

Recent Excavations in the Near East

IN a paper read on September 12 before Section H (Anthropology) of the British Association at Leicester, Miss D. A. E. Garrod outlined the results of the season's work carried out by a joint expedition of the British School of Archaeology in Jerusalem and the American School of Prehistoric Research at Mugharet et-Tabun in Palestine. The cave is the last of the group of the Wady el-Mughara, at the foot of the western slope of Mount Carmel, to be examined. Of the caves previously excavated, the Mugharet el-Wad yielded a prehistoric culture sequence ranging from Natufian through three Aurignacian horizons down to Mousterian; the Mugharet es-Skhul is purely Mousterian, the industry corresponding very closely in type to that found at the base of the Mugharet el-Wad. Skeletons found in Skhul differ in many respects from those of the Neanderthal race, notably in the greater height of the cranial vault and in the presence of a well-defined chin.

At Mugharet et-Tabun were found the final stages of the Lower Palaeolithic. The sequence is:—

(1) Bronze Age to Recent.

(2) Upper Mousterian.

(3) Lower Mousterian, an upper layer, in which were found teeth of *Hippopotamus* and *Rhinoceros Merckii*. Like that of the Upper Mousterian, the flint industry is in the Levalloisian tradition, but differs from it in that the individual pieces are larger and the proportion of unworked to worked pieces greater. The characteristic form is a large oval Levallois flake. The lower layer of the Lower Mousterian yielded remains of *Rhinoceros* and a Levalloisian industry with abundant narrow triangular points and flakes, but no large oval flake.

(4) Acheuleo-Mousterian. From this layer downward the change in the flint industry is fundamental. The upper layer contains scrapers and flakes more or less Clactonian in type, Chatelperron points, narrow blades with fine edge—retouch, and hand-axes. The industry of the next layer is similar, but smaller in size; in the next the flake implements are still of High Lodge type, but the characteristic tool is the fine pointed Micoquian hand-axe; in the fourth, La Micoque forms are absent and the industry resembles that of the second layer.

(5) Upper Acheulean, characterised by a hand-axe, generally pear-shaped, rather thick and on the whole roughly made.

(6) This contains small rough flakes, much utilised, but no hand-axes, no points and only a few scrapers. This industry is identical with that found by Peyrony at the base of La Micoque, well below the level of the typical Micoquian hand-axes: the name Tayacian has been suggested for it.

The most important human remains found are a complete lower jaw from the base of the Lower Mousterian, and a nearly complete skeleton from the upper part of the same layer. Sir Arthur Keith reports that the skeleton is that of a woman of 25–30 years of age and about 4 ft. 11 in. in stature. The limbs show all the peculiarities of the Neanderthal type of Europe. The massive curved supra-orbital ridges are in shape and size almost identical with those of the Galilee skull, and the supra-orbital width is greater than the greatest width of the frontal bone, a feature not observed in European Neanderthal skulls. As in the case of the child's skull found at Mugharet es-Skhul, the temporo-mandibular region is

modern in type, though the mastoid process and digastric region are Neanderthaloid. The lower jaw is receding and chinless. The portion of the jaw which gives attachment to the muscles of the tongue shows a transitional state between that of a young gorilla and that of modern human jaws. The metatarsal bone of the great toe is much flatter than in any modern race and in this respect resembles the grasping great toe of the gorilla.

The characters of the Tabun skeleton are predominantly those of the Neanderthal race, but it also shows those modifications first seen in the Galilee skull and in the child's skeleton from the Mugharet es-Skhul. It may therefore be assigned to that branch of the Neanderthal genus for which Keith and McCown proposed in 1932 the name *Palaeanthropus Palestinus*.

The isolated lower jaw, unlike that of the skeleton, possesses the long eminence which constitutes a true chin, yet both jaws must be attributed to the same race, for the teeth and mental foramina are similar.

Though further excavation remains to be done at Tabun and the study of the material already excavated is by no means complete, a new and important chapter in the prehistory of Palestine has already been opened.

Later in the same day, Section H heard a paper entitled "Ur: The Archaic Period" in which Dr. C. L. Woolley outlined the present state of knowledge of the sequences at Ur. Recent discoveries in Mesopotamia, beginning with Dr. Campbell Thompson's work at Eridu, have produced at Eridu the early painted pottery later called al 'Ubaid ware; at al 'Ubaid the ornate temple of the First Dynasty of Ur; at Kish the predynastic Palace and the "A" cemetery; at Jemdet Nasr the characteristic polychrome pottery and semi-pictographic tablets; at Ur the Royal cemetery. The question was to correlate these various cultures and epochs.

Stratification at the four main sites, Ur, Tello, Warka and Kish, gives homogeneous results and establishes beyond question the general sequence thus:

(1) Al 'Ubaid, the culture of the earliest settlers in the Lower Valley, with its painted geometric pottery.

(2) Uruk, characterised by burnished red and grey wares.

(3) Jemdet Nasr, with polychrome pottery.

(4) The Plano-convex period.

Excavations at the foot of the Ziggurat at Ur have given a complete plan of the First Dynasty buildings of c. 3000 B.C. These rested on remains of buildings dating to the moment of transition from Jemdet Nasr to the Plano-convex period. Then came the buildings in 'Riemchen' associated, the first with small decorative cones of coloured clay, the second with large cones having hollow ends. The stratification was then picked up at Warka, which gives First Dynasty and Jemdet Nasr remains, and below these, solid temple constructions of which the second is contemporary with the late 'Riemchen' building at Ur, but preserves intact the elaborate decoration of mosaic by coloured clay cones. The Ur building with hollow-ended cones is not represented at Warka, but instead there is an older building, dating to just after the al 'Ubaid period, the walls of which are decorated with clay pots inset in the mud plaster.

This building is a ziggurat, and thereby is proved the continuity of Sumerian architecture from the Third Dynasty of Ur back to the close of the al 'Ubaid period.

A more detailed stratification was again found at Ur, where a cutting showed an unbroken rubbish layer dated by seal impressions of Mesannipadda to the First Dynasty of Ur, overlying the Royal cemetery: this has given for the cemetery a *terminus ante quem*. Below the cemetery is a stratum rich in seal impressions and inscribed tablets older than the royal graves, but demonstrably later than Jemdet Nasr. Below this were found graves of three sorts, differentiated by level and by content:

- (1) Graves with clay pots of 'reserved slip ware'.
- (2) Graves with pots having simple decorations of pinkish-red paint on light clay.
- (3) Jemdet Nasr graves with three-colour pottery, characteristic stone vessels, etc.

These graves were cut into soil rich in al 'Ubaid potsherds which continue, except for a break of clean flood deposit, down to virgin soil. At Warka the section shows 19 metres of al 'Ubaid stratified culture underlying the period Archaic VI to which the early ziggurat belonged.

The sequence thus is:—The Plano-convex period, starting about 2700 B.C. It includes the Second Dynasty of Ur, the First Dynasty, the Cemetery period, the "reserved slip" ware period and that of the pinkish-red paint on a light ground. It must have been a very long period. The Jemdet Nasr period seems at present more important for its character than its length. The Uruk period, with its succession of great buildings at Warka, must represent a considerable lapse of time, as also that of al 'Ubaid, with its tremendous deposit.

Short dating is impossible: the finds are spread over the whole period between 2700 B.C. and the beginning of human occupation of the Lower Valley. Throughout this, in spite of marked changes, there is a link of continuity which can only be due to the presence of Sumerians in the land from the very outset. The changes seem to be due to incursions by people of similar stock but in different phases of the kindred culture, differently evolved beyond the borders of Mesopotamia, and there is, therefore, modification but no revolutionary change: the history is continuous and through it all can be traced the development of the great Sumerian civilisation.

The Spherical Pendulum*

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A PENDULUM which is free to swing over a segment of a sphere has possible paths which vary from a rotation resembling an engine governor ball to the swing of a simple pendulum in a plane; which plane appears to rotate very slowly but really indicates the rotation of the earth beneath it (Foucault pendulum effect).

The intermediate orbits between the circular and the linear paths are ellipses, which latter precess at a rate dependent on the maximum and minimum angles of the pendulum and corresponding ratio of major and minor elliptical axes (see Fig. 1). This precession of the ellipse produces a pattern which it will be seen resembles that produced by two opposed rotations having a ratio near unity (such as 100 : 101, with appropriate amplitude); which may be drawn by harmonograph, etc. Virtually, the pendulum behaves as if it had two frequencies; which is in agreement with the facts that the effective length of a pendulum swinging in a circle is $L \cos \alpha$, where α is the angle of the swing maintained and L is the length of the pendulum; and that in tracing a single ellipse a maximum and minimum angle and corresponding minimum and maximum effective length are reached twice.

It will be seen that the greater the angle reached, the greater the variation of effective length of the pendulum; and it is found that the rate of precession increases rapidly as the angle increases. Also, if the ratio of major and minor axes of the ellipse is high (which, in the limit, becoming infinite, means the pendulum swinging in a plane), the rate of precession is small, in the limiting case becoming zero. As the ratio of the major and minor axes approaches 1, the rate of precession becomes a maximum for the angles involved.

When the pendulum is capable of swinging over a hemisphere, and is oriented to a maximum and

minimum angle of 180° and 90° (which is a 2 : 1 ellipse), the vertical projection of the orbit becomes

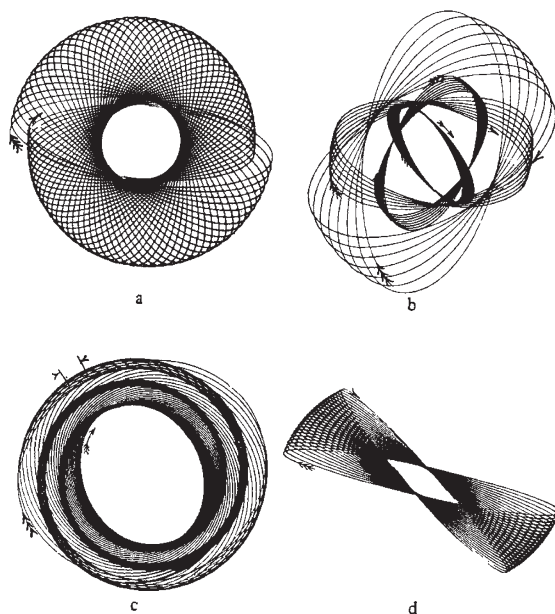


FIG. 1. Paths traced by a spherical pendulum.

- a, ellipse axes, 1 : 3; major angle, 41° ; precession, 5° .
- b, ellipse axes, 1 : 2; major angles, 44° , 32° , 24° , 19° ; corresponding approximate precessions, 9° , 4° , $2\frac{1}{2}^\circ$, $1\frac{1}{2}^\circ$.
- c, ellipse axes, 13 : 15; minor angle, $33^\circ 50'$; major angle, $39^\circ 20'$; approximate precession, 10° per cycle.
- d, ellipse axes, 1 : 10; minor angle, $4^\circ 20'$; major angle, $44^\circ 22'$; approximate precession, 2° .

a five loop figure, corresponding to the 3 : 2 figure with opposed rotations as produced by the twin-elliptic pendulum, etc., with appropriate amplitudes.

* Demonstration before Section A (Mathematical and Physical Sciences) of the British Association at Leicester on September 12.