

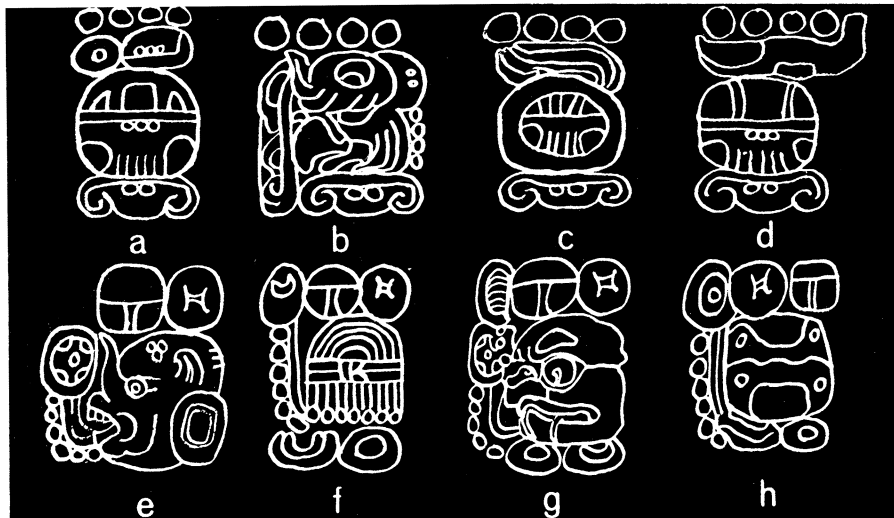
Ancient city planning on the Yucatan Peninsula

A map showing the sites of Mayan cities, towns and villages looks like a Buckminster Fuller scheme for the placement of population centers of the future. The highly structured settlement pattern, however, is not a vision of tomorrow but a reconstruction of yesterday. It is a result of the application of locational analysis to the civilization of the lowland Maya which reached its Classic peak between 600 and 900 A.D. on the Yucatan Peninsula.

An overall organization plan of the Maya lowlands shows that there were four regional capitals. Around each capital existed a hexagonal lattice of secondary centers. Tertiary hexagons developed around the secondary centers, and shifting villages and hamlets grew up around the tertiary towns. Theories have suggested that such geographical organization was developed as a defense system. The outer cities, for instance, would act as buffers to protect the major or core cities.

Joyce Marcus of Harvard University disagrees. She is currently engaged in Maya hieroglyphic research at the Dunbarton Oaks Center for Pre-Columbian Studies in Washington. From studies of Maya hieroglyphs and from locational analysis, Marcus concludes that the territorial organization of the Maya was based on their quadripartite view of the universe. She further concludes in the June 1 SCIENCE that the core-buffer theory is inoperative.

The Maya quadripartite model of the universe says that heaven is divided into four levels or regions. Each level is associated with a cardinal direction, color and god. Hell is similarly divided and, therefore, the Mayas divided the earth or their territory into four major areas. Each area had a ceremonial, religious, political and commercial capital. It is around such capitals that the



Drawings: Marcus/Science

Maya hieroglyphic inscriptions relating to the four regional capitals.

hexagonal lattices developed. But they developed on a central-place theory, not a core-buffer theory, says Marcus.

According to the central-place theory, outlying cities or service centers are placed where they will ensure uniform distribution of population and purchasing power, uniform terrain and resource distribution and equal transport facility in all directions. All central places perform the same functions and serve areas of the same size. The most economical spacing of such service centers would be equidistant, resulting in hexagonal patterns. The Maya, however, did not recognize this pattern. They simply saw that a whole series of smaller centers were dependent on a primary center. In view of the geography of the area (irregular topography and seasonally flooded swamps), says Marcus, it is amazing how nearly uniform the spacing of such centers is. This suggests, she goes on, the degree to which the service functions of these centers strongly overrode such factors as good soil, water, shelter or defense.

Hieroglyphs found on *stelae* (free-standing, carved stone monuments) in the various cities help confirm her

theory. Such hieroglyphs were once thought to be mainly astronomical and cosmological. It is now believed that many are records of ruling dynasties. Using such information Marcus notes that the four capitals apparently could mention each other by name (or hieroglyph), but no secondary center could mention a primary center except that to which it was subsidiary. This fact makes it possible to identify the various secondary centers dependent on a primary center. The *stelae* further indicate that the secondary centers and capitals were sometimes socially and politically linked by royal marriage alliances. A royal marriage often stimulated a flurry of monument carving.

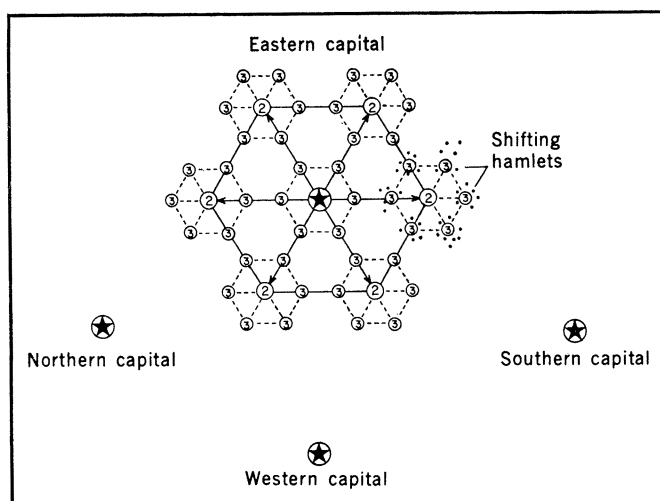
Most surveys of Maya territory have concentrated on major centers. But as more information on minor centers and hamlets becomes available, Marcus hopes to complete her analysis of the social, political and territorial organization of the lowland Maya and confirm her theory. □

Evolution of a molecule: Code-breaking in the lab

Nucleic acids are the chemical molecules that contain genetic information. How primitive molecules evolved on the primordial earth into ever-more-complex nucleic acids is one of the more intriguing questions of modern biology.

During the past decade D. R. Mills, F. R. Kramer and Sol Spiegelman of Columbia University College of Physicians and Surgeons have arrived at a better understanding of how nucleic acids, specifically RNA molecules, probably evolved. Their most recent experiments, reported this week, should pave the way for an even better insight into the evolution of nucleic acids.

In 1965 the Columbia researchers



Idealized diagram of Maya hexagonal territorial organization with capitals, secondary and tertiary cities.