INTERPRETATION OF MAYA GLYPHS BY THEIR PHONETIC ELEMENTS.—PART II.

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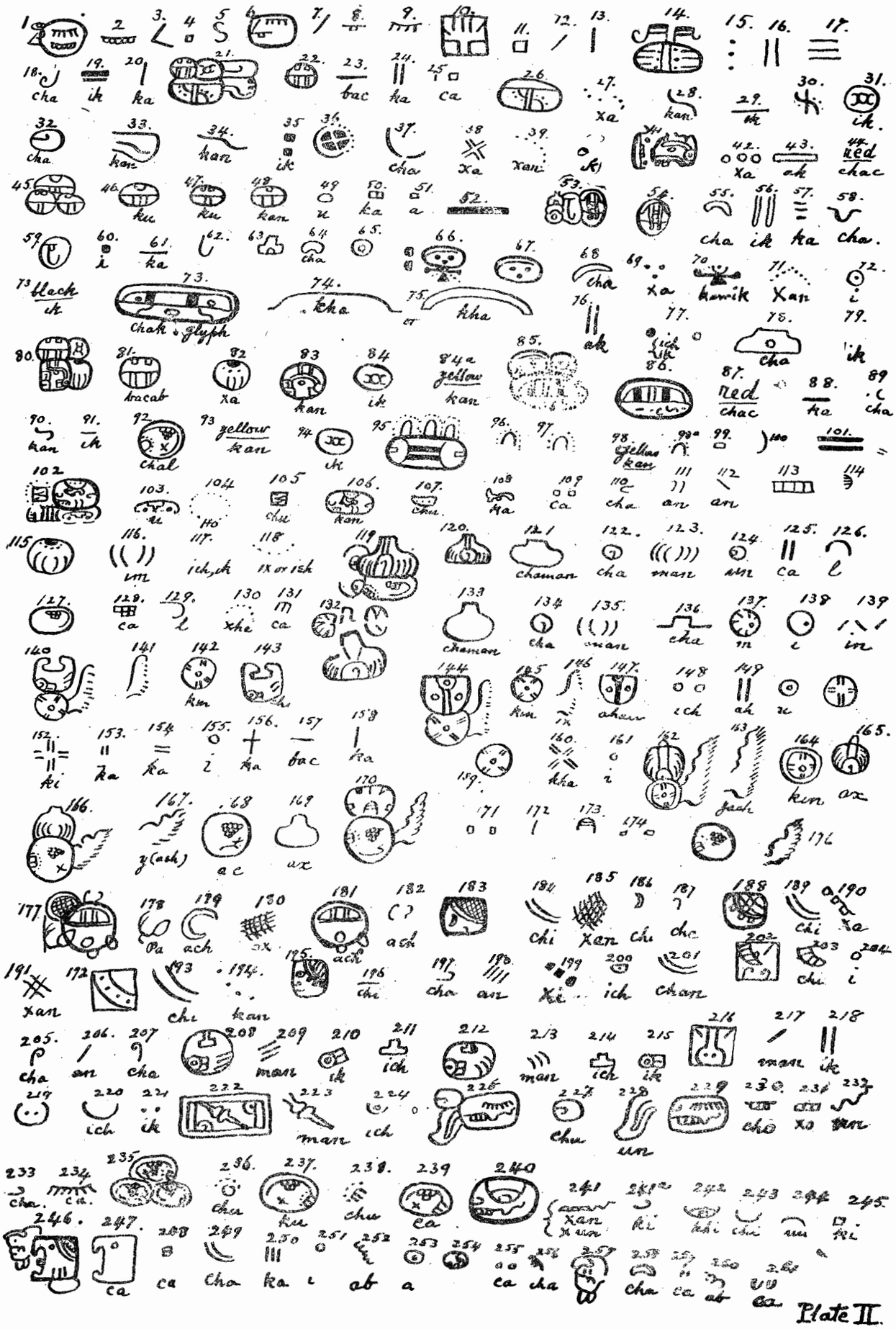
PROCEEDING with the analyses begun in Part I of this article, there is on Plate II, fig. 14, a glyph which appears in the Codex Cortesianus, Plate 16, among a series of five glyphs just above an ideo-phonetic drawing of *Hun Kimil*. In fig. 171, Plate I (see *Science*, No. 567, vol. xxii.), attention has already been called to one of this series of glyphs and the suggestion made that the phonetic elements composing it recall the name of *Kukulkan*. It is but a variant of fig. 160, Plate I; see analysis of the glyph given in Part I of this article. The glyph to the left of this, the analysis of which is given on Plate II, figs. 226, 227, 228 to 234, reads *ah chun Kan*, and by reference to the Codex Cortesianus, Plate 16, it will be seen that there is still another which is a variant of it, repeating *ah-chun-can*. Next to it, reading from right to left, is the glyph referred to above, fig. 14, which we analyze on Plate II, figs. 15, 16, 17, 18, 19, 20, as *Xakan-ik*="the revolving wind." Reference will be made to this presently. The last of the series (See Plate 16, Cortesianus) is the glyph Plate II, figs. 240 to 245, the elements of which, as in the glyphs shown at figs. 1 to 5, 6, 7, 8, 9 of the plate (see day signs of Landa; Troano 6), express "Hun-ki"; the *m* and *il* do not seem to be expressed in any of the glyphs of *Hun-Kimil*. Other examples of abbreviation are to be remarked, as in the day sign *Muluc*, generally expressed "u-uk," and in the day sign *Lamat*, generally expressed "Lamak," at times "am-ak" (see glyphs day sign *Lamak* in *Chilan Balam* of *Kaua*); at times "ach" or "ak" (see Troano 6, 11, 18, 30, 31, 32, 34). In looking over a series of analyses of the day signs, all of which interpreted by my list of phonetic elements have yielded the names suggested by Landa, the names of the day signs *Muluc* and *Lamat* are less clearly expressed by the elements composing them than those of the other day signs. The glyph fig. 10, Plate II, taken from the *Chilan Balam* of *Kaua*, gives a series of these elements which are similar to those we have derived from the codices; using the elements fig. 11 as *hun*, and fig. 12 as *un*, we obtain "hun" or "hu-un"=*hun*. The syllable *Ki* is derived from the value assigned this element on my phonetic list (see Part I of this article, *Science*, No. 567, page 326), Plate I, figs. 1 and 2=*ka* v/s; thus: *Ka*, *Ke*, *Ki*.

Vowel fluctuation, I repeat, must not be overlooked in this method of interpretation now described by me; in fact it is my opinion that the Maya glyphs can never be interpreted without considering it as an important factor in the work. The method of the Touaregs of the Sahara in deciphering their manuscripts affords a clue, for it is said that when the natives undertake this difficult task they begin by spelling the consonants aloud . . . applying to them in succession the various vowels until a word is found that makes sense. In fact, it is absolutely necessary to proceed in a like manner in the Maya script, only, instead of chanting, the combinations can be worked out with pencil and paper. In an endeavor to interpret a series of glyphs the amount of labor that this requires can be duly appreciated. The rest of this article will simply be devoted to an explanation of these fluctuations, adding, where necessary, a few remarks upon the interpretations made.

Fig. 21 is a well known compound glyph, variants of which frequently appear in the hieratic script and the codices, especially in the Peresianus (Plates 2 to 10). The phonetic elements of one of its components, Fig. 22, it will be seen by reference to figs. 23, 24, 25, Plate II=*bacab*. It is a variant of the day sign *Been* and was evidently used by the scribe to express *be*, derived from its phonetic value of *ba* v/s. The next component is fig. 26, where we have the curved aspirate line, fig. 27=*xa* v/s, *cha* v/s, the serpent curve, fig. 28=*Kan*, *chan*, *Ka* v/s, and the parallel line=*ik*, derived from one of its values of ka v/s. We have here a repetition in a new combination of the word *xakau-ik* = "The Revolving Wind," which has already been suggested by the glyph fig. 14, Plate II. The element fig. 30 is in fact closely allied to the *x*, *ch*, and *sh* sounds, the curved element, fig. 28, supplying the monosyllable *Kan;* this associated with the curved aspirate line, fig. 127, gives *xan* or *xakan* or *shakan*. The rest of the phonetic elements composing this glyph, fig. 31, repeats *ik*, fig. 32=*cha*, fig. 33=*kan*, fig. 35=*ik*. The enclosing outline of this glyph is not unlike the single curved *Kan* line, fig. 34, and it seems like a variant of fig. 228, also a *Kan* element and a component of the compound glyph, fig. 226, with the element fig. 227 placed above, this element, fig. 227, also appearing in fig. 21, fig. 32, just above fig. 33. The enclosing outlines of certain glyphs have at times an ideographic significance which it would be well for Maya paleographers to bear in mind. In this case fig. 33 has for its principal phonetic element a motive obtained from the serpent line, fig. 192, Plate I, *Science* No. 567; see also fig. 122, Plate I. The outline enclosing it is adapted to the curve of this element and is evidently a determinative sign, being purely ideographic. The glyph fig. 27, therefore, repeats *Bacab xakan ik*="*Bacab* of the revolving wind," or, still better, "Of the shifting or changing wind." The sense intended is evidently *Bacab*="ruler," *xakan ik*="changing wind," or "wind that blows from the cardinal points." As this glyph is intimately associated with the *bacab* and *chak* cult in the Peresianus, the interpretation, it cannot be denied, is a probable one. If space permitted much interesting material, the results of analyses of glyphs in other codices, could be brought to support the truth of the interpretation given.

Fig. 36 is a glyph which appears in the Codex Peresianus, Plate 17. Its phonetic elements and their values are given in figs. 37, 38, 39, 40=*xakan ik*, a third repetition of this sentence. The glyph fig. 36, Plate II, is attached to the support of a representation of a straw house (*xanil-na*); see Plate 17, Peresianus. Underneath the house is the representation of *Kukulkan* in the act of turning over or revolving, symbolizing the sentence *xakan-ik* (or it may be *chak*, *kan*, *ik* = Chak, or "God of Serpents and Wind"). There are some interesting facts in connection with this figure, which is ideo-phonetic. Its ideographic sense, the action of revolving, has just been suggested. The color of the garment covering the body of the chak is green=*xan*, on which are small squares of a darker green color arranged by twos (=*Ca*) and by fours (=*Kan*), suggesting xakan; the black squares attached to the roof arranged in pairs= *Ka* v/s (=2) or ik, together with the red color back of the figure (=*chac*) and the yellow colors of the straw roof (*Kan*=yellow). All of these accessories are ikonomatic and recall Chak-kan-ik or xakan-ik, supporting the interpretation that we have made of the glyph fig. 36, Plate II, which is attached to the support of the roof of the straw house. I am loth to consider all of these facts the result of mere accident; there is too much method in their arrangement. The colors used are without doubt ikonomatic. On Plates 15, 16, 17, 18, *Peresianus*, there are many repetitions of the words, chak-ikal = "the hurricane" and "xakan-ik" = "the revolving" or "whirlwind." We find the sentences repeated in the Dresden Codex and in certain parts of the script of *Palenque*—notably on the bas-reliefs representing Kukul-kan as Chak of Water and Wind, that atone time stood at the right and left of the doorway of the temple of the Four Winds and Chaks at Palenque (so called Temple of the Cross); "the cross" being simply, as Brinton first suggested, a wind symbol.


Chak glyph
Plate II.

Before proceeding further it must be remarked that in fig. 40, Plate II, we have given the color black, which plays such a conspicuous part in the glyph, fig. 36, the phonetic value of *ek* or *ik*. It frequently appears with these phonetic values in Maya script, and it is my opinion that red may also have the phonetic value of *Chac*, cha v/s, yellow *Kan*, ka v/s, and green *xan*, *xa* v/s. It will be impossible to discuss the subject here; we leave the suggestion to time to decide, but attention is called to the fact that color seems to be ikonomatic in Maya script. Above the *ideo-phonetic* figure in Plate 17, Peresianus, (a compound of ideographic suggestion and phonetic elements), is a series of glyphs whose analyses are made on Plate II, figs. 41 to73. It will be observed that many of the phonetic values assigned by me to certain phonetic elements are being repeated in new combinations with probable results. The interpretation given is *u-chak Kukulkan, chakikal, Chakanik*. There are two more glyphs in this series on Plate 17 (Peresianus), but as they are somewhat erased it would be necessary to compare them with others on Plates 15, 16. 18, (Peresianus), and other parts of this codex, which is here impossible. The series of glyphs on all of the plates referred to, viz.: 15, 16, 17, 18 (Peresianus), read from the lower right hand glyph toward the left, thus:

F. E
D. C
B A

and repeat name of *Kukulkan* with reference to his title of God of Wind and ruler of the cardinal points. The order of repetition of the words given by the glyphs varies in some of the plates. The series is in fact a repetition of the compound glyph of the Peresianus, as shown in my plate, fig. 21, with the addition of the title *Chakikal*, thus: *Bacab, xakan ik, Chakikal* = "Ruler of the Cardinal Points, God of Wind." (*Bacab* = ruler, xakan-ik=the "cardinal points" or the winds that revolve around it; *Chak*="God," *ik*="wind," or this latter may be read="hurricane.")

Especial attention is called to the glyph fig. 45 in this series, where three *Kan* glyphs express the name *Kukulkan*, their different phonetic values being indicated by the small *phonetic additions* attached to the top of the glyphs inside of its enclosing circle, see figs. 45, 46, 47, 48, 49, 50, 51. The name of *Kukulkan* is also repeated on Plate 23, Peresianus; three *Cauac* glyphs being used, their values being changed by the phonetic additions attached. See figs. 235, 236, 238, 239, Plate II.

Fig. 73 is a well-known glyph in the Peresianus. It has been designated by me the Chak glyph from the fact that the phonetic elements within it express that word and the figures attached to the glyphs in the Peresianus, there is good reason to think, are *chaks* or *bacabs*, supporting my analysis of its phonetic elements. The phonetic elements of which it is composed are frequently repeated in Maya script and are among the most primitive of those represented in Part I of this article, published in *Science*, No. 567.

A repetition of the title Bacab-xakanik, with the yellow color appearing with phonetic value, is given in the series, Plate II, figs. 80 to 84*a*, taken from Plate 16, Peresianus. See also series figs. 85 to 101. The glyph fig. 102 my analysis indicates to be that of *u Hoobnil-Kan*. The dotted aspirate circle, fig. 104, gives *Ho*, derived from the phonetic value of *cho* or *sho*, *xo* v/s. The square, fig. 105, encloses the same elements that are found in the day sign *Chuen*, and its phonetic value *cha* is indicated by the square in which it is enclosed—the square, generally, being associated with á, *Ka* v/s, sounds. If the same elements referred to were in a circle they would probably be *cho* or *chu*, as the circle is intimately associated with i, o, u, *ch*, *ik* sounds. The square and circle are probably vowel elements; see Article I, Plate I, figs 27, 43.

NOTES ON THE GENUS STROMATOCERIUM.

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One wishing to recall the typical form of the genus *Stromatocerium* turns to Hall's monumental work, "Palæontology of New York," and in Vol. I., p. 48, finds the description of this well-marked genus. The horizon of *Stromatocerium vagosum* is that of the rocks of the lowest member of the Trenton period, that is, the Black River. This fossil is accepted as a guide in determining the rocks of that epoch.

That this form should flit across one geological horizon, should come and go, having no ancestry and leaving no descendants, seems strange. But this sudden appearance and disappearance is more apparent than real. It may not be possible to trace exact lineage, but likenesses and relationships are quite evident. The relatal forms are *Cryptozoon* below and *Stromatopora* above. It is true these are somewhat widely separated, both by structure and by stratigraphical position. Yet in general structure they are so alike that one has often been mistaken for the other.

We may briefly consider the stratigraphical relation of the *Stromatocerium* to the *Cryptozoon* in the rocks lying below. Immediately beneath the Black River is the Chazy, the rocks of which at their best estate have a thickness of near 900 feet. Beneath the Chazy lies the Calciferous, with its distinct divisions of rocks, the formation having a thickness of near 2,000 feet.

The rocks of these two epochs bordering Lake Champlain and filling so great part of the valley between the Green Mountains and the lake have a recognized likeness. Had not the name, Champlain, been preoccupied, this term could have been applied with appropriateness to the time period which would be constituted of the two epochs, Coazy and Calciferous.

The Chazy rocks may be looked upon as a wedge separating the Calciferous from the Black River rocks. The edge of this wedge in some places thins down and disappears, so the Black River is let down in contact with the Calciferous. The stratigraphical separation between the *Cryptozoon* and the *Stromatocerium* thus becomes zero.

So far as horizon is concerned the Cryptozoon may have clambered up into the Black River rocks. But the piling up of a little less than a thousand feet of Chazy rock, mostly calcareous, indicates the passage of a long interval of time. The sponge-like forms of the Chazy are not *Cryptozoa*. The concentric structure has been retained by several, yet they are clearly distinguishable from that fossil. One of the most noticeable of these forms is a *Stromatocerium*.

The genus as characterized by Professor Hall may admit of considerable variation, yet these Chazy forms in all essentials correspond to the type. They differ, however, from *Stromatocerium vagosum*, and so widely do they diverge that the difference can hardly be less than specific. They have been studied with some care and specific names applied, but a general statement of position and character will be enough for the present.

The divisions of the Chazy rocks may be properly designated from below upward A, B, C. Distinct forms of *Stromatocerium* are found in each. That found in A, the lowest division, has a growth in shape and sometimes in size like the old-time straw bee hive. It appears in B but somewhat modified in form. The special form in B is peculiar in growth and massiveness. The fossil is made up of a series of corrugations, these being from a quarter of an inch to a half inch in height. Blocks three feet by