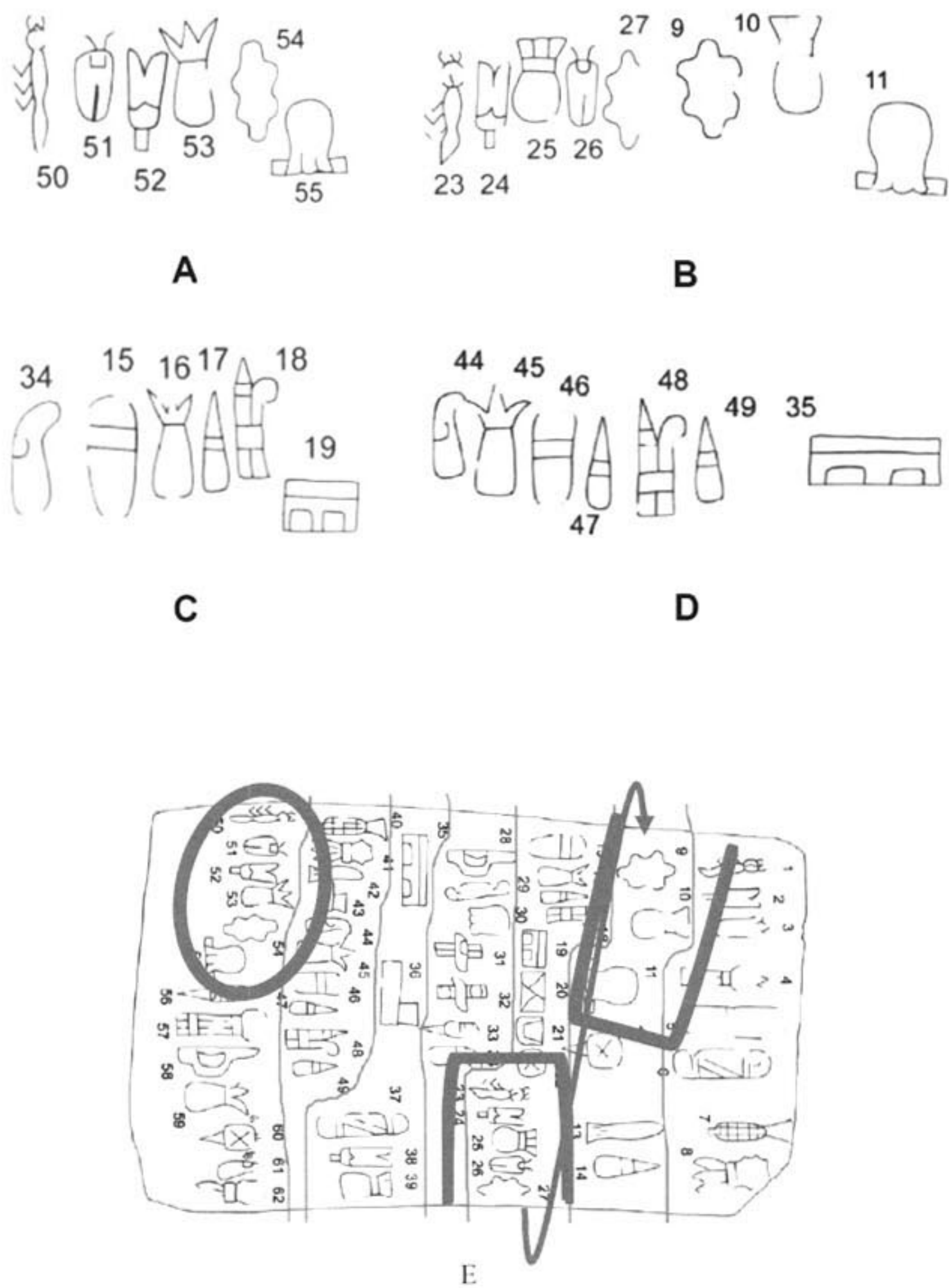
Figure 7. Lengthy, repeated sequences of signs within the text.

Martínez et al. 2006:1612): "Reading order is more difficult to establish. Most Mesoamerican scripts read left to right in unmarked conditions, i.e., when not arranged in unusual architectural settings. Left to right is likely to be present here, too. Yet, there is no strong evidence of overall organization. The sequences appear to be conceived as independent units of information, although to judge from shared details of carving they were recorded by the same hand."

This shows that the authors in question simply assumed a left-to-right reading order given the general Mesoamerican practice. Their claim that "there is no strong evidence of overall organization" suggests, moreover, that they did not find support for this assumption from the patterns of sign repetition and co-occurrence. Despite the claimed equivocal organization of the text, there are in fact two major clues as to the reading order from patterns of sign co-occurrence and sign sequences. Moreover, it can be shown that the reading order and format will require a renumbering of the signs in the text.

First, and using for now the numbering of signs within the text in the original study (Figure 4), the sequence of signs 44.45.46.47.48 is repeated, with an interesting reversal of two of its component signs

(discussed below), in the sequence of signs 34.15.16.17.18. Now, the latter sequence is immediately followed, at position 19, by a sign cataloged by Rodríguez et al. as sign #11 (Figure 6a). This sign #11 also appears after the sequence of signs at positions 44.45.46.47.48, at position 35, if one allows for the fact that in this case sign #3 is intervening between positions 48 and 35 (Figure 6b). This longer set of sequences (34.15.16.17.18.19, 44.45.46.47.48.35) could be indicative of the reading order as being left-to-right (Figure 6c). And second, it is clear that the text must be read starting on the bottom left side of the block, again using the orientation of the text assumed by Rodríguez Martínez et al. (2006) as the basis for determining "bottom" and "top," defined here as the corner with sign #50 in the original illustration (Figure 4).

Given this evidence, if we were to start writing and reading from the topmost line, with sign #1, we would encounter a problem: two major sign sequences repeated twice in the text, would now become disjointed. The first such sequence was just described. The second sign sequence involves positions 50.51.52.53.54.55 (Figure 7a), completely contained within line A regardless of the reading order one assumes (i.e., whether line A is the first or last line of the whole text). If the text is read from the top (position #1), the repetition of sequence 50.51.52.53.54.55 at positions 23.24.25.26.27.9.10.11 (Figure 7b) would no longer be a sequence. The same would apply to the sign sequences in Figures 7c and 7d, which have already been discussed above.

The evidence therefore points to the need to renumber the signs in the text, with position 50 now becoming 1, position 62 now 13, and 8 now 62, as seen in Figure 8. It is of course possible to read the text in a right-to-left, top-to-bottom format and still preserve the repeated sequences mentioned. However, doing so would require that lines #2 and #1 would start with a significant gap on the margin, a possibility that I regard as less likely. One of the referees of this paper has made a very good point of relevance here: "More importantly, there is a very clear clue in the inscription itself that the order is top-bottom. Compare the top line and the bottom lines. The top line has signs that are generally a bit larger and plenty of space is left between them. In the bottom line signs are crammed together. Clearly the scribe must have started out at the top

and ended at the bottom, where he began to run out of space. Similar examples of signs getting smaller and more crammed at the end of a text are well-known (e.g., Yaxchilan L 10)." I agree that this is a plausible analysis. However, it is just as plausible that the scribe began writing cramming signs as closely together as possible to make sure that there would be enough room for all the signs, and that after it became clear that there was going to be enough room for all the signs, the scribe began to space them out more.

Structural Analysis

The analysis carried out next is purely structural, without reference to language or possible orthographic values. It is based on the presence in the Cascajal Block text of sequences of signs that are repeated two or more times, with or without variation. There are different levels of repetition sequences. Some are more encompassing than others. Henceforth, the revised numbering from Figure 8 is used.

The first set of such encompassing sequences is seen in Figures 9a and 9b, and consists of signs at positions 18–24 and 35–40. It was already discussed in the analysis of the reading format and reading order. This sequence shows two subunits, each of which is defined on the basis of variation. The first subunit, made up of signs 18–20 and 35–37, respectively, shows variation in the placement of the second two signs with respect to each other. Second, signs 21–24 and 38–40 show variation in the absence of sign CS 3 after sign CS 19 in the second set.

The second lengthy repeated sequence is found at 44–51 (Figure 10a) and 1–6 (Figure 10b). These sequences exhibit internal variation as well. Signs 45–47 (Figure 10c) and 4–6 (Figure 10d) exhibit a case of reordering with respect to one another. Also of interest is that CS 10 and CS 2 appear to be equivalent in this context, unless the reordering they exhibit is somehow motivated by the differential use of CS 10 or CS 2. Signs 49–51 (Figure 10e) and 5–6 (Figure 10f) also exhibit variation with respect to each other: in the first sequence, CS 10 is present, while in the second it is absent, in both cases in between CS 6 and CS 18. The repetition of CS 6 as signs 48 and 49 is possibly a crossover effect, the result of continuing the inscribing of the same logogram or syllabogram after switching
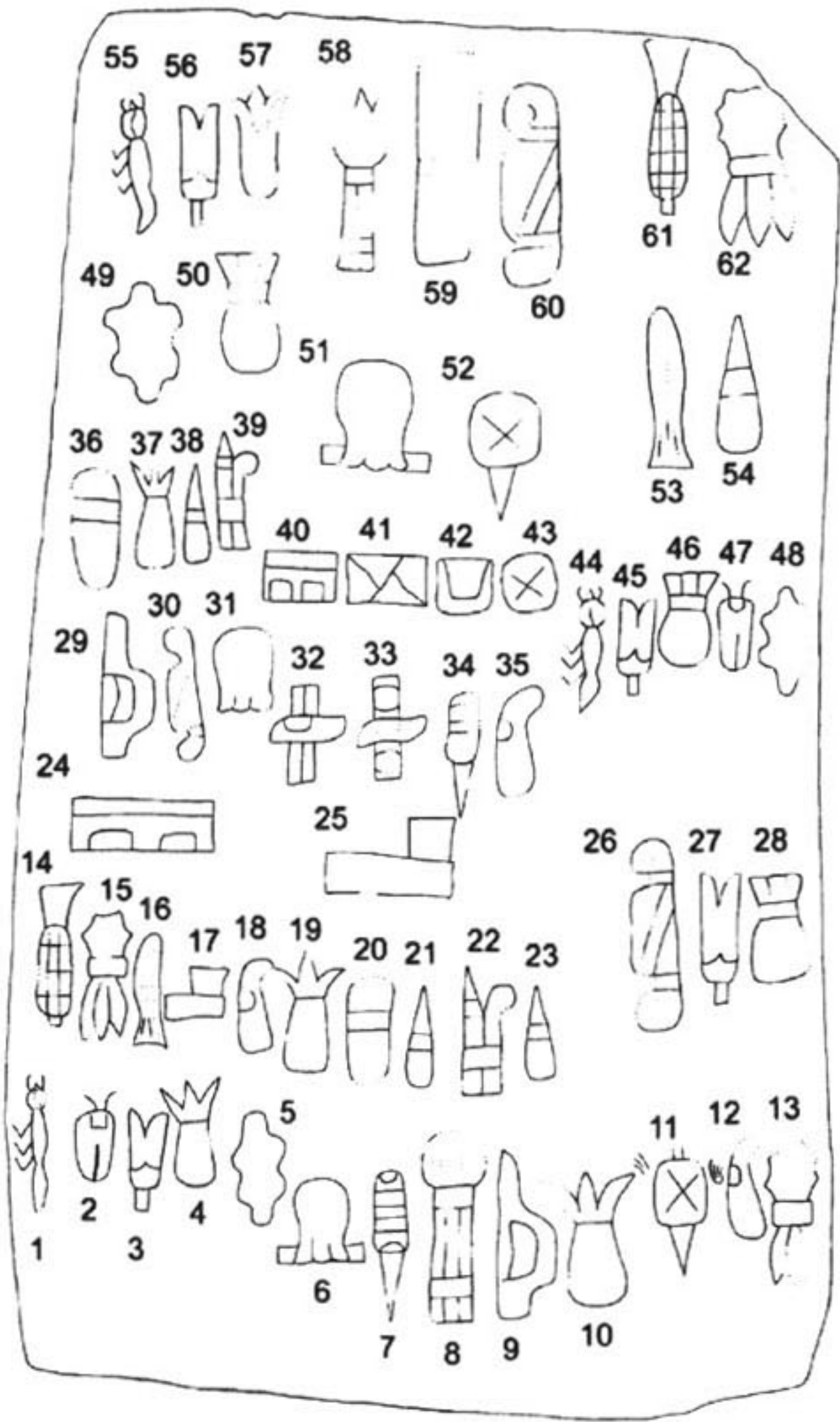
Figure 8. Drawing of Cascajal Block (from Rodríguez Martínez et al. 2006: Figure 4) with renumbered signs to reflect analysis of reading order presented in this paper.

from one row/column to the next.

The intriguing fact is that the two lengthy repetition sequences discussed so far show an identical pattern of variation: both contain two subunits defined by internal variation, in both cases one of the first of the two subunits consist of three signs, in both cases this first subunit exhibits a reversed ordering of two of its three signs, and in both cases the second subunit exhibits variation defined by the presence or absence of a sign. This is more than likely a significant structural parallelism, one that could require a linguistic explanation—although at this point this is not an exhaustive assessment, just a plausible result. Also, this parallelism could sup-

port the suggestion that CS 10 and CS 2 are simply slightly different versions of the same sign. (This could also be true for the signs at positions #7 and #52 in the reordered text. These two glyphs, each composed of two distinct graphic elements, also the ones that resemble a bloodletter and which were earlier in this paper argued to be analyzable into three distinct signs, both appear after CS 28 in the context of the same repeated sequence. Similarly to CS 10 and CS 2, such distribution could suggest that these signs at positions #7 and #52 are in fact the same sign showing slight graphic variation in its two contexts.) This parallelism is not the one alluded to in the original description of the
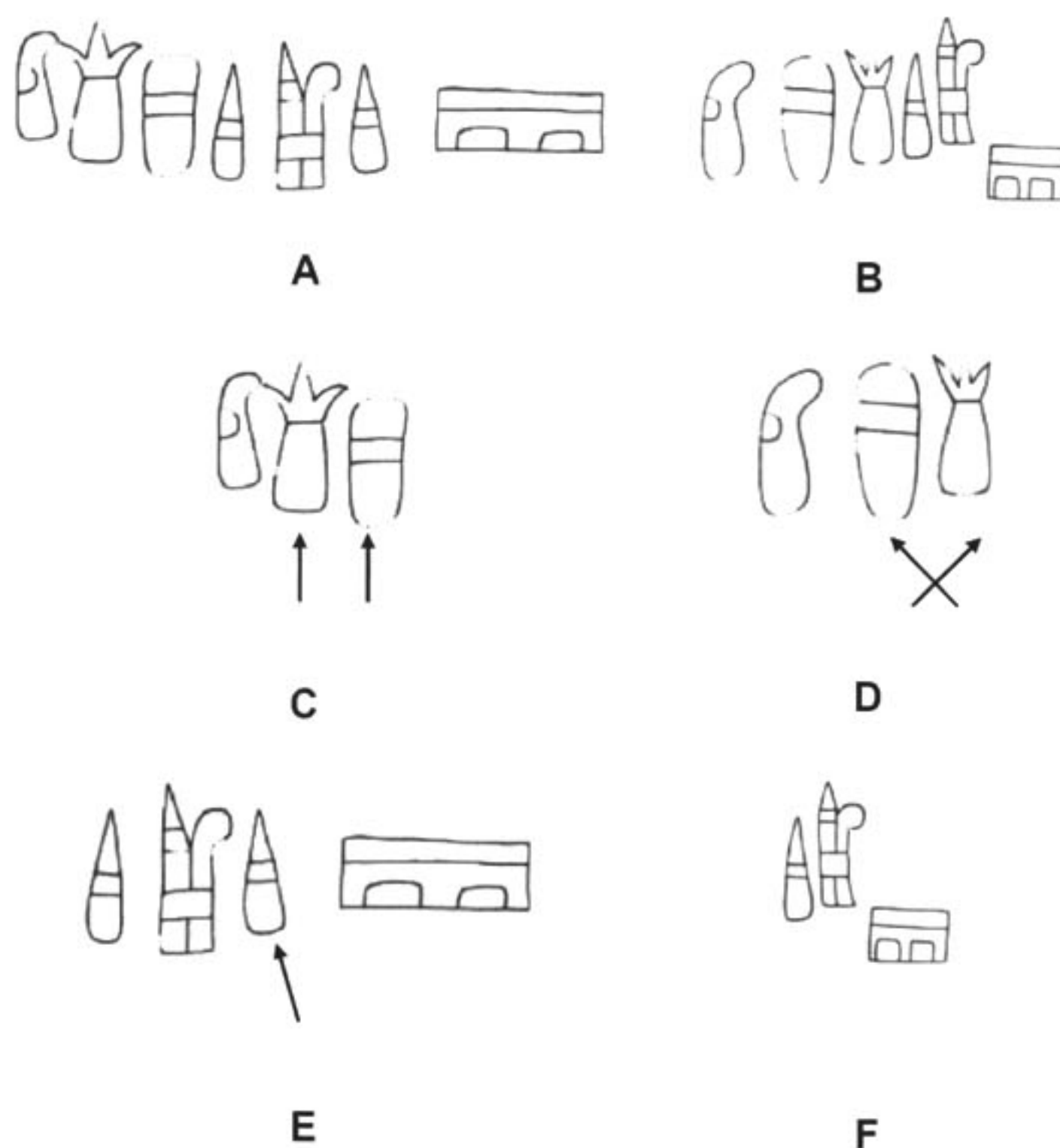
Figure 9. Repeated sign sequence. (a) Signs 18–24. (b) Signs 35–40. (c) Signs 18–20. (d) Signs 35–37. (e) Signs 21–24. (f) Signs 38–40.

Cascajal Block (Rodríguez Martínez et al. 2006: 1613), but rather a much more comprehensive type involving more than two signs at a time. Also, the presence or absence of certain signs and the examples of reversals could be accounted for by a number of different interpretations, based on linguistic affiliation assumptions and orthographic assumptions, for example, or based on semasiographic principles. No such interpretation is attempted here, and thus any justification of what these patterns mean must be deferred to future study.

In addition, it appears that the second comprehensive repetition sequence contains a third subunit, one that is actually attested elsewhere in the text (Figure 11a), and it is thus attested three times (Figures 11a–c), with some variation—as already described. Skidmore (2006:4) had previously identified two of these repeated sequences (Figures 11a–b), the ones that are identical.

Another repeated sequence found in the text consists of the last two signs of the whole text (Figures 12a–b), and was also already highlighted by Skidmore (2006:4), who in addition noted that two

signs are repeated in a sequence twice, corresponding to the sign positions 21.22 and 38.39. These sequences were already illustrated and mentioned before (Figures 9e–f).

Frequency of Distribution

Four signs are repeated four times in the text. CS 1, CS 2, and CS 3 were previously listed as occurring four times each in Figure 5 of the original signary (Rodríguez Martínez et al. 2006). In the revised signary (Figure 3) CS 4 also occurs four times. None of these frequent signs seems to occur initially in any of the long repeated sequences described above. Instead, the following two signs, CS 5 and CS 6 (Figures 13a–b), each of which occurs three times in the text, seem to occur initially in the long repeated sequences.

What this means is unclear. However, based on their frequency, and their distribution at the beginning of two long sequences repeated twice in the text, CS 5 and CS 6 seem promising as potential markers of ergative and/or possessive prefixes (cf. methodology in Justeson and Kaufman 1993). But
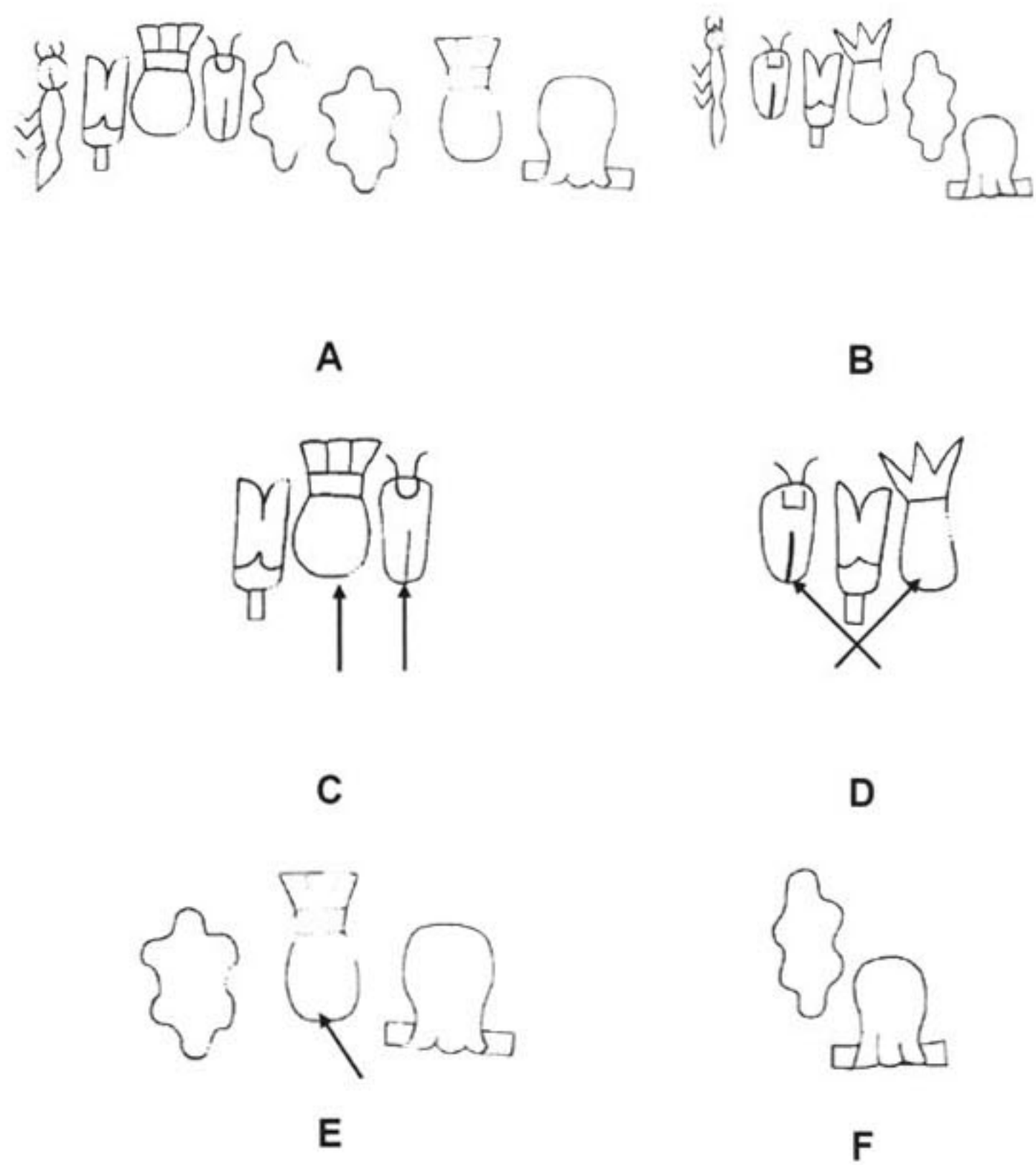
Figure 10. (a) Signs 44–51. (b) Signs 1–6. (c) Signs 45–47. (d) Signs 2–4. (e) Signs 49–5. (f) Signs 5–6.

this is simply an observation of where a possible hypothesis would start. In other words, if I were to try to analyze this text as a linguistic text, preferably after many more similar texts were discovered, I would start with the most frequent signs as likely representations of very frequent grammatical markers.

The San Andres Stamp Text

A fascinating fact did not receive mention from the scholars who described the Cascajal Block (Rodríguez Martínez et al. 2006): the left-to-right reading order, proposed by those authors and supported by the present study—notwithstanding the revision from a bottom-to-top to a top-to-bottom reading direction after rotation of the block advocated here—is consistent with the reading order described for the San Andres roller stamp text (Figure 14a), which dates to ca. 650 B.C. (Pohl et al. 2002). Also, both exhibit signs in pure Olmec style.

Interestingly, the bird and the glyphs present on the stamp are intertwined, with two speech scrolls emerging from the bird's mouth in a left-to-right fashion, and each speech scroll containing one glyph consisting of several signs—three signs in the first speech scroll, and possibly four in the second. This type of interplay between pictorial art and hieroglyphic writing is well known from later Epi-Olmec, Zapotec, and Mayan inscriptions. The difference between the San Andres Stamp and cases of intertwined image and text in Mayan writing, for instance, is that in Mayan the orientation of the individual signs was generally vertical, when compared to the orientation of the associated pictorial imagery. The San Andres roller stamp, unlike Mayan, shows the embedded glyphs oriented horizontally, that is, rotated 90-degrees to the right with respect to the associated pictorial image of the standing, speaking bird. This suggests that the script on the stamp was characterized by a columnar format, one in which signs were nonetheless oriented
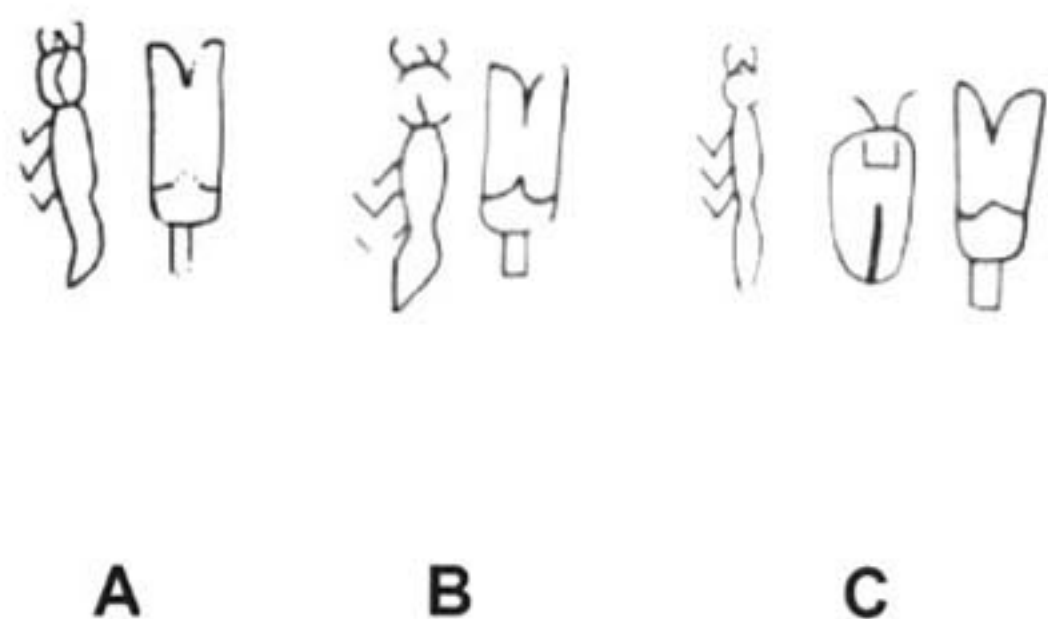
Figure 11. Sequence showing variation. (a) Signs 44–45. (b) Signs 55–56. (c) Signs 1–3.

Figure 12. Another repeated sequence. (a) Signs 61–62. (b) Signs 14–15.

horizontally, rather than vertically. One could argue that the Cascajal Block text works similarly (Figure 14b), but because of the lack of pictorial imagery in the Cascajal Block it is not possible to know for sure. If so, rather than pointing upward, as suggested by the authors who described the Cascajal Block (Rodríguez Martínez et al. 2006:1612), the signs could be oriented horizontally (i.e., rotated 90 degrees to the right, the same as with the signs on the San Andres Stamp), in which case the reading format would be not one of rows, but one of columns. It would in fact be a regular, run-of-the-mill, left-to-right, top-to-bottom, single-column format, text—generally like later Mesoamerican scripts prior to the innovation of the double-column format by the Mayans, and just like in Epi-Olmec writing, except that in those later scripts, including Epi-Olmec, signs were not systematically oriented horizontally through rotation. Support for this suggestion is found on the possible text of the obsidian core from La Venta (Méluzin 1995:Figure 37), which shows a likely columnar text consisting of three signs in the belly of a bird (Figures 14c–d)—the Principal Bird Deity of Mesoamerican iconography. Indeed, the relative orientation of the bird and the text suggests the text is read in a column, and more importantly, that the signs are not standing up, but rotated 90 degrees to the right, given the orientation of their long axis. Interestingly, the first sign on this short text appears to be the same as CS 6 (Figures 14e and 14f).

Another important trait of the San Andrés roller stamp is found in its likely ritual day count; indeed, it has been noted by scholars of writing systems that the conjoining of a graphic system for counting with a graphic system for referring to entities,
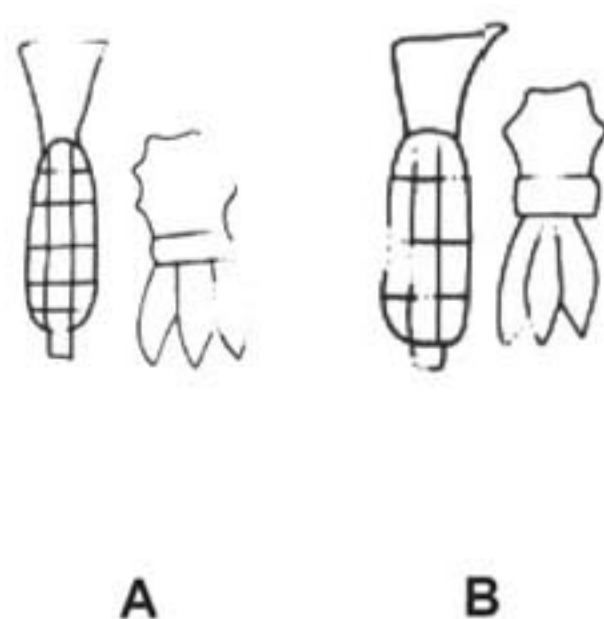
in the form of a sign for a numeral juxtaposed with a sign for an entity that is counted, is strictly a linguistic principle of graphic encoding, and therefore, writing (Justeson 1986). It is quite probable, as the discoverers of the San Andres roller stamp claim, that such a representation—which they read as "3 Lord"—is found on that text. If so, the conclusion would be clear: the San Andres Stamp is a text, and it is writing. Hence, the claim by Houston that "A few isolated emblems... fall well below the standard for first writing" (Stockstad 2002:1873) requires qualification, for it does not take into account the likely linguistic structure of counted entities. The fact that the stamp can now be shown to exhibit a reading format and order comparable to that of the Cascajal text further strengthens this conclusion.

A Broader Perspective

The recognition of the existence of an Olmec writing system, as defined in the narrow sense, has had a gradual history that long precedes the Cascajal finding—or the San Andres finding for that matter. Indeed, several authors have described characteristics present in Olmec art and iconography that correspond to what is expected of such narrowly defined writing during the past four decades. Such characteristics can be categorized into: visual format principles, patterns of sign occurrence and co-occurrence, and outright linguistic encoding. Regarding the first, most authors argue that a "text" format is required; this means that it is expected that a writing system would be organized into rows or columns, or a combination of rows and columns. With regard to the second, authors argue that prin-
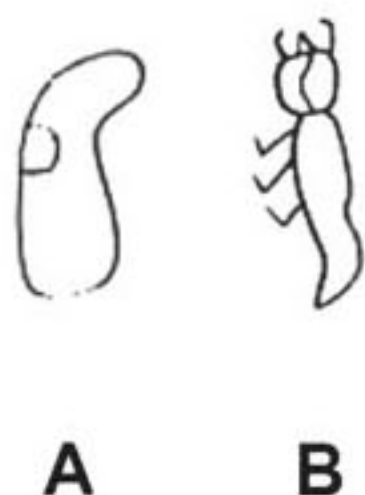
A　　　B

Figure 13. Signs occurring initially in long repeated sequences. (a) CS 6. (b) CS 5.

cipled patterns of occurrence and co-occurrence of signs are also required. This means that signs follow orthographic principles devised for the communication of messages, and that such principles will produce a systematic patterning for the use of each sign, and also for its co-occurrence (or lack of co-occurrence) with other signs. And last, authors require that the principles of occurrence of individual signs and of co-occurrence of groups of signs follow the linguistic structure of a language—that they exhibit a usage indicative of sound, word, sentence, and discourse structure correlating with a specific language.

As a matter of fact, examples of text-like artifacts in the form of ceramic roller stamps (Figures 15a–b) have been described from the site of Tlatilco (Valley of Mexico), dating to the Early Preclassic (1200–900 B.C.), making them coeval with, if not earlier than, the Cascajal Block (Gay 1973; Kelley 1966). Some of these exhibit signs that are repeated two or three times, although the brevity of these artifacts usually limits the identification of patterns of co-occurrence of signs and sign sequence repetition. Additionally, several authors have noted that various Olmec-style greenstone celts (Figure 15c) exhibit imagery arranged in a vertical, linear, columnar format (Gay 1973; Justeson 1986; Mora-Marín 2001), the format common to all Mesoamerican scripts that developed by the Late Preclassic period (400 B.C.–A.D. 200). They have also noted that some such artifacts also exhibit what appear to be sequences of events, each event represented by segmented body parts such as hands and arms engaged in specific actions (Figure 15d), rather than by means of a pictorial narrative or portrait, and thus strongly suggestive of "incipient writing" given the likely linguistic encoding—possibly corresponding to verbs—of such sequences of actions (Justeson 1986:440).

Interestingly, Rodríguez Martínez et al. (2006: 1613), as well as Skidmore (2006:5), have put forth the possibility that the elongated items present in the two celts mentioned (Figures 15c–d) could very well be examples of signs in the same script as that of Cascajal. Another interesting example is the case of the aforementioned incised obsidian core from La Venta (Figures 14c–d), one which Méluzin has observed appears to have three signs arranged linearly, and resembling a text (Méluzin 1995:Figure 37). The first sign on this potential text resembles CS 6; if this identification is correct, that would place it in a clause-initial context, providing yet another piece of evidence that may aid in its eventual decipherment, especially if a linguistic structure is tested, in which case a frequent clause-initial marker, such as a person agreement marker, would seem plausible (Justeson and Kaufman 1993; Kaufman and Justeson 2004). And lastly, some of these authors have indicated the likely presence of linguistic encoding in the form of counted entitites—ritual day counts. At Oxtotitlan Cave (Guerrero), a site with mural paintings possibly dating to ca. 800–700 B.C. (Grove 1970), Painting A-1 (Figure 15e) appears to show a ritual day count "3/6 ALLIGATOR" (Justeson 1986:Fig. 4). Also at this site, Painting 3 (Figure 15f) appears to show a vertical linear sequence of four or five glyphs, and thus displaying the vertical linear format of later Mesoamerican scripts (Mora-Marín 2001). Monument 24 (Figure 16a) from Chalcatzingo (Valley of Morelos), possibly dating to ca. 600 B.C., shows what seem to contain day signs with postposed numerical coefficients (Figure 16b), including an example with two bars, probably for "10" (Angulo 1987). And of course, the San Andres roller stamp (Pohl et al. 2002) also provides evidence for this juxtaposition of numerical coefficients and counted entities, a characteristic of linguistic encoding, rather than of pictorial encoding, which would resort to the simple repeated representation of the entity counted to represent quantities of that entity.

Thus, the case for Olmec writing has a rich history of accumulating clues, and it is simply not the case that evidence for such writing was altogether lacking prior to the Cascajal and San Andres findings. More important, such clues have come from inside and outside the Southern Gulf lowlands, and
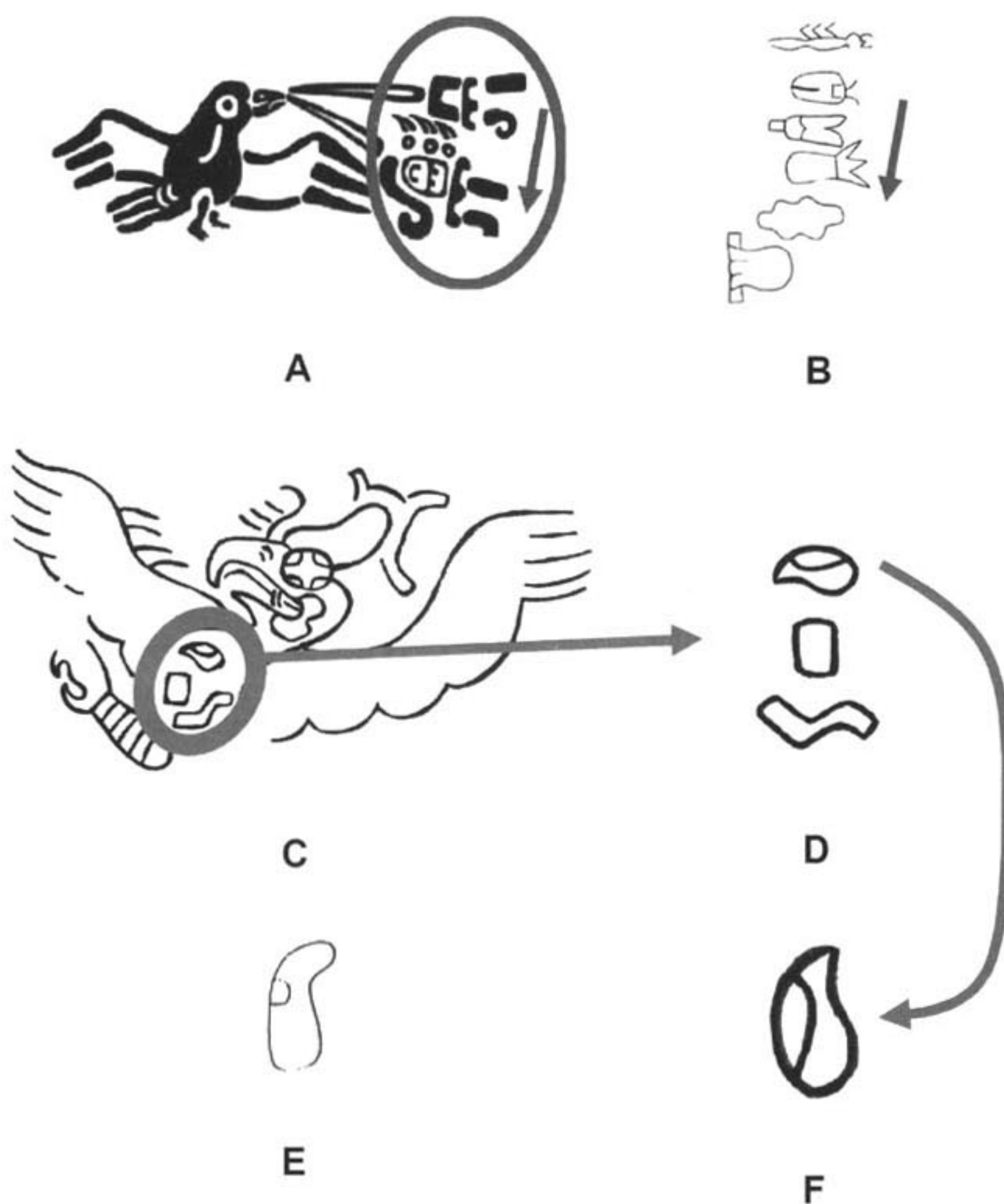
Figure 14. Drawing of San Andres Stamp and additional texts possibly exhibiting same reading format and reading order as Cascajal Block text. (a) Drawing of San Andres Stamp by Ajax Moreno. Courtesy of Mary Pohl. (b) Detail of Figure 4 from Rodríguez Martínez et al. 2006. (c) Drawing of La Venta obsidian blade with Principal Bird Deity imagery and possible text (from Méluzin 1995: Figure 37a). (d) Photograph of rubbing of Chalcatzingo Monument IV-7 (27) (from Angulo 1987: Figure 10.22). (e) CS 6 from Cascajal Block. (Drawing from Rodríguez Martínez et al. 2006: Figure 4). (f) Detail of drawing of incised obsidian core from La Venta (from Méluzin 1995: Figure 37a).

it is possible that the heartland may hold no chronological precedence over the rest of the Olmec area. Instead, Olmec writing may have evolved as a result of interregional interaction among participants in Olmec culture from throughout Mesoamerica. Such interregional interaction and co-development may very well have led to the rise of distinct regional—Zapotec, Epi-Olmec, Mayan—scripts by ca. 400–300 B.C. It remains to be seen, however, whether the Cascajal script became extinct, as argued by Rodríguez Martínez (2006:1613), or whether it was possibly a template for later writing systems.

Conclusions and Implications

The Cascajal Block, argued here to exhibit a left-to-right and top-to-bottom reading order, if the text is rotated 90 degrees to the right with respect to the orientation assumed by Rodríguez Martínez et al. (2006), has opened a door to the study of Olmec civilization that was previously closed, but not for lack of attempts by many committed scholars who have provided tantalizing evidence of an Olmec script. Recent work on Epi-Olmec decipherment (Justeson and Kaufman 1993, 1997; Kaufman and Justeson 2001, 2004) has the potential to provide

A

B

C

ruler and warrior

greeting to local lord
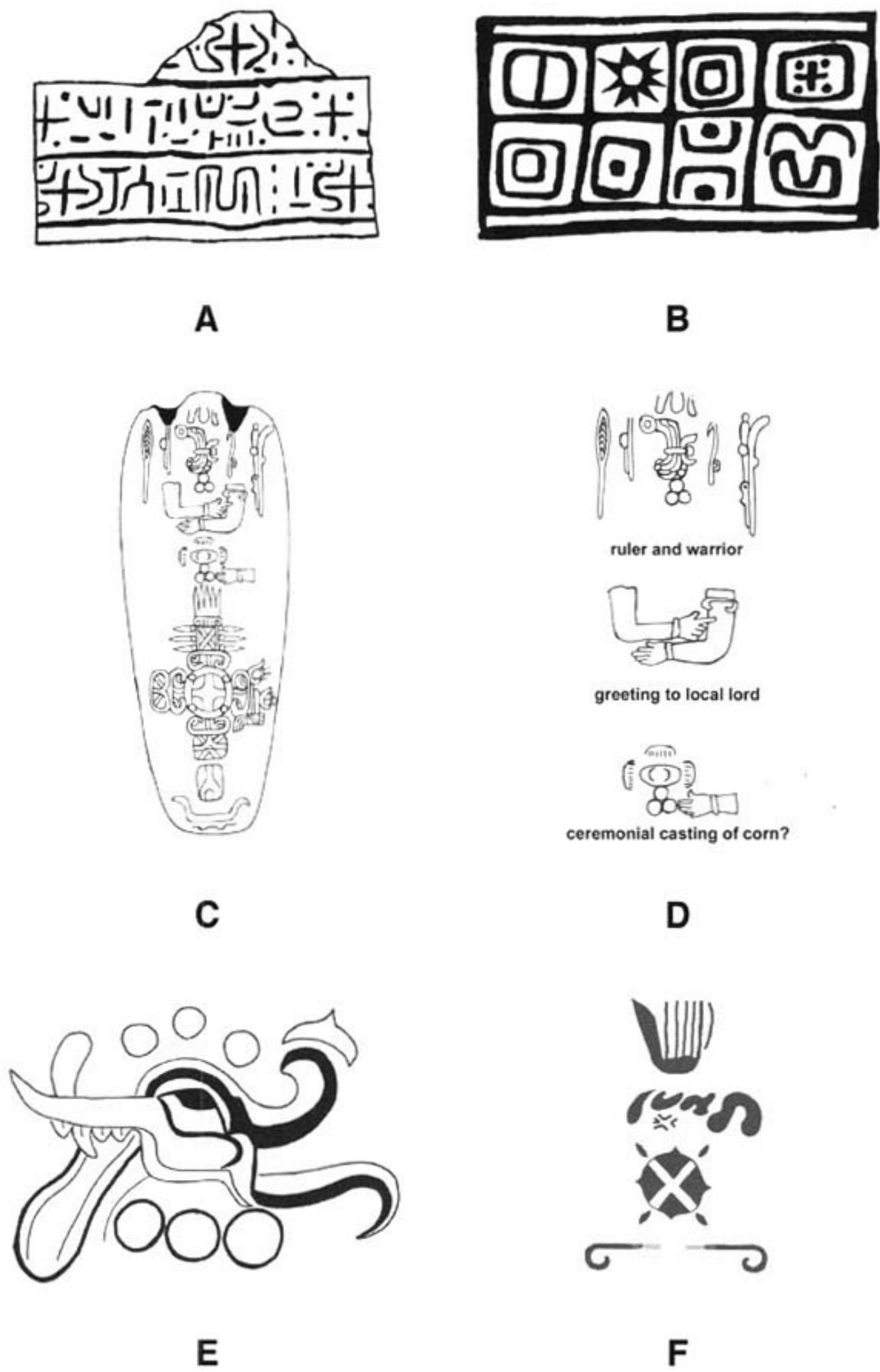
ceremonial casting of corn?

D

E

F

Figure 15. Examples of other, previously published and discussed, Olmec-style texts or text-like carvings. (a) Tlatilco roller stamp. (Photo from Kelley 1966: Figure 1). (b) Tlatilco roller stamp (drawing from Gay 1973:285). (c) Humboldt jade celt. (Drawing by present author based on photograph in Benson 1996:134, Figure 2). (d) Details of Humboldt jade celt. (e) Oxtotitlan Painting 3. (Drawing from Grove 2007:Figure 7b; available through FAMSI website at http://www.famsi.org/research/grove/index.html; used with permission from David Grove). (f) Oxtotitlan Painting A-1. (Drawing from Grove 2007:Figure 13f; available through FAMSI website at http://www.famsi.org/research/ grove/index.html; used with permission from David Grove).

a starting point, both in general terms, given the likelihood that the language of Olmec writing is a Mije-Sokean predecessor of the language of Epi-Olmec texts, and in more specific terms, for addressing the question of possible continuity between Olmec writing and subsequent scripts,

and, should Olmec writing be shown to be a direct ancestor of Epi-Olmec writing, for studying the evolutionary history of a script that could span a millennium and a half. Indeed, despite two negative reviews of the work on the decipherment of Epi-Olmec (Anderson 1993; Houston and Coe
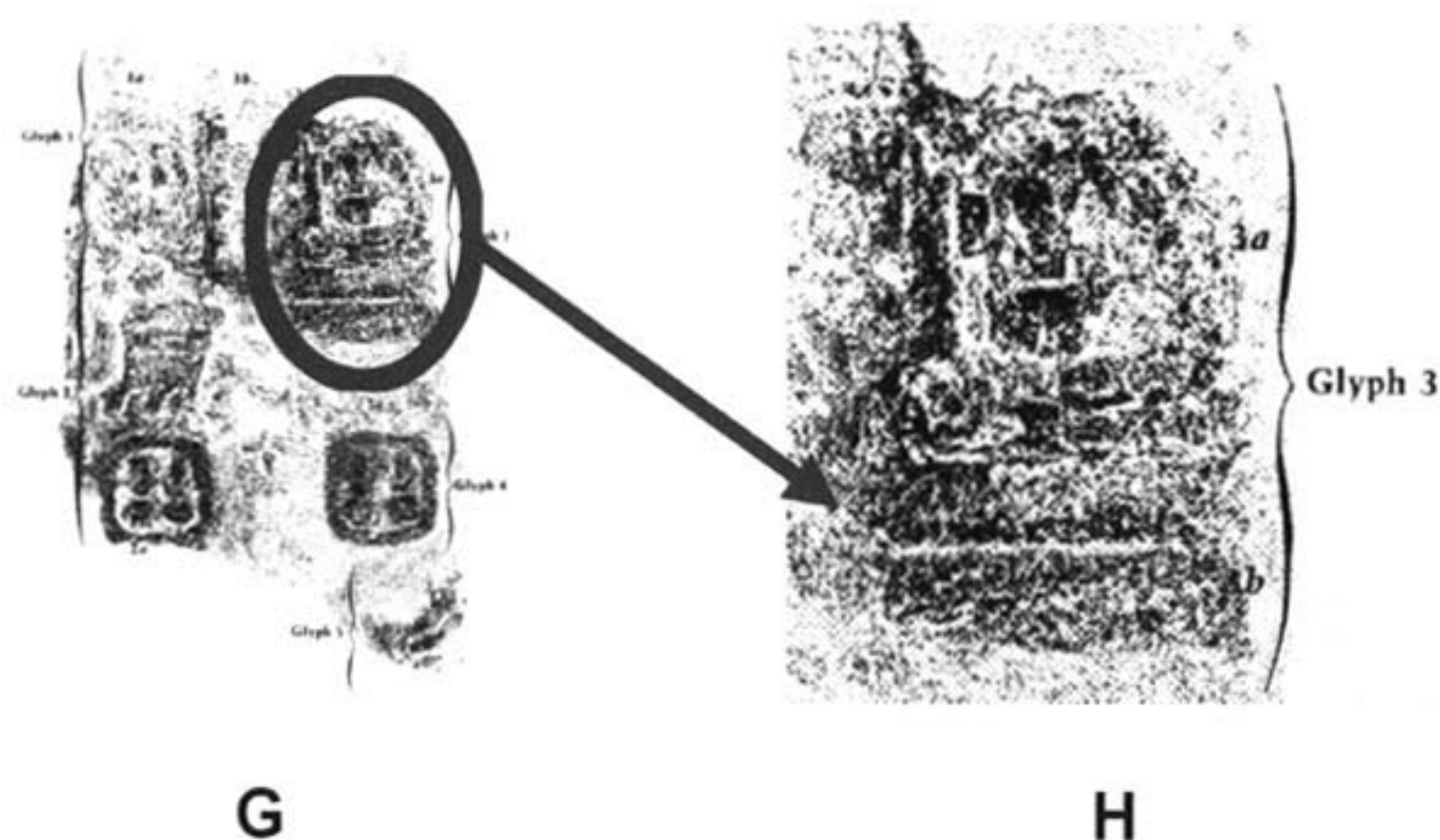
G   H

Figure 16. Middle Formative Chalcatzingo monument with evidence of calendrical and numerical signs. (g) Chalcatzingo Monument 24. (h) Detail of Chalcatzingo Monument 24 showing glyphic cartouche with two bars, possibly for "10," underneath it. (Photos taken from Angulo 1987 and used with permission of David Grove).

2003), other authors have regarded such work as highly cautious, systematic, and productive (Kelley 1993; Mora-Marin 2005; Wichmann 1994). Also, it is necessary to revisit the work by scholars who have cataloged Olmec and Epi-Olmec signs and artistic motifs and studied their patterns of occurrence and co-occurrence (Anderson 1993; Joralemon 1971; Macri and Stark 1993; Méluzin 1987, 1995). Finally, it is necessary to look with an open mind for examples of interaction between art and writing, and for the evolution of a linguistically structured script from a nonlinguistically structured script. This is true of monumental and portable objects alike, even though some may bear only two or three glyphs. For even if such texts are brief and lack the type of repeated and variable sign sequences that are preferred, the interplay between image and text in such examples may prove to be crucial in future attempts to decipher the script.

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