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The Surveying and Statistical Professions and their Age.

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IT is remarkable that Democritus should have plumed himself on being as skilled in geometry as were the Harpedonaptai (ἁρπιδοναπται) the Egyptian priest-surveyors of his day (the fifth century before the present era). For a long time it was not known what these functionaries were, but it is now some decades since it was shown that the Harpedonaptēs (ἁρπιδοναπτης), or rope-stretcher, was a surveyor, one of the elements of whose professional knowledge was the ability to set out a right angle by means of the 3, 4, 5 triangle, using a cord to do so. The priest-surveyor dates back, however, much further than this. The story of the development of Egypt carries us back far beyond the time of Democritus, viz., to the period of about 2000 to 2500 B.C. Till recently all preceding this was lost in the obscurity of the past.

Researches in Babylonia, however, have lately brought to light the fact that at least 2000 years earlier than the period mentioned, viz., at least as early as 4500 B.C., there existed a fairly well elaborated system of cadastral survey, as well as of land taxation and a fiscal system, and these in so advanced a state that they implied even then a long period of growth and development. Earlier than 4500 B.C. we have, however, no records.

It is said by Boscawen* that "no nation of the ancient world ever attained such a high state of perfection in agriculture as the Sumerian population of Babylonia." This knowledge comes to us through recent Babylonian research. The earliest inscriptions are those of the Kings of Sirpurra or Tello, and they relate to the making of canals, tanks, dams, etc., for the regulation and storage of water, a means by which the natural agricultural wealth, itself remarkable, was greatly increased. That the fertility was extraordinary is shewn by the fact that the yield was about 43 bushels of corn to the acre.†

The history as a whole goes to show that the organisation even so early as this was by no means primitive, a point which later will appear more clearly.

Not the least interesting of the things of this period, throwing light upon the state of the cartographic art, is the discovery of a scale to which certain plans were drawn. To this we shall now refer.

On the west bank of the Euphrates are the ruins of Mughier, formerly the city of Ur. This, the capital of the district, was one of the most important cities of Chaldea, and at Sirpurra a large number of inscriptions have of late been found, relating to the two chief rulers of this city, viz., Ur-bau and Dungi. These kings were overlords of this sacred city, dedicated to the god Nin-Sugur. The viceroy, probably of Ur-bau, was Gudea, who seems to have displayed

* The First of Empires. Harper & Bros., London, 1903, p. 8.

† The penalties in the laws of Khammurabi show that the estimated yield was six gur per gan, the gur being eight bushels, and the gan (now feddan) about 1½ acres.

great activity in building. The palace of Gudea was at Tello, and ~~has been explored~~ by M. de Sarzec. It covers about an half-acre, and has its sides directed to the cardinal points, as do most other Chaldean buildings. In this palace the walls attain to 12ft. in thickness, and, indeed, the thickness sometimes reaches 20ft.; on the outer side the walls are buttressed.

At the north-east corner of the building, and adorned with crenelated buttresses, were a number of structures, grouped round a stage tower: this is supposed to have been the temple of the palace. In front of the entrance are two bases of large brick columns of ingenious construction, representing the two tree gods, Tammuz and Giz-Zida, who guarded the entrance to heaven. These pillars are presumed to be the origin of the two pillars in front of Solomon's temple Jachin (Yakin) and Boaz.

In several of the buildings are statues of the Viceroy, and in one he is represented as seated with a tablet or drawing board on his knees. On this tablet is a plan of the whole structure to scale, and at the right side thereof the graver with which it is drawn. On the upper part is the scale to which the plan is drawn. Besides this tablet there is also another with a bevelled and graduated scale, as well as a second graver.

By comparison with the building, it has been ascertained that the cubit was 20.63 inches; that is to say, the unit was the Egyptian cubit, and not the Babylonian cubit of 21.6 inches. This points to the fact that at this time probably the Egyptian had architectural influence with, or was the instructor of the Chaldean.

Boscawen states that the placing of the plan on the knees is undoubtedly to be attributed to Egyptian influence. The god of mathematics and of science was I-em-hotep, or Imonth, son of Ptah, who is always represented as seated with a papyrus spread out on his knees, viz., in the attitude which Gudea has in the statue referred to.

The main interest of the records here lies in the detailed relation of the various countries from which Gudea drew his materials. Thus from Kimash in Central Arabia, and from Magan or Sinai, came gold, copper, and hard stone; from Barsip, the modern Kalat-Nijdim near Carchemish, came limestone. Various woods were derived from the same place, and from Gubin (Koptos?), hardwoods; from the Upper Nile and from Amanus, cedar.

In this connection it may be noted that, as early as 2800 B.C., there was evidently a fleet travelling in the Red Sea, and going round Arabia as far as the Gulf of Akavah.

The earliest inscription relating to agriculture was found on the obelisk of Manishtu-su of Kish (Cush). On this obelisk details and prices are recorded, these pointing to a well-developed management of estates. The area was calculated and the value estimated by the corn tariff. The area was expressed in terms of the gan, or Arabic feddan (one and one-ninth acres), and the corn was estimated by the measure of capacity, the gur of eight bushels.

Properties were described by bounds, as for example:—

"Bounded on the north by the canal Zi-kalama, on the south by Bit Gisimanu, on the east by the Canal Amastiak, on the west by the land of Amalisdugal."

The oldest examples of plans of estates, so far as is known, are on the series of tablets dating from the reign of Sargon I. (B.C. 3800). The Babylonian surveyors drew plans, not only of estates, but also of houses, and some of the best of these, belonging to the age of Gudea, are now in the Imperial Ottoman Museum of Constantinople.

There is a curious legend as to the origin of surveying and other knowledge. Berosus, contemporary of Alexander the Great, states that in Chaldea there was originally a great multitude of various tribes of men living like animals, without order. From the Sea, however, came a frightful animal Oannes, its body being like a fish, but under its fish's head was a human head with human voice, and on its fins were human feet. Coming forth from the sea at morning, it passed the day with men, returning at night to the sea. It was this god that taught men language, science, agriculture, *the rules for the boundaries of land*, the method of building cities and temples, and all that appertains to civilisation and human life.

This being, Oannes, has been identified with the fish-headed and fish-shaped God, Ea, figured in Babylonian sculptures, and carved on Babylonian gems and seals. Ea was the "lord of the deep," "the wise god," "he who knows all things," "lord of deep knowledge," "divine lord of laws," etc.

The name of the surveyor was Gan-gid-da "the man who measures with a cord." This agrees with the story of Democritus and the meaning of the word "Harpedonaptēs."



The records of the cadastral surveyors of a district are inscribed on bun-shaped tablets, which, stored in jars, have been found often in a marvellous state of preservation. The records of several fields are inscribed on a single tablet. Each field has been measured, the area calculated, the nature of the crop stated, and the estimated value has been given. On the reverse side is a calculation of the assessment of the value of the estate, and an indication of the rent paid for it. The tablets are so fresh-looking as often to appear as if they had just come from the kiln.

The surveys, apparently, were made every six or seven years. They set out the results formally as follows:—

$(600 \times 2) + (60 \times 3) + 30 = 1410$ gur corn, Royal Standard.

The field of Aballa.

$(600 \times 3) + (60 \times 2) + 42\frac{1}{2} = 1962\frac{1}{2}$ gur.

On the bank of the old canal.

$(60 \times 8) + 50 + \frac{1}{2} = 530\frac{1}{2}$ gur.

The field of Dungi-Zi-kalama.

$(60 \times 9) + 40 = 580$ gur.

The plantation of Bazi-gella.

$(60 \times 5) + 16 + \frac{1}{2} = 316\frac{1}{2}$ gur.

The field of Dumzi.

Making a total of $3600 + (600 \times 2) = 4800 - 1 = 4799$ gur.

Totals	1410
	1962½
	530½
	580
	316½

4799 gur.

Such records as these indicate how early are systematic statistical records. William the Conqueror, in his *Doomsday Book*, was merely following an example which preceded his day by at least 5500 years.

In connection with the statistical aspect of this early civilisation, it may be mentioned that not only do cadastral records exist, but also statistics of their trade and commerce. Among the tablets found at Tello, are inventories of articles sent from north to south in the reign of Sargon I., 3800 B.C. On one tablet it is mentioned that as many as 1540 sheep and 854 goats were so sent, and, according to another tablet, 1720 gur, or 13,760 bushels, were sent—probably by boat—from Agade to Sirpurra, that is in the opposite direction. On other tablets again it is recorded that dates, sesame, honey, milk, butter, wool, various woods, silver and gold, were imported or exported. These records go back as far at least as 4500 B.C., it being related that Ur-Nina, King of Sirpurra, drew upon the resources of the land of Magan (Sinai), where there were stone quarries and copper mines, and upon Mulukkhka (Midian)—an alluvial gold-producing country—for his requirements. In the former place, hardwoods, blue and green turquoise, and porphyry diorite, and other materials, were obtainable, and from these last-mentioned stones the early kings, not only of Chaldea, but also of Egypt, made their great memorial statues, as, for example, the diorite-statue of Khafra, the builder of the second pyramid, 3700 B.C., and the statue of Gudea, 2800 B.C. The records show that Naram-Sin of Agade invaded these regions, viz., Sinai and Midian, about 3750 B.C., but it is also stated that the first king of the fourth Egyptian dynasty, Senefru, a little later, expelled the foreign (Babylonian?) stone-cutters from the mines. As evidence of organisation, it may be mentioned that Senefru kept troops at the mines of Sinai, built strong forts for them, and employed criminals to work in the mines.

There are many tablets of the period of about 3500 B.C., in the museums of Paris and Constantinople, and, belonging to a period somewhat later, viz., about 2500 B.C., hundreds of tablets have been found, containing records of flocks and herds, or corn, dates, etc. It has been ascertained that corn was the standard of value, the sign for price being "corn and a measure."

Dating back as early at least as 4000 B.C., is an inscription relating to a valuation of land and other things, which runs as follows:—

(3 × 1080) + (3 × 108) + 3 × 18 gan (padanu)	= 3834 feddan
sim su	= its price
(3 se × 3600) + (3 × 600) + (3 × 60) gan saggal	= 12.780 kor of seed corn
1 siklu kaspi	= at 1 shekel of silver
1 se gur saggal	= per kor of seed corn
kaspu su	= its money value
3 bilti 33 mana kaspi	= 3 talents 33 mana of si
sim ekli	= price of the field

This is not the whole of the inscription, but it is sufficient to indicate the type of record. It is evident from the inscription that the corn standard was then replaced by a silver one, and the weights and measures were sexagesimal.

Here it may be said that it is not only in Chaldea that there are at the present time evidences dating back many years earlier than say, 2500 B.C., a period till lately lost in the haze of the past. Till quite recently, Egyptian history dated back only to about 3700 B.C., to the pyramid Medum, the burial place of the first king of the fourth Egyptian dynasty, Senefru, before mentioned. The names of the principal Pharaohs of the three preceding dynasties are now also known. The weapons, artistic ornaments, and pottery, of the fair-skinned and reddish-haired race of that time show their state of civilisation to have been remarkable, to say nothing of the organisation necessary to undertake such a task as the building of this great pyramid. The art of writing was well developed, and differed fundamentally from the Chaldean; as, for example, the Egyptian ideogram for heaven was "a covering vault," the Babylonian "a star," the Egyptian denoted water by "wavy lines representing waves," while the Chaldean used a sign representing "rain drops." The dynastic Egyptians came, however, from the East. The use of gold, copper, precious stones, the style of the architecture, the grouping of tombs round the temple of their god, the existence of a definite Pantheon, all reveal the high character of the civilisation.

Among its interesting features may be mentioned the use of the stele, or monument stone. There were two kinds of Babylonian steles, viz., the *aban narud* or "worked stones," which were elaborately carved, and the *kudurri* or boundary stones," viz., boulder stones, sufficiently shaped to receive inscriptions, and serving to mark the boundaries of estates. These steles were often very artistically carved. In this connection it may be mentioned that the Sinaitic population engaged in quarrying and mining appear to have been divided into two classes, the *Annu*, or "stone-cutters," and the *Mentiu*, or "cave-dwellers." It is abundantly evident that these stone-cutters were skilful in the art of dressing stone. For example, the blocks show the dragging under the tool when being dressed; the natural cleavages were largely used, and often half a face may be found adze-dressed, and the balance hammer-dressed. The stone-dressing adze was of flint.

The carving, as said, is often of high artistic value, as is shown, for example, by the stele of Naram-Sin, son of Sargon, found at Susa, and dating back to nearly 3800 B.C. This carving represents with considerable detail a campaign in a mountainous country. The King and his Babylonian soldiers are ascending the mountain, having all but reached its pinnaced summit. The enemy are hiding themselves among the trees. Immediately behind the King is his body-guard, with long spears and standards. A fallen foe, pierced by a javelin, lies at his feet, and behind the fallen man a suppliant. This sufficiently indicates the attention then given to artistic representation.

To return to the question of boundary-stones: It is evident from the fact of the care taken in regard to these, and from the laws of Khammurabi (about 2285 B.C.) in regard to the use of land, that the boundaries thereof were a matter of concern. This is obvious when we pay attention to the laws concerning agriculture. For example, Khammurabi made it imperative to cultivate land; payment for reclaiming land had to be made, viz., ten gur (eighty bushels) of corn for every ten feddan (eleven and one-ninth acres); if neglect

of proper irrigation methods led to destruction of a neighbour's crop, ten gur (80 bushels) for each feddan (one and one-ninth acres) had to be paid; and if, through neglect of cultivation, the quantity of a crop diminished, reparation to the full extent of the loss was required. It is easy to see that such a civilisation necessitated a considerable record of affairs, as, indeed, the tablets show.

This elaboration of record is incidentally confirmed by the law requiring that for "corn, wool, oil, or any kind of goods to trade with," a receipt shall be given; or by the law defining the emoluments and penalties of the medical profession according as their operations are successful or unsuccessful; or again, by the law dealing with defective architecture.

The results of the Babylonian researches show that modern civilisation was extraordinarily well developed at least 4500 B.C. In an essay* on Trigonometrical, General, and Cadastral Survey, published about ten years ago, it was said that "rope-stretching" as a surveying method dates "back to the time of Amenemhat I., 2000 B.C. It is now evident that Babylonia preceded Egypt in this knowledge, and that, great as was the work of Ramses II., it was, after all, merely carried out in the spirit which distinguishes Babylon long before. We see that the surveyor and the statistician were active members of the community 6500 years ago, and it is not unlikely that the records of that date, inscribed on various kinds of tablets, will last long after the paper records of to-day have perished. One naturally asks were not the civilisations then themselves old? The giant undertakings, eclipsing in their magnitude anything in the modern world, indicate that the world was very old then, and probably even those early days had an ancient history.

* By the author of this paper, "Prize Essay on the Nature and Public Utility of Trigonometrical, General, and Cadastral Survey," 1891.