

Methods of Recording Numbers

Dust-footed Time will never tell its hour,
—JOHN MASEFIELD, *Lollington Downs*

NUMBERS LOOM LARGE in Maya hieroglyphic writing; there are few texts that entirely lack them. This is not strange in view of the Maya preoccupation with time and its multitudinous divisions, and in consideration of the part numbers played in divination. Not only were all periods of time accompanied by numbers, but numbers had to be combined with names to designate the days. Furthermore, numerals were incorporated in the names of many gods, and there is no reason to doubt that many of these were expressed hieroglyphically.

Among gods and goddesses with names of this description may be mentioned: Hun-Batz (One Monkey), Ox-Multun-Tzekil (Three Heaps of Skulls), Uac-Lom-Cham (Uac-Lot-Chaam, Six Molars), Ah Uuc-Cheknal (He Who Fertilizes the Maize Seven Times), Uucub-Cakix (Seven Macaw), Bolon-Tz'acab (Nine Generations; Bolon can also mean uncontaminated [Redfield and Villa, 1934, p. 356] or can be used as an intensive), Lahun-Chan (Ten Sky), Buluc-Ch'abtan (Eleven Penances?), Oxlahun-ti-Ku (Thirteen Gods), Hun-Pic-Tok (Eight Thousand Flints), and Hun-Pic-Tz'iu (Eight Thousand Cowbirds).

Some names of gods incorporating numbers are clearly of calendrical origin. These include Hun-Ahau (1 Ahau), Hun-Came (1 Cimi), Hun-Tihax (1 Etz'nab), Bolon-Imux (9 Imix), and Beleje-Toh (9 Muluc). In a number of cases the name glyphs of gods depicted in the codices are supplied with coefficients. Among these are God Q, whose hieroglyph is a picture of his head with the number 10 placed before it (p. 131; fig. 15,6,7). God Q is a god of death probably by sacrifice, and it is, therefore, fitting that the number 10 should form part of his name, since 10 symbolizes death and is the sign of the death god. The glyph of God R, whose head rather resembles that of the maize god and who is a benevolent deity, has a coefficient of 11 (fig. 15,9,10).

A glyph, like the Chicchan sign, but with a coefficient of 1, appears a number of times in the codices (fig. 42,19) as the name glyph of an unidentified god. The glyph for Lahun-Chan exactly depicts his name (p. 218). There is a hieroglyph of a god with coefficient of 6 attached to a Yax sign with "Ben-Ich" superfix; several others, notably the long-nosed gods with coefficients of 7 and 9, include numbers.

The name glyph of the Moan bird incorporates the number 13. This may be prefixed to the head of the bird itself or to the symbol for the sky. In the first case the meaning is "thirteen layers of clouds"; in the second, "thirteen skies [or layers of sky]" (figs. 20,19,20,23,24; 42,12,21).

Some hieroglyphs with numbers probably correspond to ritualistic terms. Gates (1931, p. 58) has suggested that the Oc glyph with a special suffix and a coefficient of 3 may correspond to the Maya salutation *oxtezcun*. This term, which Villa (1945, p. 159) gives as *oxtez*, is used in prayers and means "thrice greeted." It is highly honorific. There is, however, reason to believe that this glyph has the meaning of good tidings, and is used in passages indicating the good or bad luck of the day. In any case, *ox* surely does not have any directly numerical connotation, but rather has an intensificatory value, the term being attached to various words to add emphasis, more or less as in our own expressions "a thousand thanks," "a thousand times no," or "ten times better." Glyphs of the ritualistic offering of 9 tortillas to the bee god are on Madrid 103b, 106b.

In the books of Chilam Balam numbers are constantly used in passages describing the ritual of the current katun. For example, Chumayel (p. 89) says of Katun 9 Ahau: "Nine was its cup; nine was its plate," the number of the cup and the plate being in such cases, as Roys has pointed out, the coefficient of the day Ahau on which the katun ends. Something of that sort is probably expressed on Copan B, where three glyphs in succession have coefficients of 4. The inscription commemorates a katun (9.15.0.0.0) which ended on 4 Ahau. Likewise, numbers, principally 6, which accompany a succession of 10 glyphs on Quirigua P, probably have a ritualistic value.

Of the nine glyphs which represent the gods of the nights, three (1st, 4th, and 5th) have coefficients. These numbers—9, 7, and 5—almost certainly were incorporated in the names of those nocturnal powers (fig. 34; p. 209). Moreover, not a few animals, birds, and insects have numbers incorporated in their names (Roys, 1949). No wonder, then, that with such a constant use of numbers, Maya hieroglyphic texts are so freely larded with numerical expressions.

BARS AND DOTS

The most frequent method of expressing numbers under 20 is by means of bars and dots. Each bar represents five; each dot, one. Thus, to express the number 13, the Maya wrote two bars and three dots; 16 was transcribed as three bars and one dot; four as four dots. Numbers could be written horizontally or vertically. If the bars were placed horizontally, the dots were above them; if the bars were in the vertical position, the dots were to their left (figs. 30-35).

The clue to this system of numeration was in books of Chilam Balam, where examples were found of days, the coefficients of which were written both in Spanish script and by means of bars and dots. An explanation in Maya of the system, with drawings of bars and dots in the margin, occurs in Mani, and is dated 1793 (Perez 92). The text with a translation is given by Brinton (1882, pp. 47-48) without naming the source. The sequence of the coefficients with the series of 260 days on Madrid 65-73 supplies full confirmation.

In the sculptured texts there is often considerable ornamentation. The numerical bars may have decorative lines added, with the unfortunate result that sometimes it is difficult to tell whether a somewhat eroded coefficient is one quite thick bar with interior ornamentation or two rather thin bars (figs. 47,4; 48,2). Ornamentation of the interiors of both bars and dots is particularly frequent in texts dating from the first half of Baktun 9.

Rather than leave a dot (more correctly speaking, a circle) with large blank spaces to each side of it, the Maya sculptors frequently added decorative details, which generally took the form of small crescentic ornaments. Their presence or absence in no way affects the number. Thus the number 6 would frequently be carved as one circle flanked by crescents and a bar, 17 would be sculptured as two circles with an ornamental crescent between, and three bars (figs. 3,1; 4,12).

Usually crescents were added if there were only one or two circles to bring the sum of circles and ornaments to three. Quite rarely, two crescents are added to two circles, producing a less elegant and somewhat confusing coefficient (fig. 2,13,14). Early texts usually lack ornamental crescents, but after 9.10.0.0.0 they had become quite common, although some cities, notably Palenque, showed a preference for unembellished coefficients. In late times variations on the crescent became quite common. Of these the St. Andrew's cross was the most popular, appearing in many inscriptions carved between 9.17.10.0.0 and 10.3.0.0.0 (figs. 2,22; 4,34).

The use of crescents, too, is a snare and a delusion to the epigrapher, for when severe weathering has taken

place, it is often difficult to distinguish between a numerical circle and an ornamental crescent. A coefficient which was written as 11 seems to be a damaged 13, or erosion converts circles into crescents so that a damaged 13 appears to be 11 or 12. In some cases the sculptors appear to have used circles which look remarkably like crescents, and crescents hardly distinguishable from circles; in other cases ovals or circles slightly larger or smaller than the numerical circles are used as decorative elements (fig. 35,16). These, too, are hard to distinguish from the numerical circles if any weathering has occurred. Nevertheless, one should not complain of such little difficulties; overcoming them brings an increment of zest to the epigrapher. No such troubles confront the student of the three codices, for that type of decoration is absent from the hieroglyphic books, although crosses were occasionally used.

In Dresden and Madrid color distinguishes the main uses of numerals. Coefficients of day signs are red; distance numbers and coefficients of month signs are black. This may have been an ancient custom since on the Uaxactun fresco the coefficients of the days are red, and on the Santa Rita frescoes numbers with day sign are red or yellow, whereas a coefficient with a glyph which is certainly not a day sign is gray. On the other hand, the coefficient of the day sign on the IS vase from Uaxactun is a yellowish cream outlined in black, but all other coefficients are similarly painted. Also all glyphs and coefficients of the text in House E, Palenque, are painted black.

In Dresden two IS sometimes occupy the same space, the coefficients of one being placed in the spaces between the coefficients of the other. In such cases the numbers of one IS are painted red; of the other, black. Symbols for zero or completion are invariably painted red.

Bars and dots may stand alone (p. 139), but more usually they serve as prefixes to glyphs. Like all prefixes, so far as is known, they could be placed to the left of the glyph they qualify or above it. In the earliest texts they usually stand above the glyph; in later texts they are more often to its left, but frequently are above it. For the sake of symmetry all coefficients in a passage usually occupy the same position with respect to the glyphs they modify.

In the case of Glyph A of the lunar series the coefficient is a postfix, and stands below or to the right of it (figs. 36; 37), and very rarely, other glyphs have numerical postfixes (fig. 3,3-9). The belief has been expressed that coefficients used as prefixes are to be read as multipliers; when used as postfixes they are to be taken as additions. This theory was formulated soon

after the meaning of Glyph A of the lunar series was discovered. However, subsequent investigations have disproved it, for coefficients of the moon glyph as used as a distance number in the codices and in the inscriptions are added despite the fact that they usually occur as prefixes, and the same is true of Glyph E of the lunar series. It seems probable, therefore, that the coefficient of Glyph A of the lunar series appears as a postfix in order to distinguish that glyph from Glyph E (they are really identical, save that Glyph E sometimes has the distance number postfix). Actually, there is one case of the coefficient of Glyph A being a prefix (Quirigua K), the exception which proves the rule.

The addition of the *u* bracket converts cardinals to ordinals (p. 188); other affixes represent numerical classifiers (pp. 54-57).

HEAD VARIANTS: ONE TO NINETEEN

The Maya with their mystical attitude toward numbers were not satisfied to use only bars and dots to depict them. In many texts, although rarely in Dresden and never in the other codices, numbers are expressed by portraits of deities, whose features or attributes are the key to the number thus portrayed (figs. 24; 25).

It cannot be proved that every numerical profile is that of a god, but nearly all can be identified as such, and it is therefore safe to assume that all have a similar derivation. An explanation has been given for this association of numbers with gods (p. 99). The identification of these heads is largely due to the investigations of J. T. Goodman.

One (fig. 24,1-7). The head for 1 is that of a youthful deity with classical profile embracing almond-shaped eye, deformed head, prominent, straight nose, the edge of which continues upward in a straight line to form the forehead, open mouth, drooping lower lip, and receding chin. The distinguishing marks are a lock of hair which passes in front of the ear, and curves forward along the base of the jaw, and a long rod inserted in the earplug. There is usually a small ornament on the forehead, formed of one, two, or three circular elements. An *ll* sign frequently appears on the cheek as though to represent tattoo or paint marks.

The deity who rules during the month Kayab is the same individual (p. 117; fig. 23,21-27) and there is very little doubt that the head variant of the day Caban on Quirigua D (fig. 10,7) is again the same deity. In fact, the main element of Caban is in all probability the lock of hair. A lock of hair is the distinguishing mark of the goddess whom Schellhas (1904) designates with the letter I, and who, I have shown, is the moon goddess (Thompson, 1939). She is also a goddess of the earth

(*cab* means earth) and of the maize. Furthermore, this curl appears in Landa's alphabet to represent the letter *u*, but that is precisely the Yucatec name for the moon. Thus the identification of the head form of one with the moon goddess can be accepted as fully proved.

Two (fig. 24,8-11). The identification of the head which represents the number 2 is due to the acumen of Enrique Juan Palacios (1935), who deciphered several examples on the Tablet of the 96 Glyphs at Palenque. The distinguishing characteristic is a hand which surmounts the head; the features are those of a youthful individual. There is a double curve on his cheek, and the *ll* mark may be present.

In discussing the day Etz'nab it was noted that it was not improbable that God F was connected with the sacrificial knife. Before investigating this matter further, it should be pointed out that Schellhas (1904) confuses two distinct gods and classifies them together under the letter F. One god is distinguished by a curving line which starts on his forehead, passes through his eye or immediately behind it, and terminates below the ear (fig. 15,1-3,6,7); the other god has a sharper curve which faces in the opposite direction, and is placed behind the eye (fig. 15,4,5,9,10). The latter I call God R; to the former I assign the letter Q, thereby avoiding any confusion by discarding the letter F. God Q is closely associated with death both in his ornaments and attributes and in many of the scenes in which he appears; he shares with the death god rulership of the north in the diagram of world direction on Madrid 76; God R is benevolent, and his associations are with the maize god. The curving line on his face resembling the Caban sign perhaps is indicative of his connection with the soil. The respective glyphs of these two gods are distinguished by faithful delineation of these facial markings. Furthermore, God Q has a numerical coefficient of 10 before his name glyph; God R has the number 11. Part of Schellhas' confusion of these two gods undoubtedly arose from the fact that God Q has in front of his face, as one of his attributes, the eye of death. In the reproductions of the codices this often resembles a numerical dot, and as a consequence, Schellhas and others after him (e.g. Gates, 1931, p. 117) have supposed that this should be added to the two numerical bars beneath to yield a coefficient of 11. It has, however, no numerical value; it merely identifies the wearer as a god closely connected with death (fig. 15,6). Lastly, God Q usually has a long strip of material, perhaps bark cloth, pendent from his earplug; God R has a short rod. In the illustrations of his paper Schellhas shows a picture of God R to typify his merged God F, but in the text the description of the god applies rather to God Q. This same

illustration is similarly labeled by subsequent writers including, I regret to say, myself. Thus are errors perpetuated, gathering authority with each fresh appearance.

The resemblance of God Q to the Mexican god Xipe was first noted by Schellhas, for both gods are distinguished by the line curving through the eye or immediately behind it. In the case of Xipe it is known that these lines appear on both sides of the face and represent the seams of the mask of human skin usually worn by that bloody god. Moreover, it is not unreasonable to suppose that the lines of dots on God Q's body correspond to the crescentic markings on Xipe, which, in turn, represent the human skin he wore. As evidence that God Q, like Xipe, was a deity of human sacrifice, it should be noted that he, in the company of the god of death, presides over a scene of human sacrifice, in the diagram on Madrid 76. On Madrid 84-86 he appears three times, on each occasion with a knife in one hand, a torch in the other. On another occasion he is thrusting a stone-pointed lance in the mouth of God M.

In Mexican art the hand is a symbol of death. The figure identified as Tzitimitl on Magliabecchi 76 has a headdress of hearts and hands surmounted by paper banners, all three being well-recognized symbols of human sacrifice and death; hearts and hands alternate on the collar of the same fearful being. Noguera (1927) reports the occurrence of human hands in a combination with hearts and skulls, on one of the two sacrificial altars of Tizatlan, Tlaxcala, and presents a brilliant discussion of their distribution in art and their undoubted use as symbols of mortality. He cites examples of the hand associated (1) with skull, a bleeding foot, and what was probably the glyph for jade (precious substance, a symbol for blood); (2) with skull and an unidentified symbol; (3) with flint knives; (4) with scorpions, sacrificial bone needles, blood, human hearts and hands. All of these elements represent sacrifice or death. It might also be noted that the Aztec god of death not infrequently wears human hands pendent from his ears.

I think the reason for associating human hands with sacrifice is not too recondite. The Mexican god of human sacrifice was Xipe, who was the god peculiarly associated with the gruesome custom of donning the flayed skin of the sacrificial victim. It must have been difficult to step into the skin of the victim; it was practically impossible to insert one's fingers in the human gloves. Accordingly the human skin was cut at the wrists, so that the wearer's hands were not encased. The skin of the victim's hands hung from the wearer's wrists. These dangling hands form a prominent characteristic of Xipe and his impersonators. In that way the hand may have become a symbol of death and sacrifice through its conspicuousness

in the Xipe costume. Xipe, as noted (p. 87), was also the god of the sacrificial knife, and, because war was waged for sacrificial victims, he further served as a god of battle.

God Q has the same facial markings as Xipe and, too, seems to have been connected with human sacrifice. He carries stone knives or points on a number of occasions. This may show his connection with those implements, since stone knives are not over-common in the codices, but the fact that he holds them may have no significance, and the human hand is nowhere associated with God Q. Maya art was less preoccupied with death than were the various schools of art in central Mexico. Skulls and cross-bones, bleeding hearts, and other symbols of the morbid imagination of their northern neighbors are rare in the healthier religious art of the Maya of the Initial Series Period (they appear in battle scenes, understandably, on the Bonampak murals). Nevertheless, there is one clear example of the association of human hands and death in Maya religious art. The head form which represents completion or zero has as its identifying characteristic a hand across the lower jaw (fig. 25,37-45). The head itself frequently displays death symbols such as the percentage sign, the death eye, on the forehead or on the collar, and the three dots placed horizontally on the forehead. Thus the association of hand with death holds also for the Maya area.

Another association which brings together death or sacrifice, stone knife, and hand is to be found in the Yucatec name for the sacrificial knife *u kab cu (ku)*, "the hand of god" (Scholes and Adams, 1938, 1:142).

The head for number 2, as carved on the Tablet of 96 Glyphs at Palenque, has a curved line on his face, like that of God Q, but well behind the eye instead of passing through it. Each has a hand on his head suggestive of death and sacrifice. Furthermore, we have seen that there is evidence indicating that the days Caban to Oc are connected with the numbers 1 to 13. To Etz'nab, accordingly, corresponds the number 2, but that is the day "knife," more particularly "sacrificial knife."

The garment of near-certainty to cast around the shoulders of our surmise has been woven from these various threads of evidence. It may be taken as practically proved that the head variant for the number 2 is that of a god of sacrifice and of the sacrificial knife. He corresponds closely to Xipe, and may well be the same as God Q of the codices.

Three (fig. 24,12-17). The head for 3 is also that of a youthful god with classical profile, and often with the 1L design on his cheek. His distinguishing characteristics are the Ik symbol, a disk edged with circlets which is set on the forehead, and a banded headdress.

The Ik sign may be engraved on an oval shield which covers the ear or it may be set farther forward; the headdress can be better studied in the illustrations than described. The banding and the circular area at the top seem to be characteristic.

The Ik symbol is the principal element of the day Ik, which signifies wind and breath. It replaces the eye in the hieroglyph of God B (fig. 12,11), and, as that god is a deity of the rain and the storm, it is clear that the Ik sign symbolizes rain and wind. The disk edged with circlets is also a rain symbol (p. 277), and, clinching the argument, the god of number 3 is associated with the day Cauac in the proposed scheme (p. 87). The glyph for cauac is the symbol for rain, and the word itself means storm. Furthermore, a cursive form of Ik is frequently one of the component elements of the cauac sign (fig. 26,10,11). Accordingly, there is no doubt whatever that the god of the number 3 is a deity of wind and rain.

Four (fig. 24,18-25). The head of the aged sun god represents the number 4. He has a large, almost square eye with the pupil set in the top inner corner, so that he squints. In fact Akanchob, whose name means "he with the squint who cried aloud," is the Lacandon name for a deity who is the husband of the moon, and as we know from many sources that the sun is the husband of the moon (Tozzer, 1907, p. 95; Thompson, 1939, p. 133), there can be little doubt that this was a nickname for the sun. The god of number 4 sometimes wears the kin (sun) glyph on the side of his face, and often has the upper incisors filed to a T-shape, as was the custom of the sun god. Final proof, were that needed, that the god of number 4 is the sun is to be found in the use of the symbolic form of the kin (sun, day) sign on one occasion as the symbol for 4 (fig. 25,52; p. 137). Ahau, the day with which the number 4 is associated in the day sequence, is the day of the sun god (p. 87). There is, accordingly, irrefutable evidence that the sun is the god of number 4.

Five (fig. 24,26-31). The personification of 5 is an aged god, as indicated by the single tooth in his jaw, who wears the tun sign as his headdress. This ancient deity is recognizable in the Dresden and Paris codices, since there, too, he is depicted sometimes wearing the tun headdress (fig. 21,1-3). His glyph is the cauac sign with a coefficient of 5 and a looped prefix. Schellhas, who assigns him the letter N, accepts him as the god who ruled the days of Uayeb, an identification first made by Förstemann (1901a, pp. 189-92). This old god, known as Mam, "maternal grandfather," was worshipped during the five nameless days, and at the end of that period was undressed and discarded in an irreverent manner (Lopez de Cogolludo, 1867-68, bk. 4, ch. 8). It should be noted, however, that

in the codices this god is not directly associated with the Uayeb days. Mam is also the name of the aged earth god of the Kekchi and Pokomchi, with whom important mountains are associated, and whose home is beneath the earth, where he lies bound. He is generally regarded as an evil god in the Alta Verapaz, although in southern British Honduras, where he is merged with the mountain-valley gods, his aspect is benignant. That this Mam is the same as the Mam that ruled the days of Uayeb in Yucatan is apparent from a Kekchi survival of an old tradition. As already noted, the Kekchi no longer retain their old native calendar, but the five unlucky days have survived in a curious form, for they have been transferred to Easter. According to a letter to Mrs. McDougall from Mr. Helmrich, who has lived many years in the Alta Verapaz, the Kekchi have the custom of burying a Mam during these five unlucky days, clearly a fusion with Christian practices. He states that the Mam holds power only during those five days.

That the old god of number 5 is also an earth god is evident from the vegetation which usually decorates his tun headdress. An excellent example of this is supplied by the murals of Bonampak. Among the impersonators of gods of the underworld assembled for the dance, all bedecked with water lilies, is this aged god of number 5. He carries the tun sign under his arm instead of on his head, but from the presence of the water lilies and from the nature of his companions, it is clear that he is a god of the earth. The water lily, as we have seen (p. 72), is the most important symbol of gods of the underworld.

Not infrequently God N carries a large conch shell on his back or is depicted emerging from it (fig. 21,3-7); a variant of his name glyph consists of a conch shell with the same prefix as in his usual glyph.

The conch shell has two symbolic associations. By a natural process it represents water, and as the earth was believed to be on the back of a crocodile who floated on the surface of a cosmic sea, the conch shell became a symbol of the subterrestrial region and its divine inhabitants. As such it was also the symbol of the great mother, the moon goddess, who was also a deity of procreation, of the earth, and of water. From this, combined with a certain physical resemblance, developed the association of the conch shell with birth. In the words of the interpreter of Vatican A, "They placed on its [the moon's] head a marine shell to denote that just as the [shell] fish issues from the shell, so emerges man from the womb of his mother." This employment of the conch shell as a symbol of birth was certainly an extension of the earlier association with the earth.

The conch shell is the constant symbol of Tepeyollotl, the Mexican god of the interior of the earth with jaguar

features (fig. 21,9,13; p. 74), and in the Bourbon and the Aubin Tonalamatl it appears, usually in conjunction with the night eye (also a symbol of death and the underworld), with certain deities, notably Itztlacoliuhqui with death symbols, the jaguar night-sun, Tecciztecatl, Xiuhtecutli, and Chantico, all of whom are connected with the interior of the earth (fig. 21,10-12). It should be mentioned in passing that one of the names of Xiuhtecutli was "the navel of the earth," and that Chantico, another fire deity, presumably has a similar association. I very much doubt that Tecciztecatl was actually a moon god, as is generally believed. He does not have lunar attributes, and in Middle America the deity of the moon is generally feminine. Because Tecciztecatl became the moon in the legend of the conversion of Nanahuatzin into the sun, it does not follow that he should be regarded as the moon god, any more than Nanahuatzin and the sundry other gods who served as the sun in the various creations should be viewed as sun gods. Tecciztecatl's white loincloth, the death eyes which are so prominent in his pictures, and his mergence with Tezcatlipoca indicate that he is probably an earth god. If that identification is accepted, he becomes a twin of the Maya god of number 5, who is aged and has as his symbol the conch.

The conch, as a pectoral, is worn by Quetzalcoatl and Xolotl. The former, I believe, is primarily the deity of fresh vegetation, of growth when the rains come, as is brought out in the hymn to Xipe; the latter is the god who leads the sun to the underworld. Both deities, therefore, are connected with the earth: in one case with its surface, in the other case with its interior. There is, accordingly, reasonably full evidence for recognizing the conch as a symbol of the earth, particularly its interior.

The god of number 5, therefore, is the aged god of the interior of the earth, the Mam, whose symbol is a conch shell. He is also the god of the day Imix, the day of the earth crocodile which symbolizes the earth.

Six (fig. 24,32-37). The god of number 6 is distinguished by a hafted axe set in his eye, which is squarish with a loop passing below it. The nose is Roman, and the central incisors of the upper jaw, which appear to be filed, are often somewhat prominent. A deity with an axe in his eye does not appear in the Maya codices, and is extremely rare in the sculptural art of the Initial Series Period. However, on Madrid 66 a deity, whose eye is covered by crossed bands in an oval, emerges from the jaws of a snake. The crossed bands may be a badly drawn axe.

The axe is the symbol of Schellhas' God B, a deity of the rains and storms. Over and over again he is depicted with an axe in one hand. The axe is similarly one of the

insignia of the Tlalocs, the Mexican gods of rain, who correspond closely to the Maya God B. God B is very intimately connected with serpents, a reason for supposing that the head on Madrid 66 is meant to represent the god of number 6. The close association of the god of number 6 with water and vegetation is confirmed by one of the very rare representations of this deity outside epigraphy. His head rises from the flower of a water lily on Pier F, House D, the Palace, Palenque (fig. 12,4). As noted, the water lily is a symbol of water and, by extension, of the primeval water and the alligator monster who rested in it. Indeed, the water lily plant in this design grows from the head of the alligator monster. For these reasons there is little cause to doubt that the god of number 6 is intimately associated with God B, and may in fact be a prototype of that deity, his most characteristic insigne being transferred to the eye because the numerical glyph shows only the head. The god, therefore, is a deity of rains and storms.

Seven (fig. 24,38-41). Heads of the god of number 7 are somewhat rare, but the distinguishing marks are easily recognizable. Of these the most important is a loop which passes under the eyes, and is loosely tied like a cruller, to use Spinden's expressive description, over the bridge of the nose. Characteristic, too, is the earplug which is oval and has a flamelike pendant with one tongue longer than the other. The eyes are square; the nose is Roman. The central incisors of the upper jaw are filed T-shape. There are two or three little circles below the loop under the eye.

The deity represented is the jaguar god as recognized first by Seler. This is shown by the jaguar paws of the only full-figure representation of the god of number 7, and by numerous representations of the god in sculpture and ceramics, which show the details noted above in combination with the peculiar ear of the jaguar, or the beard or spotted skin of that animal (fig. 12,14,15). Sometimes an impersonator wears the twisted loop of the jaguar god combined with the paws or beard of the jaguar; on one occasion the impersonator of the god has the number 7 on his cheek (fig. 12,13), and that number may appear on jaguar heads (fig. 52,2-E5).

As already pointed out, the jaguar is the god of the underworld, and appears to be merged with the night sun. As a god of the earth he carries the symbols of his origin, for frequently he wears the lily or shells, and not infrequently he has the symbol for night as an ornament of his ear or before his face (fig. 46,10-12,16). He is the Maya equivalent of Tepeyollotl.

Eight (fig. 24,42-49). The head of the god of number 8 has long been recognized as that of the maize god. Not infrequently he is depicted with a maize plant growing

out of his head; more often this vegetation is replaced by a spiral on the forehead. There are grounds for thinking that this spiral is the symbol for the maize plant. The god usually has a string of maize grains on the side of his face, falling around or immediately before the ear, and reaching to the chin. The face is youthful and conforms to the classical style of Maya beauty; the IL mark on the cheek is sometimes present. The earplug has a short projecting element, perhaps of bark cloth.

Nine (figs. 24,50-55; 28,1-5). The god whose head serves as the number 9 is easily identified by the markings on his chin, for the area below the line of the lower lip is covered with dots, and the face is often bearded. The features are youthful, and conform to the classical type of Maya beauty. Sometimes the yax sign appears as an ornament on the forehead and the hair may be long. There seems to be no standard form of earplug, but a jaguar claw may be on the temple. The spots probably represent jaguar markings (cf. jaguar features of Tlaloc).

To Hermann Beyer (1933, p. 678) is due the credit for first identifying the god of the number 9 as the Chicchan god (Schellhas' God H). He points out that the heads for 9 and 19 frequently have the yax element on the forehead, a feature also found with the glyph of God H. Similarly the glyph of the Chicchan god has spots around the chin, the distinguishing attribute of the god of number 9. The head for 9, as carved during the Initial Series Period, never has the Chicchan circle on his temple, but in cases of full-figure numerals there is a pendent element which emerges behind the ear and extends some distance below the chin. This is almost certainly the lower jaw of a serpent. Beyer has also identified a head with Chicchan spots as the number 9 in Dresden, where it serves as the coefficient of the baktun glyph (fig. 25,46). In support of Beyer's argument, it should be noted that the symbolic form of the day Chicchan is composed of two parallel strokes set diagonally within the frame, but that is precisely the main feature of the yax element worn by the god of number 9. This same head for 9 can replace the yax prefix in certain glyphs (figs. 3,7; 31,51). There can be little doubt, therefore, that the head for the number 9 is the serpent deity, the Chicchan, as worshipped yet by the Chorti (Wisdom, 1940, pp. 392-97).

Ten (fig. 24,56-62). The head of the god of number 10 was recognized by Goodman as that of the death god 50 years ago, and has been accepted as such by all workers in the field. The principal characteristics are the bared jawbone, the fleshless nose, the percentage signs on the cheek, the "eye" on the forehead, and the three dots on the upper part of the head. Of these characteristics only the bared jawbone is constant, but one or more of the remainder is usually present.

Eleven (fig. 25,1,2). Heads of this god are rare. The distinguishing feature is the caban, "earth," sign, the crosshatched circle and curl, indicating that the god is of the soil or a lunar deity. I think we can eliminate the latter possibility; the individual is clearly masculine. The caban curl, but without the crosshatched circle, is the identifying feature of God R (p. 131), and occasionally appears on the glyph of the maize god in Madrid (pp. 60b, 65a, 97b). That is understandable in view of that god's intimate connection with the earth. With rare exceptions, the glyph of God R has a coefficient of 11. This could indicate either that he is the god of that number (cf. occasional appearance of 7 on face of jaguar god and of 5 with the glyph of the old earth god, Mam) or that number 11 is part of his name. Names of gods incorporating that number are rare; the most prominent is Buluc-Ch'abtan, perhaps connected with *ch'ab*, "to create." However, Mesoamerican creator gods are usually celestial. Alternatively, the name means "11 Penances," reminding one that Zip, name of the Yucatecan deer god, means sin. This tenuous connection is probably fortuitous. God R is not associated with deer in the codices, but he sometimes plays parts in keeping with an earth god.

The god of number 11 rules Manik, clearly the day of deer and of hunting. One of the prognostics for Manik in Kaua is *ah uitz*, literally "he of the hills," but the earth gods are generally mountain gods and have the deer and other wild animals in their keeping. Hunters petition them for success (Thompson, 1930). Moreover, for the Quiche, Manik is a good day for prayer to the mountain god, "who is in intimate relation with the concept or idea of the deer" (Schultze Jena, 1946, p. 35). We conclude that the god of 11 was an earth and mountain deity, patron of deer and other animals, perhaps God R, and conceivably identifiable as Buluc-Ch'abtan. See page 296.

Twelve (fig. 25,3-7). The god of number 12 is a somewhat youthful deity who is rarely represented in the texts. An example from the Temple of the Cross, Palenque, supplies the clue to the god's identification through the unusual headdress which he wears, for this is the sky sign. Evidence has been presented (p. 88) for identifying him with Lahun-Chan, a variant of the god of the planet Venus, whose glyph contains the sky sign as its main element (fig. 14,2,4).

Thirteen (fig. 25,8-14). The portrait which denotes the number 13 takes two forms. It may be the profile of 3 with the bared jawbone and other insignia of the death god, deity of the number 10 (fig. 25,8,11-13), or it may be a fantastic head with a long pendulous nose (fig. 25, 9,10,14). The former is commoner than the latter. The first form, which is a blending of the features of the heads for 3 and 10, is in agreement with the method of com-

binning the insignia of the gods of the two digits, as seen in the heads for 14–19 inclusive. This arrangement appears to be a translation into glyphs of the spoken word, for in all Maya languages and dialects the numbers 13–20 inclusive have the second digit attached to the word for 10 (e.g. in Yucatec *uaxaclahun* [*uaxac*, “eight”; *lahun*, “ten”]). In the case of the heads for 13 the translation of the spoken word would seem to have conflicted with the old sequence of the 13 gods, with the result that 13 came to be carved either as the head of the thirteenth god in the series or as the combined features of the gods of 3 and 10. As a matter of fact, this did not involve a serious clash of rival claims to suzerainty of the number 13. The god of number 3, as we have seen (p. 132), was a deity of storms and rain; the individual god of number 13 without much doubt is a deity of water.

This deity of 13, as already noted, has a long pendulous nose. The eye is squarish with a loop beneath it, and sometimes there is set in it a hook, which rises from the lower edge. A fang emerges from the corner of the mouth. Details of the lower jaw are too worn in surviving examples to indicate whether it was characterized by the bared jawbone. I rather think not, although the jaw is somewhat angular. The headdress is variable; in two examples from Palenque it is composed of some material held in position by a knotted sash and surmounted by what is clearly a vegetal motif and which perhaps may be further classified as the water lily. The head closely resembles that of the Imix monster, save that the latter usually carries death symbols. It appears to be the same as a variant of the tun sign, in which a grotesque head is surmounted by the tun sign. The tun itself symbolizes water, and the Imix monster also has an aquatic significance, additional to his primary function as an earth deity. In the full-figure representation of the god of number 13 on Quirigua D (fig. 28,15), the head lacks a lower jaw. It is attached to the body of a snake decorated with a large water lily. This last item strengthens the identification of the vegetal motif on other heads as a water lily. The ophidian body confirms the identity of the god of number 13 with the tun variant noted above.

It is difficult to distinguish betwixt terrestrial and celestial snakes and dragons, and I suspect that the Maya themselves were uncertain as to where to draw the line. One of the chief characteristics of Central American mythology, and one which is exceedingly disconcerting to students, is the nomadic tendencies of the divine race. Deities passed from the upper to the nether regions at will, refusing to remain in neat categories of terrestrial and celestial beings. Furthermore, their shapes are not constant, for the dragons may be crocodiles, snakes, or fishlike beings, or a mingling of those creatures.

Whether the dragon of 13 is a celestial or terrestrial monster it would be hard to say. The evidence of the association of the god of 13 with Muluc and its patron the *xoc* monster rather suggests that the god of 13 is the *xoc*. Yet *xoc* is a mythical fish, whereas the head for 13 is that of a snake or, perhaps, a dragon. In that connection it is worth remembering that the Cipactli monster was at times regarded as a kind of fish, and the day Imox in the Quiche calendar, according to Ximenez, meant sword-fish, whereas in Maya art the Imix monster is a draconian crocodile.

Because snakes were so closely linked in Maya thought with water, and because this same head could serve as a variant of the tun, which, too, was very intimately associated with water, I think there can be no serious reason to doubt that the head of number 13 is that of a serpent, perhaps capable of transmuting itself into a dragon, which represented water. The number 13 and Muluc are, accordingly, united by their aquatic values.

Fourteen to Nineteen (fig. 25,15–36). As noted, the heads for these numbers result from a merging of the two digits composing each number. In three texts the heads corresponding to both digits are given, the one above or beside the other. Thus in an early inscription (Yaxchilan L 48) the coefficient of the kin, which is 16, is shown by means of the head for 6 above that for 10. The former is held in the paws of the monkey which in this inscription represents the kin; the latter is immediately below the monkey's paws (fig. 29,10). The other examples of this practice are on Tila B (fig. 25,12), and at Xcalumkin (fig. 53,3).

A somewhat similar practice, but combining bars and dots with the head for 10, is shown on the east jamb of the south door of Temple 11, Copan. There the coefficient of Ceh is expressed by means of a bar and four dots at the side of the head variant for 10, the whole denoting 19. In this case the bar and dots are to the right of the head, which also faces to the right. This unusual arrangement is due to the fact that the whole inscription is reversed so that the glyph, being on the right jamb of the entrance, faces one on entering the temple. In the illustration (fig. 25,36) it has been reversed.

On the early Tikal 6, what is almost surely 18 Yax is shown as the death head of 10 with a bar and three dots prefixed; the Yax is a head variant with yax prefix to left (fig. 5,53). A third example, noted by Morley (1920, p. 166), is on the east altar of Copan 5, and serves as the coefficient of the tun sign. It is composed of a numerical bar before the death head of 10, the whole reading “15 tuns.” The other cases cited by Morley are not acceptable, for in one text the IS reading is incorrect, and in the remainder the glyph given the value of 10 is a

variant of the kin sign. However, there are two other examples of this practice. On Yaxchilan L 47 the coefficient of Pax is expressed as a bar and four dots before the head for 10, making a reading of 19; on Chichen 16 the coefficient of Uo is written as a bar above the head for 10 (fig. 39,6). In all these cases the order of the digits corresponds to the spoken word, e.g. 9 and 10 (never 10 and 9) paralleling *bolonlahun*.

SYMBOLIC VARIANTS: ONE TO NINETEEN

In addition to bars and dots and head variants to represent the numbers 1-19, there are a few examples of symbolic variants for the numbers 1, 3, 4, and 8. There may be others not yet recognized.

One. This is a finger, recalling and partly confirming the belief that the commonest term for 20 in the Maya languages and dialects is the word for man, because 20 is the sum of a man's fingers and toes. The jade circle, generally shown at the wrist, is usually added to the finger (figs. 25,50; 33,18; 47,6; 48,2).

Three. On Dresden 9b the number 3 is represented as a cursive Ahau surrounded with crescents and with a prefix which may be a water symbol (fig. 25,51). Three is an aquatic god, and one would expect water symbols, particularly the T element.

Four. On an inscription at Copan the kin (sun) sign is used to express the number 4. The explanation of this usage is simple: the patron of number 4 is Kinich Ahau, the sun god, and his symbol replaces his face (fig. 25,52).

Eight. On both Copan I and its altar the number 8 is expressed by means of a bar and three dots inside an oval which is surmounted by maize foliage. This, again, is in accordance with the head variant of this number, for that is the head of God E, the maize god (fig. 25,53). A similar glyph occurs in Dresden, where it is almost surely a symbol for maize (p. 272; fig. 25,54).

COMPLETION (OR ZERO??)

For a number of years, around the turn of the century, the controversy 20 versus 0 raged. There was "great argument about it and about," with a final verdict in favor of zero. The matter boiled down to this: when, for example, the Maya wrote an IS which we would translate as 9.15.0.0.0 4 Ahau 13 Yax, did the symbols which we translate as zero mean 20 or zero? The argument was really triangular, for there was a suggestion that the symbols in question actually meant completion.

As in most, perhaps all, Maya glyphs, there is a head variant in addition to the symbolic form (fig. 25,37-45). The most characteristic feature of the former is the presence of a hand across the lower jaw. This is frequently combined with characteristics of the death god, such as

the percentage sign (Quirigua B), the death eye before the forehead (Copan 1 and 6), and the three dots across the top of the head (Quirigua J). In several cases there is a bifurcated ornament attached to the earplug, a spiral on one side, a long tapering element on the other (fig. 29,1,5,7). This element occurs rather frequently but by no means invariably in the aural ornaments of gods of the underworld (e.g. on the earth monsters beneath the crosses of the Tablets of the Cross and Foliated Cross, Palenque), on the earth monster, a true alligator, on Copan T; on the rear head of the double-headed snake, Tikal T 4 and L 3; on the main personage, Copan H; and on representations of the jaguar god, Quirigua A, and the jaguar god of number 7. It would appear, therefore, to symbolize death when used on the heads under discussion, for the underworld is the realm of the death god.

The principal meaning (there are others) of the hand is that of completion. In that sense it is used with period endings, preceding the required number of baktuns or katuns. Without much doubt its significance here is that of completion of so many baktuns or katuns. Even were the meaning not precisely that of completion, the sign cannot possibly have the meaning of zero as used in this sense. The hand is also placed below the winged cauc glyph, and the whole sign is formed usually with the addition of a "count" or a *u* prefix (figs. 5,40-46; 32,24-29). The whole surely means (count of) the approximate year completed; it cannot possibly refer to zero tuns since the glyph often occurs with the dates which are not katun endings. It is extremely unlikely that hand would signify completion in one place, zero in another. Furthermore, death symbols with the meaning of expiration (p. 189) are used as a prefix in phrases which carry the connotation of completion, and can substitute for the regular count bracket and replace the hand. Counting and expiration were the equivalent of completion in Maya thought; they are clearly the opposite of zero in the sense of the count not having yet begun.

Thus the evidence strongly indicates that the head and symbolic forms under consideration denote not zero but completion, and that a date which we read as 9.15.0.0.0 means that 9 baktuns and 15 katuns have ended, and that the count of the tuns, uinals, and kins has been completed. It is convenient to write this as 9.15.0.0.0, but with the understanding that 0 is here to be understood as it is in 10, 20, 30, etc.; that is to say, the first unit in our decimal system stands at nothing because the total has reached a multiple of the second unit. On the other hand, I am sure, although there is no evidence pro or con, that the Maya would not have used this sign in the sense of nil had they, for example, been required to report on the

production of some crop that had been a total failure, or had they wished to write the zero day (if one existed) in their calendar.

Fulton (1947, 1948) has discussed at length the concept of zero. Although in agreement with many of the ideas he expresses, I am not sure that the cyclical arrangement can be applied to the LC in view of the Maya picture of time as relays of bearers marching ever forward from one *lub* to another (see also p. 59).

There is yet another symbol which is used interchangeably with the head variant and the hand with attached elements. This is the left or top half (depending on whether it is to the left or above the period) of a sign resembling somewhat a Maltese cross with the addition of loops or diagonal lines between the arms of the cross (figs. 25,55,56; 30,1,2). The complete design is not uncommon in Maya art. In Madrid and in Fejervary-Mayer, which is from southern Mexico, the 260-day cycle is arranged in a pattern which exactly conforms to this design, the days following the sides of each arm of the cross and each loop. The whole in each case is divided into four parts of 65 days apiece. The Maya divisions are marked by the glyphs of the four world directions; the Mexican, by world directional trees and birds. Both show, in addition, a pair of gods associated with each direction and a pair (only one in Fejervary-Mayer) in the center. It cannot be chance that the same design is used in both codices in view of the considerable distances and cultural differences which separate the two areas from which they emanate. One must conclude that the design has a special association with the sacred almanac in particular or time cycles in general.

As used with time periods (kin, uinal, tun, etc.) only half to three-quarters of the glyph is shown, but that is pretty obviously because of lack of space. It is either a prefix attached to the period glyph or it may be a separate element overlapped by the sign to its right. In one example of this overlapping style (Ixkun 2, B4) it is possible that a small piece of the right arm of the cross is visible behind the open mouth of the frog head of the uinal, although the available photograph is not sufficiently clear to permit of a positive identification. Lack of space allowed Maya sculptors to cut a glyph in half (e.g. the moon sign of Glyph A of the lunar series is cut in half and attached to Glyph B on Coba 20). It would therefore appear practically certain that the symbol under discussion represents the whole Maltese cross, and lacks an arm only or an arm and parts of two others merely because of lack of space.

This same element, with a special infix, a prefix, and with lines across the top, forms the half period (the so-called lahuntun) glyph (fig. 32,46-55). The form of this

glyph is discussed elsewhere (p. 192). Suffice it to say at this point that the meaning of the whole corresponds in general to some such phrase as "half the completed period," or "half lacking to the complete period."

As will be noted shortly, the moon sign is sometimes used in distance numbers with the value of 20, the attached coefficient being added to that number. Thus, the moon sign with two bars and a dot attached has the value 31.

In one text (Palenque Cross, B13) a distance number of 20 days is expressed by means of a moon sign with this symbol resembling the Maltese cross attached (fig. 4, 17). To judge by the analogous cases the whole would mean 20 plus 0 or 20 only. This interpretation rather favors the proponents of the thesis that the symbols under discussion mean zero. On the other hand, it does not seem special pleading to offer the translation "completion of one lunar period of 20 days," although it must be admitted that zero fits this particular case rather better.

My purpose in discussing these slight variations in meaning, for they do not affect the general sense, is to show that some signs to which have been assigned the value of zero may actually correspond to verbal expressions.

The matter is discussed at some length by Spinden (1924, pp. 18-22) who appears to have been the first student of the subject to accept these signs as having the primary meaning of completion. The evidence is not entirely satisfactory, but so far as it goes, it rather suggests that this sign, like the hand and the head with hand across lower jaw, signifies completion, or perhaps it might have the slightly variant meaning of setting in order. Either interpretation would harmonize with the use of the sign as a frame for the cycle of 260 days. Translation of the sign as zero would be contrary to its use in the half-period glyph and as a frame for the cycle of 260 days.

In Dresden the above symbols are replaced by stylized drawings which have been generally accepted as representing shells. Förstemann (1886, pp. 4-5) identifies many of these as *Oliva*, a view upheld by Tozzer and Allen (1910, p. 297); many others appear to be bivalves, and one or two resemble conchs (fig. 25,59). In this connection it will be recalled that a shell is frequently combined with a hand in the symbolic variant already discussed.

If these representations of shells are examples of rebus writing, a Maya homonym, if such exists, must be sought among generalized words for shell. In this connection Roys points out that *xixim* is a general term for shell in Yucatec, and that might come from *xim* (duplication of syllable) or, more likely, from *xix*. *Xix* has a number of meanings, none of which would apply here, but Roys

notes that in composition the term seems to signify "completely," e.g. *xix ich tah te*, "to look at someone fixedly from head to foot," *xix uouol oc*, "perfectly round, spherical." He suggests with some hesitation that this might account for the use of a shell to signify completion.

GLYPH FOR TWENTY

The moon sign is used constantly in Dresden and Madrid to represent the number 20 (figs. 25,60; 63,1-4). The coefficient attached to it does not, however, serve as a multiplier, as do the coefficients of the usual period glyphs, but it is added. Thus a moon sign with a coefficient of 8 (bar and three dots) represents 28, not 160. The use of the moon sign as 20 is restricted to distance numbers. It serves with its coefficient to express intervals between dates in the various divinatory almanacs provided those distances are not less than 20 and not more than 39 days. The system presumably could not be used above 39 days. It is a shorthand system of writing, a reckoning in days alone rather than in uinals and days, just as we might say either 18 days or two weeks and four days. Examples of this usage on the monuments will be found on page 167.

Gates (1931, pp. 89-90) expresses the belief that there is no evidence that the sign used for 20 in the codices is the moon glyph, although all other investigators accept it as such without hesitation. Proof that it does represent the moon is to be found in the fact that the inscriptional type of this sign, which it resembles in appearance and duplicates in function, also serves as the symbolic variant of the head of the moon goddess in IS introductory glyphs corresponding to Ch'en (fig. 22,44-49). Furthermore, this sign occurs in planetary bands, and can be substituted for the sun glyph in the darkness glyph (fig. 43, 51,52). Moreover, it is paired with sun disks above planetary bands on several stelae at Yaxchilan. Finally, it appears in the lunar series to express the age of the moon: in two glyphs (E and A) to record a moon age of 20 days, and sometimes as Glyph D, but with a different infix, to record moon ages of less than 20 days (figs. 36; 37).

GLYPH FOR HALF

The Maltese cross with a line or lines cutting off the top and with an infix, a prefix, and occasionally a postfix was employed to record the completion of half a period (fig. 32,46-55). This glyph is mentioned above; it is discussed at greater length on page 192. It would seem that the lines across the top indicate that the whole element is cut in half. To the best of our knowledge, the Maya made no use of fractions except for a very limited use of the simplest fractions with denominator of 1, such

as in this case. Naturally, when the Maya divided their cycle of 260 days into four or five parts, each part was a fourth or fifth of the whole, but, so far as is known, there exist no glyphs to indicate that a division was a quarter or a fifth of the whole, and no evidence that the Maya regarded these parts as we do fractions. The fact that the Maya expressed the length of the moon either as 29 days or as 30 days, alternating these two numbers with necessary irregularities is good evidence that they did not employ fractions. The use of fractions is against the whole Maya philosophy of numbers based on the lowest common multiple of two or more periods. In its simplest form the relationship of the moon is to the day, not to the half-day.

SUPPRESSION OF NUMBERS

Occasionally in distance numbers a period was suppressed if its coefficient was zero (I shall continue to use the term zero in translating the signs which, I believe, represent completion). Examples of this practice are discussed on page 159 (fig. 30,3,4). There is possibly a unique example (Chinkultic 8) of the suppression in an IS of the baktun and its coefficient. The whole seems to read: A1-B2, IS introductory glyph; C1, 18 katuns; C2, 0? tuns; D1a, 0? uinals; D1b, 0 kins; D2, 11 Ahau. The suppression of the 9 baktuns may have been an error, or it may have been deliberate since there could have been no doubt of the correct number. The second IS of Lacanha 7 reads 9.6.(0).11.0 8 Ahau 18 Zac, the 0 tuns being omitted.

POSITIONAL NOTATION

In Dresden and certainly on one stela (Pestac 1; Blom, 1935) the Maya suppressed the period glyphs of IS, and used a purely positional system of numeration. The bar and dot coefficients of the five periods from baktun to kin were arranged in a vertical column, spaces between serving to eliminate the danger of confusion (figs. 46,17; 64,2). In a few cases six positions, including the pictun, are written in this system. Smaller numbers of two or more periods are also used. These numbers must first be read upwards, for it is necessary to start with the bottom number (the kin coefficient) in order to find out what period corresponds to the top number, because, naturally, with each additional coefficient, the period at the top is one higher. Such a preliminary reading was probably automatic, just as our eyes, in seeing the number 195238, register that there are six digits, and our brain automatically tells us that the first of these corresponds to the hundred thousands.

With this system of positional notation period glyphs were not essential; most probably they were retained be-

cause they enhanced the dignity of the text and exalted the grandeur of time. Presumably, they were generally suppressed in Dresden to save space in a book which was primarily a work of reference, but they occur in a few passages where their presence was required because of the elimination of zero coefficients of intermediate periods. For example, on Dresden 69 we find a distance number of one pictun, three uinals, one kin. All three glyphs are present. The baktun, katun, and tun are missing, and their suppression indicates that they are to be regarded as completed, that is, with coefficients of zero. Written with bars and dots without period glyphs, this statement would have required six spaces; with period glyphs it could be written in three.

In IS the periods are arranged in descending order from the highest, usually the baktun, to the lowest, the kin (figs. 47; 48,1), but in distance numbers the order is ascending, the coefficient of the kin being placed at the start of the series (fig. 49,1,2). There are two or three exceptions to this rule, in which the periods of a distance number are to be read in descending order.

SUMMARY

Numbers have a very important part in Maya hieroglyphic writing, not only because of the very many dates and the intervals between them recorded in the texts, but also because they are components of the names of a number of deities. Lunar calculations and perhaps ritualistic phrases involving numbers still further increase the total. There are three ways of writing the numbers 1-19. Most common is the employment of bars and dots, each bar representing five; each dot, one. Symbolic variants occur,

but they are rare. In many texts numbers are expressed by head variants. The heads for the numbers 1-13 are those of the 13 gods associated with each of those numbers. The sequence is the same as for the deities which without much doubt were the days Caban to Muluc. The heads for the numbers 14-19 combine the features of the head for first digit with the bared jawbone, characteristic of the head for 10. The head for 13 is, more often than not, formed in the same way. This method appears to correspond to a linguistic construction, for the Maya terms for 13-19, like our English terms, combine the words for the two digits. With the head variants should be included the full-figure variants, which are merely head variants with the addition of the bodies pertaining thereto.

There were special signs for 20, and symbols which are usually translated as zero but which probably had a meaning akin to completion. Certain affixes convert cardinals to ordinals or represent numerical classifiers.

The Maya did not use true fractions, but they employed a special glyph to express the completion of half a period, provided that period was a multiple in the vigesimal system of their lowest unit of time, the tun.

In the codices and, very rarely, in inscriptions on stone, period glyphs are eliminated and numerals are arranged in vertical columns, a true case of positional notation. Aesthetic considerations and a desire to magnify the grandeur of time probably account for the scant use of positional notation save in the codices. Period glyphs were known to the users of Dresden, for they appear in a few passages where their presence is essential for clarity because of the suppression of zero coefficients of intermediate time periods.