AL KHÂZINÎ'S TREATISE ON ASTRONOMICAL INSTRUMENTS

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From Houzeau and Lancaster[1] one may gain the impression that Al Khâzinî's book on astronomical instruments were extant. A study of their sources[2] shows, however, that their particular phraseology is traceable to D'Herbelot, who heavily draws upon Ḥajî Khalîfa. And it is quite certain that the statetement of D'Herbelot to the effect that such a book exists "in the Arabic libraries" means nothing more than the occurrence of the name of such a book in Ḥajî Khalîfa.[3] There is at least another source statement concerning this book,[4] and apperently later occidental notices[5] concerning it are based upon one or the other of these sources. Brockelmann clearly states that the book is lost.[6]

As I had privately indulged in some speculation concerning the content of this book and on the possibility of its containing certain items of information much needed for the history of Islamic observatories, it was a very pleasant surprise to me to find it in the Library of the Sipahsâlâr Mosque in Tehran. The book which I have found is entitled "*Risâla fî'l âlât*". The title of Al Khâzinî's lost book is specified in the above mentioned sources as "*Âlât al ʿajiba al raṣadîya*". The two works may therefore not be the same, but even then, with the Sipahsâlâr manuscript we are clearly in possession of a work which contains Al Khâzinî's knowledge and ideas on astronomical instruments and which was so far not known to have come down to us.

The manuscript in question is in Arabic. It consists of 34 pages, and is legibly written and well preserved. The first leaf, i.e., the first two pages, is bound in the volume registered under number 682 and forms the first leaf of that volume. The remaining 32 pages are in volume No. 681 and are bound as the first 32 pages of that volume. As the first two pages which are in 682 contain the title, name of author, and list of contents, and as the content of the remaining pages is in full agreement with this table of contents, there is no room for doubt that these are the two parts of one and the same

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[1] See Turkish text, note 1.

[2] Ibid., note 2.

[3] Ibid., note 3, reference 2.

[4] Ibid., note 3, first reference.

[5] Ibid., see notes 1, 2, and 3.

[6] See note 3, last reference.

book. In its present state no pages are missing. The book was copied in Musul in 683 H.

The two volumes are registered at the Library as the *Zîj-i-Sanjarî* of Al Khâzinî, and this is apperently one reason why the book on instruments has remained unnoticed to date. In reality, these two volumes form a collection of Al Khâzinî's works. The *zîj* which they contain is not complete.

In this manuscript the subject of instruments is treated in a general way and not with reference to any special observatory, and both astronomical and geodetic, or fixed and portable instruments form the subject matter of the treatise. The work is composed of seven articles of which the first six are the following: 1)Dhât al shuʿbatayn (parallactic rule or triquetrum), dhât al thuqbatayn (instrument for measuring apperent diameters, diopter), dhât al muthallath (the possesor of the triangle), quadrant, instruments of reflection (âlât al inʿikâs), astrolab. The last article apparently deals with things that can be done without instruments or with devices that can easily be set up.

As the number of its pages would suggest, the book is not a very detailed one, but the instruments are treated in a systematic way and according to a special scheme. Each article consists of three sections. The first one concerns the description of instruments, the second the uses to which they can be put, and the third one embodies geometrical proofs connected with the theories of each instrument.

I have not made a detailed study of the manuscript, but I shall dwell on one instrument which seems to be of special interest, and this is an instrument called *suds*. In addition to certain geodetic functions, it is specifically mentioned that this instrument is destined to be used for the measurement of the distance between two stars, i.e., the arc of the great circle joining them, and that this was one of the motives that led to its invention by Al Khâzinî.

The instrument consists of a quarter circle and an alidade, and it is interesting that, in agreement with the name given later on in Europe to an equivalent instrument (sextant), it was called *suds* (1/6th of a circumference) although it has an arc of 90°. The alidade is divided into sixty parts, and one side of the instrument itself is so graduated as to give sines of angles. For the functions of this instrument were such that a knowledge of the sines of angles was often needed. The instrument therefore became less accurate as the angles approached 90°. It is likely then that the instrument was planned to be used for angles ranging up to 60°, and this perhaps explains why it was called *suds*.