Yakub b. Tarik

Riyaziyyat

احمد سليم سعيدان
الاز الرشدي في الرياضيات العربية
S. 435

Riyaziyyat şöbəsində

Ekmeleddin İhsanoğlu, Boris A. Rosenfeld, Mathematicians, astronomers and other scholars of Islamic civilization and their works (7th-19th c.), Istanbul 2003, pp. 16.
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Yakub b. Tarik

11. YA`QUB IBN TARIQ

Ya`qūb ibn Ṭāriq (d. ca 796), astronomer, worked in Baghdad under Caliph al-Manṣūr.

See: AGL (66-68), GAS (V 217-218, VI 124-127, VII 101-102), IHS (I 530), KF (278), KF^2 (33), MAA (4), MAMS (II 32), SSM (31), TH (778); Hogendijk [15], [37] (ENWC), Kapp [1] (III 66), Pingree [5], [20] (DSB).

M1. Sine Division of Kardajas (Taqṭī` kardajāt al-jayb) - is mentioned in KF. "Kardaja" from Sanskrit "kramajya", sine of $\frac{1}{96}$ circumference of a circle, apparently in this treatise a table of sines through $3^{o}15'$ was given.

A1. Zij Extracted from Sindhind Degree by Degree (al-Zīj al-maḥlūl min al-Sindhind li daraja daraja) - is quoted by al-Hashimī (No 306, A1). By Abraham ibn Ezra, Jewish mathematician, in the foreword of his translation of the commentary (No 210, A1) and by Ibn al-Muthannā made on the Zīj of al-Khwārizmī (No 41, A1). Research: Hogendijk [16] (Chapter on the visibility of the Crescent), Kennedy [23].

A2. Composition of Celestial Spheres (Tarkīb al-aflāk) - is quoted in "India" by al-Bīrūnī (No 348, E2) - al-Bīrūnī [4] (I 316, 353, II 67-68) and in other works, see Pingree [4] (105-120). In particular, in "India" al-Bīrūnī [4] (II 68) quoted Ya`qūb ibn Ṭāriq's table of distances of the Sun, the Moon, the Planets, and the sphere of fixed stars from the Earth and their diameters.

A3. Book on Reasons [in Zīj] (Kitāb fi'l-`ilal) - is quoted in "Shadows" (No 348, A4) by al-Bīrūnī [12] (No 2, 84), see Pingree [4] (120-123).

A4. Book on what Rises from an Arc of a Meridian (Kitāb mā irtafa`a min qaws niṣf al-nahār) - is mentioned in KF.

GESCHICHTE DES ARABISCHEN SCHRIFTTUMS

BAND XIII

MATHEMATISCHE GEOGRAPHIE UND KARTOGRAPHIE IM ISLAM UND IHR FORTLEBEN IM ABENDLAND

AUTOREN

VON

FUAT SEZGIN

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Institut für Geschichte der Arabisch-Islamischen Wissenschaften
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INHALTSVERZEICHNIS

of printed silk in the treasure of Nara are dated 734 and 740, but that is another matter). The art of printing had certainly come from China[m] together with many other features of Chinese civilization, which the Japanese of that time were assimilating as fast as they could. Six different charms were printed on two different kinds of paper; they are extracts from the "Vimala nirbhasa sūtra"[n] in Sanskrit, transliterated by means of Chinese characters.

For a description and a photograph of the charms, and an account of their printing derived from the Shoku Nihongi, see Thomas Francis Carter: Invention of Printing in China (1925; Isis, VIII, 365).

IV. MUSLIM AND LATIN MATHEMATICS AND ASTRONOMY

IBRĀHĪM AL-FAZĀRĪ

Abū Isḥāq Ibrāhīm ibn Ḥabīb ibn Sulaimān ibn Samura ibn Jundab. Died c. 777. Muslim astronomer. The first to construct astrolabes. Author of a poem (qaṣīda) on astrology and of various astronomical writings (on the astrolabe, on the armillary spheres, on the calendar).

H. Suter: Die Mathematiker und Astronomen der Araber (3, 208, 1900).

YA'QŪB IBN ṬĀRIQ

Probably of Persian origin, flourished in Bagdad, c. 767–778, died c. 796. One of the greatest astronomers of his time. He probably met, c. 767, at the court of al-Manṣūr, the Hindu Kankah (or Mankah?), who had brought there the Siddhānta. He wrote memoirs on the sphere (c. 777); on the division of the kardaja;[o] on the tables derived from the Siddhānta.

H. Suter: Die Mathematiker und Astronomen der Araber (p. 4, 1900).

MUḤAMMAD IBN IBRĀHĪM AL-FAZĀRĪ

Abū 'Abdallāh Muḥammad ibn Ibrāhīm al-Fazārī. Son of the astronomer Ibrāhīm dealt with above, for whom he is sometimes mistaken (he may be the author of the astrological poem ascribed to his father). Died c. 796 to 806. Muslim scientist and astronomer. He was ordered by the Caliph al-Manṣūr in 772/3 to translate the Sanskrit astronomical work Siddhānta.[p] This translation was possibly the vehicle by means of which the Hindu numerals were transmitted from India to Islām.

H. Suter: Die Mathematiker und Astronomen der Araber (p. 4, 1900). Cantor: Geschichte der Mathematik (I, 3d ed., 698, 1907). D. E. Smith and L. C. Karpinski: The Hindu-Arabic Numerals (p. 92, Boston, 1911). Carra de Vaux: Penseurs de l'Islam (vol. 2, 197–201, 1921).

For al-Baṭrīq, see my note in Section VIII, below.

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[m] See my note on Ming Huang (first half of eighth century).

[n] In Japanese, Mu-ku Jō-kō kyō.

[o] The Hindu and Muslims divided the circle into 96 parts (that was an Archimedian tradition). The arc (225′) or the sine of each of these parts was called kardaja, possibly a corruption of a Sanskrit term, for which see my note on the Siddhāntas (first half of the fifth century).

[p] Al-Bīrūnī says that the translation of the Siddhānta was already completed in 770–71. Does he refer to the same work?

ist zu dieser Frage zu bemerken, dafs der Fihrist selbst Quellen anführt, die ihn als eine sagenhafte Persönlichkeit bezeichnen, es heifst daselbst (p. 355): „Eine Anzahl von Männern der Wissenschaft behaupten, dafs Gâbir nirgends woher stammte, und in Wirklichkeit nicht existiert hat.“ Seine alchymistischen und magischen Schriften sind viel verbreitet und teilweise auch herausgegeben, ich trete hierauf nicht ein. (Fihr. 354; C. I. 424 n. Ibn el-Q.)

4. Ja'qûb b. Ṭâriq gehörte zu den berühmten Astronomen und Astrologen und wird von den bedeutendsten Vertretern dieser Wissenschaften zitiert. Wann er gelebt hat, ist nicht mit Sicherheit zu entscheiden, doch ist es nach Stellen, die Reinaud in seinem Mémoire sur l'Inde (Paris 1849, p. 312—14) aus dem *Târîch el-hind* des el-Bîrûnî (Paris, 2280, früher Suppl. arabe 934) veröffentlicht hat, sehr wahrscheinlich, dafs Ja'qûb b. Ṭâriq um das Jahr 150 an den Hof des Chalifen el-Manṣûr mit dem indischen Gelehrten Kankah (od. Mankah?), der den *Siddhânta* mitgebracht hat, gekommen ist. Seine Abhandlung über die Sphäre soll er im J. 161 geschrieben haben, er mag also so gegen 180 (796) gestorben sein. Wahrscheinlich war er ein Perser.[a]) Er schrieb: Über die Teilung des Kardağa.[b]) Über das, was sich vom halben Tagebogen in die Höhe erhebt. Das Buch der Tafeln, dem Sindhind (*Siddhânta*) entnommen, von Grad zu Grad, in zwei Teilen: der erste handelt über die Wissenschaft der Sphärik[c]), der andere über die Wissenschaft der Zeitperioden (Chronologie). (Fihr. 278, Übers. 33; C. I. 425 u. 26 n. Ibn al. Q.; Reinaud, l. c. nach el-Bîrûnî.)

5. Abû Jaḥjâ el-Baṭrîq lebte zur Zeit el-Manṣûrs, der ihn mit der Übersetzung einer Reihe von älteren Werken beauftragte. Seine Übersetzungen sollen gut sein, aber doch nicht an diejenigen Honeins hinanreichen; er übersetzte besonders Werke von Hippokrates und Galenus, auch für 'Omar b. el-Farruchân (s. d. Art.) das Quadripartitum des Ptolemäus ins Arabische. Er wird so zwischen 180—190 gestorben sein. (Fihr. 273, Übers. 27; Ibn Abi U. I. 205.)

6. Muh. b. Ibrâhîm b. Ḥabîb, Abû 'Abdallâh el-Fazârî, der Sohn von Nr. 1, ein bedeutender, vielseitiger Gelehrter, besonders in der Astronomie hervorragend. Er wurde von el-Manṣûr beauftragt, die Über-

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[a]) C. I. 425 macht ihn zu einem Spanier, was er auch mit andern Persönlichkeiten, so z. B. mit 'Alî b. 'Îsa el-Aṣṭorlâbî versucht hat.

[b]) Es ist dies Wort wahrscheinlich korrumpiert aus dem indischen kramağja = gerader Sinus, d. h. der Sinus (od. der Bogen) von 225′. Vergl. auch Fihr. Übers. 66.

[c]) Dies ist jedenfalls das von el-Bîrûnî genannte Buch über die Sphäre, das bei C. als ein eigenes Werk hingestellt wird, wie auch dasjenige über die Chronologie.

Journal of Near Eastern Studies, 27, 1968 Chicago

THE LUNAR VISIBILITY THEORY OF YA'QŪB IBN ṬĀRIQ[1]

E. S. KENNEDY, The American University of Beirut and Brown University

1. INTRODUCTION

PRESENTED below are two of the many fragmentary remains of the astronomical work of Ya'qūb ibn Ṭāriq (fl. A.D. 760), one of the prominent astrologers maintained at the early Abbasid court at Baghdad ([7][2], p. 4). It will be seen that his numerical results are of the rough-and-ready variety which distinguish Sasanian and early Islamic astronomy, in contrast to the rigorous, elegant, and precise numerical methods developed from the time of al-Battānī on. The work of Ya'qūb also exhibits a mixture of Indian and Hellenistic influences, likewise characteristic of his time.

The Muslim calendar is a pure lunar one, with the beginning of each month determined by actual sighting of the new moon. For this reason, and since most medieval scientists were Muslims, the astronomical literature of the Middle Ages abounds in a variety of schemes for predicting the appearance of the new crescent above the western horizon after sunset.

Most of these methods involve the principle contained in Ptolemy's Almagest ([6], XIII, 7), that a celestial object will be visible only if it is above the horizon when the angle of depression of the sun below the horizon exceeds a certain constant.

It has recently been shown, however, (in [8] and [2]) that the early Islamic astronomer Muḥammad ibn Mūsā al-Khwārizmī used in contrast the standard Indian criterion of lunar visibility which holds that the crescent will be visible if the difference in setting time between the sun and the moon is twelve degrees or more.

Ya'qūb also employed the Indian method. His work has been pieced together from two sources, one contained in the *zīj* (astronomical handbook) of al-Baghdādī ([1], p. 124). The other was encountered by Professor David Pingree in a collection of short astrological and astronomical treatises. These have been translated as Appendixes *A* and *B* respectively at the end of the article. In both, the Arabic original is clear and straightforward, and there seems to be no point is reproducing it. Appendix *A* includes a numerical table, reproduced in transcription here.

2. CALCULATION OF THE DIFFERENCE OF SETTING

Both versions demand the calculation of the solar and lunar true longitudes at sunset (λ_s and λ_m respectively), but Appendix *A* goes on to explain the method, putting

$$\lambda = \lambda_0 + (d/24)\dot{\lambda}$$

where λ_0 is the true longitude at noon, d in hours is the length of half the daylight on the day in question, and $\dot{\lambda}$ in degrees per day is the rate of motion of the luminary on that

[1] Study supported by the National Science Foundation.

[2] Numbers inclosed in square brackets are references to the bibliography at the end of the article.

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THE FRAGMENTS OF THE WORKS OF YAʿQŪB IBN ṬĀRIQ[1]

DAVID PINGREE, University of Chicago

THE following collection of fragments and the succeeding article by E. S. Kennedy present all the material so far discovered relevant to one of the earliest of ʿAbbāsid astronomers and attempt to interpret that material historically and scientifically. Many absurd assertions have been made concerning early Islamic science by historians who have not had the time or ambition to read the original sources but who are content to continue the historiographic tradition begun in Spain in the twelfth century. These two articles and similar collections of other early Muslim astronomers and astrologers will attempt to provide a different basis for assessing the formative period of science in Baghdād.

The *Fihrist* of Ibn al-Nadīm (p. 278), which is copied in a rather inaccurate manner by Ibn al-Qifṭī (p. 378), tells us of Yaʿqūb very little indeed.

> Yaʿqūb ibn Ṭāriq, one of the best astronomers. Among his books are: *Kitāb taqṭī kardajāt al-jayb; Kitāb mā irtafaʿa min qaws niṣf al-nahār*; and *Kitāb al-zīj maḥlūl fī al-Sindhind li-daraja daraja*, which is in two books; the first is on the science of the sphere, and the second on the science of the dynasty (*duwal*).

The first of these works must have described the method of converting a table of sines whose argument is expressed in intervals of 3;45° (a normal Indian table of *kramajyā*'s, from which, apparently through Pahlavī, comes the Arabic *kardaja*) to one whose argument is expressed in intervals of 1°. It was either a part of, or was used in writing, the *Kitāb al-zīj*. The second work apparently deals with the problem of determining the altitude of the Sun from the day-circle. It may have been extracted from the *zīj*, or from the *Kitāb al-ʿilal* which Ibn al-Nadīm neglects to mention. The fragments of the third work are discussed below. The subject of the second book of this *zīj*, *ʿilm al-duwal*, seems extremely peculiar; perhaps one should amend the text of both Ibn al-Nadīm and Ibn al-Qifṭī(!) to *ʿilm al-dawr*, "science of revolution(s)."

The *Sindhind* upon which Yaʿqūb's *zīj* was based was, of course, that translated by al-Fazārī[2] from a Sanskrit work allied to the *Paitāmahasiddhānta* of the *Viṣṇudharmottarapurāṇa*[3] and the *Brāhmasphuṭasiddhānta* of Brahmagupta.[4] The Sanskrit work was brought to Baghdād by a member of an embassy sent from Sind to the court of al-Manṣūr (754–775);[5] the date is variously reported as being A.H. 154 (24 Dec. 770–12

[1] The best previous discussion of Yaʿqūb is by Nallino, *Raccolta*, 5, 215 ff.

[2] On al-Fazārī see D. Pingree, "The Fragments of the Works of al-Fazārī," to appear in a future issue of *JNES*, and the commentary to the forthcoming edition of al-Hāshimī's *Kitāb ʿilal al-zījāt* by E. S. Kennedy and D. Pingree.

[3] See *JNES*, 24 (1965), 334–36.

[4] Brahmagupta wrote the *Brāhmasphuṭasiddhānta* at Bhillamāla (Bhinmal) in southern Rājasthān in Śaka 550 (A.D. 628) during the reign of Vyāghramukha of the Cāpa family (24, 7). Ibn al-Adamī, according to Ṣāʿid al-Andalusī, ed. p. 50, trans. p. 102, refers to Q.b.gh.r. (*var.* F.y.gh.r) the Indian king; according to Ibn al-Qifṭī (p. 270) he refers to F.y.gh.r. This latter pointing is correct, and Fyaghra is Vyāghra(mukha).

[5] See Ibn al-Adamī in the passages cited above in n. 4; al-Bīrūnī, *India*, ed. p. 351, trans. Vol. 2, p. 15; and al-Hāshimī, *Kitāb ʿilal al-zījāt* 95 v: 3 ff.

Planisphärium und über das Meßinstrument für den wahren Mittag hingewiesen werden.

Ya'qūbī, *Buldān* 241; Mas'ūdī, *Murūğ* VIII, 290–291; Ṣā'id, *Ṭabaqāt* 13; Yāqūt, *Iršād* XVII², 117–119; Qifṭī, *Ḥukamā'* 270–271; Ṣafadī, *Wāfī* I, 336–337. – Suter S. 3; Nallino, *'Ilm al-falak* 147–163; Sarton I, 530; D. PINGREE, a.a.O.

Die uns bekannten Titel von astronomischen Schriften (s. Kap. Astronomie) lauten:

1. – *al-Qaṣīda fī 'Ilm an-nuğūm*, „Lehrgedicht über die Astronomie".
2. – *K. al-Miqyās li-z-zawāl*, „über das Meßinstrument für die Bestimmung der Mittagslinie."
3. – *K. al-'Amal bi-l-asṭurlāb wa-huwa ḏāt al-ḥalaq*, über den Gebrauch der Armillarsphäre.
4. – *K. al-'Amal bi-l-asṭurlāb al-musaṭṭaḥ*, über den Gebrauch des planisphärischen Astrolabiums.
5. – *K. az-Zīğ 'alā sinī al-'arab*, diese Schrift ist in einer Bearbeitung in Rabat erhalten (s. Kap. Astronomie).

YA'QŪB B. ṬĀRIQ

YA'QŪB B. ṬĀRIQ gehört neben AL-FAZĀRĪ, NAUBAḪT, MĀŠĀ'ALLĀH, 'UMAR B. AL-FARRUḪĀN AṬ-ṬABARĪ zu den ältesten bekannten arabischen Astronomen-Astrologen, die unter AL-MANṢŪR (136/754–158/775) tätig waren und die gleichzeitig als die ältesten bekannten arabischen Mathematiker betrachtet werden müssen. Bereits zu Anfang dieses Jahrhunderts wurde deutlich gezeigt, daß YA'QŪB und AL-FAZĀRĪ dem numerischen Element einen erheblichen Platz in ihren astronomischen Schriften einräumten und sich mit der Berechnung der Planeten, der Schiefe der Ekliptik, der scheinbaren Sonnen- und Monddurchmesser und des Erdumfanges befaßten und sich dabei trigonometrischer Methoden bedienten. Dies scheint aber nicht im geringsten dazu beigetragen zu haben, die unzutreffenden Anschauungen über die Entstehungszeit der arabischen Wissenschaften in Frage zu stellen. Erst in den letzten Jahren haben D. PINGREE und E. S. KENNEDY den sehr bedeutsamen Versuch unternommen, Fragmente aus den Werken von YA'QŪB B. ṬĀRIQ zu sammeln, zu untersuchen und auszuwerten. PINGREE hat betont, worauf ich bereits (s. o. S. 12) hingewiesen habe, daß diese Fragmente geeignet sind, die herrschenden Vorstellungen von der frühen arabischen Wissenschaft zu revidieren.

GAS. VI. e, S. 124-127, 129

Yaʿqūb b. Ṭāriq 4.1, 1978

Dieser arabische Astronom war zur Zeit des abbasidischen Kalifen al-Manṣūr tätig. Während seine Fachkollegen hauptsächlich die von den Griechen und Persern übernommene Astrologie pflegten, spielten Yaʿqūb b. Ṭāriq und sein Zeitgenosse al-Fazārī (s. o. S. 122) als muslimische Repräsentanten der spätsasanidischen Schule bei der Rezeption der mittelpersischen und indischen Astronomie eine große Rolle. Die Bedeutung der Titel und Fragmente der Werke des Yaʿqūb b. Ṭāriq für die Geschichte der arabischen Astronomie hat C. A. Nallino bereits am Anfang unseres Jahrhunderts erkannt. Noch näher kennen wir sie jetzt durch Untersuchungen von D. Pingree und E. S. Kennedy. Yaʿqūb b. Ṭāriq scheint, wie seinem Kollegen al-Fazārī (dies gilt auch für die persischen und indischen Kollegen), der *Almagest*, besser gesagt die ptolemäische Darstellung der Astronomie, nicht direkt bekannt gewesen zu sein.

Yaʿqūb bevorzugt den persischen Kalender, bei dem das Jahr aus 365 Tagen besteht, die in 12 Monate zu je 30 Tagen zusammengefaßt werden, wobei die restlichen 5 Tage nach dem achten Monat *Ābān* zusätzlich eingeschoben werden. Der Beginn dieses Kalenders nach der Yazdiğird-Ära fällt mit dem 16. Juni 632 n. Chr. zusam-

YAʿQŪB IBN ṬĀRIQ (*fl.* Baghdad, second half of eighth century), *astronomy.*

Yaʿqūb ibn Ṭāriq was the astronomer most closely connected with al-Fazārī in introducing the *Zīj al-Sindhind* to Islamic scientists; he seems, in fact, to have collaborated personally with the Indian astronomer who came to Baghdad with an embassy from Sind in 771 or 773. The most important of his works in this connection were *Zīj maḥlūl fī al-Sindhind li daraja daraja* ("Astronomical Tables in the Sindhind Resolved for Every Degree"), *Tarkīb al-aflāk* ("Composition of the Spheres"), and *Kitāb al-ʿilal* ("Book of Causes").

Evidently the most prominent feature of the *Zīj* was that the interval between the entries in the columns of arguments for the tables was one degree. Its basic parameters were very similar to those of the *Zīj al-Sindhind al-kabīr* of al-Fazārī, except that Yaʿqūb completely accepted the equa-