stone is well known, but according to Marshack precision of the kind evidenced in the mosaic has not until now been documented in prehistoric Mesoamerica.

Examination of the mosaic by low-powered microscope revealed that no two of the 325 pieces of pyrite still in place were the same size or shape. Yet they fit precisely. There is not enough space between pieces for cement or the insertion of so much as a razor's edge.

Analysis of the manner in which these pieces were put together, Marshack told the American Association for the Advancement of Science meeting on Science and Man in the Americas in Mexico City, "revealed an extraordinary arithmetical sequence and pattern."

Each two pieces meet or join along a horizontal straight line. These two, forming a unit, are then joined to another two, along a vertical straight line. These four are joined to another similarly formed set of four below, along a horizontal. This set of eight forms the basic unit of the mosaic, it is joined to a similar set of eight, and in similar ways sets of 16, 32, 64 and 128 are established. All the evidence indicates preplanning and control counting and adjustment in the inlay process, observes Marshack.

The right margin of each section of 128 divides the width of the mosaic into three precisely equal parts. The edge of the third part, unlike the others, is a curve, whose arc begins at precisely the two-third point. Reconstruction of missing pieces along the arc gives a sum for the third section of 98. The total number of pieces in the original mosaic thus totals 354. This, Marshack notes, is the number of days in 12 observational lunar months ($12 \times 29.5 = 354$).

He further notes that if the third section had been a rectangle like the others, the pieces would have totaled 384. This is the number of days in an observational 13-month "long" lunar year.

Such a year of 13 moons encompasses either two solsticial or two equinoctial solar observations at an interval of 365 days.

Such a long year, Marshack suggests, could also represent the intercalary year needed to bring solar and lunar years into phase.

Study of several anomalies in the pattern, especially seven triangular-shaped pieces, produced evidence that they also are related to the lunar notation. By determining the probable sequence in which the inlays were emplaced and by numbering each piece in sequence, Marshack found that the numbers assigned to the triangles indicate particular events during the lunar year.

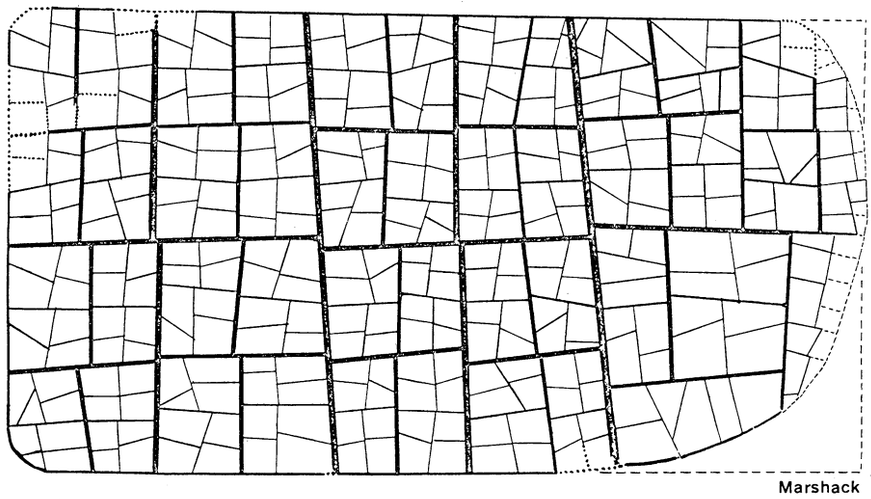
Three of the triangles, for instance, are numbers 60, 267 and 324. They are the days of the moon's last crescent or first invisibility following the second, ninth and eleventh lunar months.

"If the arithmetical, geometrical and sequential data here presented are calendric," states Marshack, "the Las Bocas mosaic documents a constellation of cultural skills and strategies that could be used in the maintenance of astronomical and calendric alignments, observations and notations."

Marshack's presentation provoked lively interest from the participants in the session on archaeoastronomy in pre-Columbian Mesoamerica. There were many questions about particular points of his analytical technique, but no frontal attack on his basic interpretation. Privately, however, several participants said they disagreed that the mosaic was a lunar calendar. Marshack agrees that the mosaic poses many questions.

"Where is the evidence for the development of a tradition this complex? The development of a calendar requires record keeping. Was there a pre-classic form of calendric record keeping?

"The origins of the technology and the lore supporting this highly complex piece, circa 1000 B.C., remain unknown." □



Marshack

The 354 stones in this 3,000-year-old mosaic count the days of a lunar year.

Hollister quake expected imminently

Stanford University geophysicist Robert Kovach has ventured the most precise scientific earthquake prediction yet, by telling colleagues at the San Andreas Fault Conference at Stanford last week that a 5.8 magnitude quake can be expected "in the next two weeks" near Hollister, Calif.

Kovach's expectation—he dislikes the word "prediction"—follows the announcement in March by a U.S. Geological Survey team that a moderate (4.0-5.0 on the Richter scale) quake was probable in the region within a few months (SN: 3/31/73, p. 207). That prediction resulted from observation of increasing numbers of tiny "microquakes" around Hollister.

Kovach bases his guess on the theory of "dilatancy," which has recently attracted much attention among earthquake watchers (SN: 4/21/73, p. 255). According to this theory, abrupt changes in the level of groundwater should just precede a quake. Though the process by which this takes place is not fully understood, some geophysicists suggest that shattering of rocks at the strain center of a fault increases their porosity (dilatancy). The groundwater level lowers at first due to the increased volume, but slowly rises again to its old level. This, in turn, may lubricate the fault, allowing it to slip.

Kovach and his associates have been monitoring the water level in a 600-foot well near a winery south of Hollister for two years. On Sept. 1, 1972 the water level began to drop and took until June 1, 1973 to return to its normal level. The longer this period, the larger the quake, according to dilatancy theory, so from the 280-day duration, Kovach estimates the strength of the expected quake to be around 5.8 on the Richter scale, somewhat larger than that predicted by the Geological Survey Team.

(Energy release from a quake increases 30-fold for each point on the scale. A 5.6 Richter quake in Hollister in 1961 damaged the courthouse badly enough so that it had to be replaced.)

Kovach said his measurements will constitute an "interesting test" of the dilatancy theory, and may have prepared the 8,500 residents of Hollister for what he calls "a healthy jolt." □