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## AN EXCITING NEW ARABIC VERSION OF EUCLID'S *ELEMENTS*: MS MUMBAI, MULLĀ FĪRŪZ R.I.6

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ABSTRACT. — This paper introduces an anonymous and undated Arabic version of Euclid's *Elements*. It tries to determine its relationship to the textual history of the Arabic *Elements* as known today. The value of the version, the paper argues, is its close relationship to the works of the first known translator of Euclid's *Elements* into Arabic, al-Hajjāj b. Yūsuf b. Maṭar, the light it sheds on philosophical debates surrounding the *Elements*, and the new textual basis (Books I to IX with some lacunae) it yields for the further study of the early history of Euclid's *Elements* in Arabic.

Résumé (Une passionante nouvelle version arabe des Éléments d'Euclide : MS Mumbai, MULLA FIRUZ R.I.6)

Cet article présente une version arabe, anonyme et non datée des Éléments d'Euclide. Il vise à déterminer la relation de cette version à l'histoire textuelle des Éléments arabes telle qu'on la connaît aujourd'hui. Cette version est jugée intéressante pour le rapport étroit qu'elle entretient avec les ouvrages du premier traducteur connu des Éléments d'Euclide en arabe, pour les informations nouvelles qu'elle offre sur des débats philosophiques concernant les Éléments et finalement pour la base textuelle nouvelle qu'elle met à notre disposition pour des études plus approfondies sur la première période de l'histoire des Éléments d'Euclide en arabe.

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## 1. INTRODUCTION

The textual history of Euclid's *Elements* in Arabic is multifaceted and far from being deciphered in a convincing manner. Four major factors have caused this unsatisfying situation. The first of these four factors is the complexity of the texts found in the preserved manuscripts as well as of the stories narrated in medieval Arabic sources about this history. A second factor is the scarcity of reliably ascribed and dated textual witnesses of major components of this history. A third factor is the focus of modern researchers on mathematical aspects of Euclid's work and their fate in the hands of scholars from Islamic societies. The final factor is the lack of interest among modern researchers for the study of philological and visual elements of the text and its numerous versions and variants. Information stored in medieval sources was and is often taken at face value. The order and content of definitions, postulates, axioms, and theorems as well as their proofs attracted much more solid attention than the analysis of any given book of the *Elements* in its entirety. The philological properties that may lead to identifying different translators, editors, or users and the variances between the diagrams that may highlight the functions attributed to visual knowledge as well as the relationship between individual manuscripts are most often considered at best of secondary importance to the historical project at large. Hence, several unfounded claims about the origin of entire manuscripts, certain theorems and definitions as well as individual technical terms have been made in the past.

The manuscript, which I will introduce in this paper, possesses strikingly peculiar features that allow excluding a set of fragments characterized by shared technical terms from the primary transmission of Euclid's Elements in Arabic. The primary transmission of Euclid's Elements designates all texts that can be proven to be translations into Arabic of a Greek or Syriac version of Euclid's work. Due to the broad range of skills needed in the process of translating Greek and Syriac scientific texts into Arabic in the eighth and ninth centuries, the translations were often submitted to proofreading or other procedures of correction by a colleague. Furthermore, due to various other factors such as the vivacious interest in translated scientific texts in Baghdad, the capital of the Abbasid Caliphate and center of the translation efforts, the potential of a scholarly career at court or the continuously changing accuracy, efficacy and range of scientific terminology, translations quickly became obsolete or at least old-fashioned. As a result, they were either replaced by new translations produced by younger scholars or by editions. The latter came either from the pen of the original translator(s) or were produced by scholars interested in the discipline and the subject matter of the text. In respect to these various

follow-ups of any given translation, new translations as well as editions by a translator will also be understood as components of the primary transmission of Euclid's *Elements* in Arabic. Editions, epitomes, paraphrases, or commentaries by scholars not directly involved in the production of a translation will be referred to as components of the secondary transmission of Euclid's *Elements*. The secondary transmission of Euclid's *Elements*. in Arabic also comprises translations into other languages such as Latin, Syriac, Persian, or Sanskrit.

Several scholars contributed from the eighth to the tenth centuries to the emergence of the primary transmission of Euclid's Elements in Arabic. The most important names to be mentioned here, since they will be referred to in my analysis of MS Mumbai, Mulla Firuz R.I.6 (called from now on: MS Mumbai), are al-Hajjāj b. Yūsuf b. Mațar (fl. ca. 786-833), Ishāq b. Hunayn (d. 911), and Thābit b. Qurra (d. 901). Several medieval Arabic sources, among them the *Kitāb al-fihrist* compiled by Ibn al-Nadīm (d. 995), a bookseller and member of intellectual circles in Baghdad in the second half of the tenth century, and the preface to one of the two extant Arabic manuscripts of Abu l-'Abbas al-Nayrizi's (d. ca. 922) commented edition of the *Elements* report that al-Hajjaj b. Yusuf b. Matar translated the *Elements* either for the Abbasid caliph al-Harun al-Rashid (r. 786–809) or on order of his vizier Yahyā b. Khālid al-Barmakī (ex. 805). He is also credited with having produced either a new translation or a substantial edition of his old translation almost a quarter of a century later for the then reigning caliph al-Ma'mūn (r. 813–833). Ibn al-Nadīm claimed that this new translation superseded the first one. The author of the preface to al-Navrizi's work characterized in contrast the edition as a version that cut out superfluities, corrected errors, filled gaps, and improved upon the translation's language. As I have argued in other papers, the extant fragments that can be connected to al-Hajjāj's work suggest thinking of his second version as an edition rather than as a fresh translation [Brentjes 1994; Brentjes 1996]. All textual fragments that can be connected to al-Hajjāj's work, or at least said with some confidence to have been derived from it, will be labeled as members or derivatives of the Hajjaj tradition of the Elements. On the basis of Ibn al-Sari's (d. 1153) testimony, Djebbar has proposed to consider one such fragment as a remnant of al-Hajjaj's original translation [Djebbar 1996, p. 103]. This fragment possesses a particular terminology, namely *talbin* = the making of bricks, which it uses for describing squares and rectangles. This terminology altered the Greek way of speaking of these two types of figures as something being above a line into something that was made like a brick (of a size) a times b or a times itself. The term talbin, a verbal noun of the second root of the verb labana, is - as far as I know - not attested in dictionaries

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of classical Arabic. This fact and its use as if it signified the result of a process, not the process itself, i.e., a brick rather then the making of a brick, implies an origin in a context of translators whose mother tongue was not Arabic. Perhaps it was a word used by the first translator of Nikomachos of Gerasa's Introduction into Arithmetic, who worked in the early ninth century for caliph al-Ma'mun's general Tahir b. Husayn (d. 822). Djebbar supported his identification of such fragments with al-Hajjaj's original translation by pointing to the practical connotations of the term and its similarities to other terms of an apparently analogous practical character which are known from other fragments ascribed to al-Hajjāj's work [Djebbar 1996, pp. 98-104]. I have argued that the fragments using the terminology of bricks show strong features of change and hence cannot be accepted as a remainder of al-Hajjāj's translation without further arguments and other textual witnesses [Brentjes 1994, pp. 84-91]. The text contained in MS Mumbai is such a new witness. This fact constitutes one aspect of its importance for the study of the textual history of Euclid's *Elements* in Arabic. I will show that MS Mumbai speaks against the origin of the *talbin* terminology in al-Hajjaj's translation. Rather, it possesses features that point to an origin of this terminology in the secondary transmission of the *Elements*. These specific features linking an apparently practical terminology to the secondary transmission of the Arabic Elements and in particular to philosophical debates about the ontological and epistemological status of philosophical and mathematical disciplines are another aspect that makes this new textual witness of the *Elements* in Arabic exciting. They underline that interpretations of texts without investigations of their contexts tend to reflect more our own beliefs than those of the historical actors.

Almost half a century after al-Ḥajjāj's second version, Isḥāq b. Ḥunayn translated Euclid's *Elements* anew. He gave his text to the mathematician and translator Thābit b. Qurra, who edited it. It is not clear what kind of changes were involved in this process of editing. As a student of his highly skilled father Ḥunayn b. Isḥāq (d. 867), who had translated many Greek medical works and is generally hailed as the best translator of the ninth century, Isḥāq b. Ḥunayn had an excellent training as a translator from Greek or Syriac into Arabic. Hence, it is not very likely that Thābit b. Qurra interfered much in his colleague's Arabic style and choice of words. Indeed, extant manuscripts of the first two books of the Arabic *Elements* ascribed to Thābit b. Qurra show that this assumption may be correct. The language in these manuscripts namely features an undeniable and substantial influence of Greek syntax. The neglect of proper Arabic syntax is most likely not an expression of Isḥāq b. Ḥunayn's lack of knowledge, but the result of a conscious adherence to Greek style

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based on beliefs about what constituted a good translation. Thus, Thābit b. Qurra may have focused mainly on improving the mathematical content of the text produced by Isḥāq b. Ḥunayn. According to notes in extant manuscripts, he did this by adding alternative proofs and occasionally an additional theorem.

In the first two books of the extant manuscripts containing texts ascribed to Ishāq b. Hunayn and Thābit b. Qurra such as MS Tehran, Malik 3586, the latter's additions show philological features that set them apart from Ishāq b. Hunayn's translated text. Thābit b. Qurra apparently did not share his colleague's view on what constituted a good translation. He did not try to preserve Greek syntax in Arabic nor did he use the same technical terminology as Ishāq b. Hunayn.

The subsequent books present a much more complicated appearance. The extant manuscripts contain different variants, possibly even versions, of texts that are ascribed partly to Thābit b. Qurra and partly to al-Ḥajjāj b.Yūsuf b. Maṭar. Their philological features are much less pure than in the first two books. In particular, they loose their clear remnants of Greek syntax. Furthermore, the terminology shifts considerably and looses in some books its previous stability. Several, often conflicting judgments have been offered to the effect that certain of these manuscripts carry a text of the Ḥajjāj tradition, while others contain the text translated by Isḥāq b. Ḥunayn and corrected by Thābit b. Qurra (abbreviated from now on as: Isḥāq-Thābit tradition). Without a meticulous analysis of the features of these variants or versions – mathematical, philological, and visual –, however, no reliable results can be achieved.

MS Mumbai deserves our particular attention because of several peculiar features. Including the two aspects I already mentioned earlier, five features constitute the specific value of this manuscript for the further study of the textual history of the Arabic Elements. First, the manuscript contains a text that includes in its margins, as interlinear glosses, and as interpolations variants ascribed to Thabit b. Qurra and al-Nayrīzī as well as anonymous comments. This relationship indicates that the main text of this manuscript was not believed to originate from either of the two scholars. Second, parts of the anonymous comments are closely related to fragments, often ascribed to the philosopher and scientist Ya'q $\bar{u}b$ b. Ishaq al-Kindi (d. ca. 873). Third, the main text, not the glosses, comments, and interpolations contain some technical termini, among them the one mentioned earlier (talbin), that are either linked in the sources to the work of al-Hajjaj or are known from translations of philosophical or mathematical texts made in the eighth and early ninth centuries such as al-tina (matter). Fourth, parts of the anonymous comments explain the shift in technical terminology as the result of a philosophical