An Egyptian surveying instrument

Original

Availability:
This version is available at: 11583/2450375 since:

Publisher:
I.I.C.E. - Istituto Italiano per la Civiltà Egizia

Published
DOI:

Terms of use:
openAccess
This article is made available under terms and conditions as specified in the corresponding bibliographic description in the repository

Publisher copyright

(Article begins on next page)
An Egyptian surveying instrument - by Amelia Carolina Sparavigna

Redazione Archaeogate, 14-10-2011

In 1906, an Italian archaeological mission lead by Ernesto Schiaparelli, found a tomb of the New Kingdom, which had survived intact until the discovery. In this tomb, Kha and his wife Merit were buried. Kha was an architect and an important supervisor at Deir El-Medina, during the 18th Dynasty [1]. Nowadays, coffins and items of the tomb are kept at the Egyptian Museum of Turin [2], with a small wooden statue of the architect (Fig.1). Kha had for his afterlife, some tools that he used for his job as supervisor. Among them we can see a wooden cubit that can be folded by hinges. Since wood was the preferred material for the architects (3), quite probably this cubit was the one that Kha handled during his job. Besides the rulers, Egyptians had several other tools for masonry, such as plumbs, levels and squares [1,3].

As ours, the Egyptian plumbs consisted of a suspended plumb bob [3].

Among the items of the Kha's tomb, one is unique (see Fig.2). The label tells that it is supposed to be the case of a balance scale, or the scale itself. Due to its form and related moment of inertia, it is better to reject the hypothesis that this object can be a sort of balance. The complex decoration of the case suggested me that this is a protractor, able then to determine directions and measure angles [1]. The decoration of Fig.3 has a 16-fold symmetry of a compass rose with 16 leaves. Outside this rose there is a polygonal line with 36 sides. As discussed in [1], the fraction 1/16, corresponding to one leaf of the compass rose, is a component of the Eye Of Horus, a symbol defined during the Old Kingdom to represent the number one. The number of the sides of the polygonal line corresponds to the number of Decans, the 36 groups of stars which rise in succession from the horizon due to the Earth revolution. Considering the case as a protractor, this is a quite interesting gauge having two scales, one based on Egyptian fractions, the other based on Decans.

To show how to use the Kh's protractor, we can consider the measurement of the angle of an inclined plane. Note that the case has a lid (Fig.2). Let us remove the lid; the case has a perfectly straight surface, as shown in Fig.4. When the surface is horizontal, using a plumb to have the vertical direction, one of the directions of the rose of Fig.3 coincides with the direction of the plumb. If the surface is inclined, the direction of the rose is inclined forming an angle with respect to the vertical. This angle is the angle of the inclined plane. Therefore, architect Kha could have used his tool, with the contemporary use of a plumb, for a practical measurement of inclination.

Let us be even more specific and concrete: we can use the Kh's protractor to measure the stair angle of buildings, as, nowadays, the universal protractor - a tool available at most hardware stores - is used to determine this angle. The procedure is the following: a straightedge is laid across a minimum of three steps (see Fig.5). The universal protractor is put on the straightedge and the angle determined with a plumb. In the case that the flight of stairs is very long, it is necessary to measure the stair angle at two or three different places along the run to check that the angle remains constant on all the flight of stairs. A modern universal protractor for masonry is shown in Fig.6. Note that the modern tool has the same shape as the object found in the Kh's tomb. In fact, during his job as supervisor, Kha had surely the need of surveying the constant inclination of stairs.

To conclude this discussion, let me propose a comparison of the decoration of this Egyptian item with that of a compass rose of directions. The rose I use is that we can see in a table of Surveying from the 1728 Cyclopaedia [4,5]. This rose has two scales. As shown in Fig.7, we can go back from the compass rose to the Kh's rose, with small adjustments. May be, the origin of the design of the compass rose is in the ancient Egyptian tools.

References
2. Turin Egyptian Museum: the tomb of Kha.

Amelia Carolina Sparavigna
Dipartimento di Fisica
Università di Torino, Torino, Italy.
Articoli recentemente pubblicati in Egittologia [archivio]:

Il Corso "Storia e manifattura del papiro" del Museo del Papiro di Siracusa si è tenuto nel Museo Egizio del Cairo

Alle origini della Cristianità: chiese ritrovate in Israele, Turchia ed Egitto

Il restyling "faraonico" del Museo Gregoriano Egizio in Vaticano - di Alessia Amenta

Fig.4: Considering the object of the Kha's tomb as a protractor, we can measure the angle of an inclined plane. We can put it on a smooth surface. In the case that the surface is horizontal, using a plumb to have the vertical direction, one of the directions of the rose in Fig.2 is coincident with the plumb. In the case that the surface is inclined, the direction of the rose is inclined with respect to the vertical. The angle with the vertical direction has the same value of the angle of the inclined plane.

Fig.5: We can use the Kha's protractor to measure the stair angle of buildings. Nowadays, a universal protractor, available at most hardware stores, measures this angle in the following way. A straightedge is laid across a minimum of three steps. The protractor is put on the straightedge and the angle determined with a plumb.

Fig.6: A modern universal protractor for masonry. Note that the modern tool has the same shape of the object found in the Kha’s tomb.

Fig.7: Starting from a compass rose of directions (up-left, from a table of Surveying in the 1728 Cyclopaedia [4,5]), we can go back to the Kha’s rose (down-right) with small adjustments.