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The Causes and Features of Earthquakes in Avicenna and Fakhr al-Dīn al-Rāzī

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This paper discusses the explanations for the causes and features of earthquakes in the works of philosopher and scientist Avicenna (980–1037) and in the theologian Fakhr al-Dīn al-Rāzī (1149–1209), who was deeply familiar with the work of Avicenna and who criticized him sharply on many occasions. The aim of this paper is to check the well-known hypothesis according to which Muslim theologians sometimes set out doctrines that were much more innovative from a scientific point of view than those of philosophers, strictly linked to Aristotle. This paper thus contributes to the history of Graeco-Arabic translations and the history of science. Avicenna's and Fakhr al-Dīn al-Rāzī's doctrines are compared with Aristotle and the Arabic tradition of the *Meteorologica*.

Introduction

Avicenna, known in Arabic as Ibn Sīnā and one of the most famous Muslim philosophers, was a celebrated physician and scientist who lived between the eleventh and twelfth centuries. Fakhr al-Dīn al-Rāzī (d. 1209) was an anti-*mu'tazilite*, or orthodox, theologian who was deeply familiar with the work of Avicenna and who criticized him sharply on many occasions.

We will consider here the question of earthquakes as addressed by these authors with the aim of checking the well-known hypothesis according to which Muslim theologians, who were generally less influenced by Aristotle, sometimes set out doctrines that were much more innovative from a scientific point of view than those of philosophers. This paper thus contributes to the history of Graeco-Arabic translations and the history of science.

Aristotle was a major source for theories about earthquakes, so we must first recall the extent to which his views were known to the Arabs. Aristotle dealt with earthquakes in Book II of his *Meteorologica*: in Chapter 7 he confutes the positions of Anaxagoras of Clazomenes, Democritus of Abdera and Anaximenes of Miletus and in Chapter 8 he expounds his own ideas.

Aristotle on earthquakes

According to Aristotle, earthquakes are caused by the pressure of air (*pneuma*) produced when the earth, which is in itself dry but may be moistened by rain, is heated by the sun and by its internal fire. Earthquakes mostly occur when this *pneuma* makes rising vapour (*anathymiasis*) flow back into the earth: this happens mainly in calm weather, though earthquakes may occur when winds (*ànemoi*) blow because they contribute to making the *pneumata* turn inwards. Severe earthquakes occur when the sea is full of currents and when the earth is porous: in these cases seawater fills the pores of the earth, forcing out *pneumata*. Rains and droughts produce similar effects.

Phenomena related to earthquakes such as dimming of the sun are noted. This occurrence is not explained, but Aristotle does explain why calm and cold usually precede an earthquake and why a long streak of fine cloud may herald one; he later explains why earthquakes can occur at an eclipse of the moon. Aristotle also states that the effects of severe shocks frequently persist for 40 days and even for periods of one year or two. Subterranean noises during earthquakes are discussed, and the reasons why water may come out of the earth – in this case, the *pneuma* exerts its force from beneath. Tidal waves are caused by *pneumata* acting in the opposite direction.

Aristotle remarks that earthquakes are confined to one locality while winds (*ànemoi*) are not. He considers that horizontal shocks are determined by large quantities of *pneuma*; on rare occasions, shocks may run up from below, when large quantities of stones come to the surface. Finally, he explains why earthquakes are rarer in islands.

Aristotle's *Meteorologica* in Arabic is known through the translation by Yahyā ibn al-Bitrīq,[1] who died in 830. A summary by Hunayn ibn Ishāq (808–873), the most famous of Arabic translators, is also available.[2]

Yahyā ibn al-Bitrīq's version

Yahyā's version of the chapters on earthquakes appears to be more of a summary than a translation, which is strange because his translation of Book IV of the *Meteorologica* is very faithful to the original.[3]

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The main points of Aristotle's arguments are summarized, though not always in the same order. Chapter 7 briefly resumes the theories of Anaxagoras, Democritus and Anaximenes. But let us turn to Chapter 8.

In Greek, there are three terms for the main agents of the phenomena described. In the English version by Lee, which I have quoted in this work, *pneuma* and *ànemos* are both translated as 'wind'; *anathymìasis* is rendered as 'exhalation'. To these we must add *atmìs* (vapour).

The Arabic sources speak of *rīh* (wind) and *bukhār* (vapour) only. The first can translate *pneuma* and *ànemos*, the second *anathymìasis* and *atmìs*. This may explain some departures from Aristotle's text and some misunderstandings by the Arabic authors.

Yahyā attempts to resolve the inconsistencies resulting from this shift in terminology:

Yahyā ibn al-Bitrīq	Aristotle
However, earthquakes are as I say now, because an exhalation [*al-bukhār*] comes both from humid and from dry. The earth by its nature is dry, but when it rains it becomes moist, the sun acts in it and extracts from it a humid and a dry exhalation [*bukhāran rutban wa yābisan*]. Dry exhalation is wind [*al-rīh*]… Its beginning is in two ways: either an exhalation [*bukhār*] appears from the earth [in the form of] a wind ascending upwards [*rīhan sā'idan ilā-l-'uluww*], or it is a wind inside the earth [*rīhan fī bātin al-ard*], and it becomes agitated here. Owing to that agitation, an earthquake occurs.	Now it is clear, as we have already said, that there must be exhalation both from moist and dry, and earthquakes are a necessary result of the existence of these exhalations. For the earth is in itself dry but contains much moisture because of the rain that falls on it; with the result that when it is heated by the sun and its own internal fire, a considerable amount of wind is generated both outside it and inside, and this sometimes all flows out, sometimes all flows in, while sometimes it is split up.
The proof that wind [*al-rīh*] is that which moves the earth is that among the four elements there is no element capable of moving and crushing violently other than wind, and this is the mover of water and of fire with a violent movement, so that fire flares up and rises water with violence and potency owing to this. For this [reason], the movement[4] that exists in the earth – that is unique – does not belong to anything[5] except wind. The warming exhalation is wind	… Our step should … be to consider what substance has the greatest motive power. This must necessarily be the substance whose natural motion is most prolonged and whose action is most violent. The substance most violent in action must be that which has the greatest velocity, as its velocity makes its impact most forcible. The farthest mover must be the most penetrating, that is, the finest. If, therefore, the natural constitution of wind is of this kind, it must be the substance

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Continued

Yahyā ibn al-Bitrīq	Aristotle
[*al-bukhār al-musakhkhin huwa al-rīh*], and when it is agitated, it shakes the earth violently, and that action is an earthquake (ed. Badawi, p. 65, 3–66, 2).	whose motive power is the greatest. For even fire when conjoined with wind is blown to flame and moves quickly. So the cause of earth tremors is neither water nor earth but wind, which causes them when the external exhalation flows inwards (II, viii. 365b21–366a5; transl. H.D.P. Lee[6]).

We should note that though Aristotle added the idea of 'splitting (*merìzetai*) the pneuma' as a third possibility, Yahyā ibn al-Bitrīq here introduces only two processes leading to earthquakes: a wind formed outside or inside the earth.

The differences are largely philological. We can recall at least that Yahyā misunderstands the names, as in his statement that '… in some places an earthquake occurs and it does not stop until when the earth gets cleft, so that the wind comes out from that cleft and a noise is heard …' (pp. 67, 9–11), which is a faithful translation of 366b33–35: '… in some places there has been an earthquake which has not ceased until the wind which was its motive force has broken out like a hurricane and risen into the upper region …'. But the examples given by Aristotle – Heracleia in Pontus and Hiera, one of the Aeolian islands – are completely misunderstood by Yahyā, who incorrectly transliterates the names (pp. 67, 11–68, 1), although it is clear that the same places are referred to, as the continuation of Yahyā's text also demonstrates (pp. 68, 1–6 and 367a3–12).

Another example: Yahyā explains floods caused by earthquakes in terms of the blowing of different winds, and cites the south and the north winds, whereas Aristotle spoke of different forces exerted by wind from the surface or from beneath, mentioning the case of a 'tidal wave', and he referred to the south and the north wind (*notos* and *boreas*) only in reporting what happened in Achaea, which is also cited by Yahyā.

In terms of content, Yahyā adds an explanation of the fact that the sun is obscured in the case of earthquakes: '… because together with the wind soil and dust have come out from the earth'. And when recalling earthquakes during eclipses Yahyā mentions eclipses of the sun and of the moon, whereas Aristotle spoke of eclipses of the moon only. Yahyā's explanation is different, too:

Yahyā ibn al-Bitrīq	Aristotle
Moreover, an earthquake occurs with an eclipse of the sun and of the moon,	For the same reason an earthquake sometimes occurs at an eclipse of the

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Yahyā ibn al-Bitrīq	Aristotle
because at this [time] the heat of the sun does not reach the air [*al-hawā'*] as it did before, then the wind [*al-bukhār*] is congested and does not rise upwards as it did before, so it is agitated there with the earth, and for this an earthquake occurs (ed. cit., p. 69, 3–7).	moon. For when the interposition is approaching but the light and warmth from the sun, though already fading, have not entirely disappeared from the air, a calm falls when the wind runs back into the earth (II, viii. 367b20–24).

Lastly, Aristotle spoke of a shock running horizontally in the case of abundant winds and of rare cases of shock running up from below, whereas Yahyā states that abundant winds move the earth from side to side and few winds – *oligàkis* (occasionally) in Greek – move it upwards and downwards.

Hunayn ibn Ishāq's summary

Hunayn's summary – three pages in the edited version – merely lists some of Aristotle's arguments and ignores the overview of his predecessors. Wherever it differs from the original it follows Yahyā's version, starting with the first lines of Chapter 8 where the third kind of earthquake listed by Aristotle is omitted:

Hunayn ibn Ishāq	Yahyā ibn al-Bitrīq	Aristotle
	However, earthquakes are as I say now, because an exhalation [*al-bukhār*] comes both from humid and from dry.	Now it is clear, as we have already said, that there must be exhalation both from moist and dry, and earthquakes are a necessary result of the existence of these exhalations.
Earth by nature is cold and dry, but when it rains, it becomes moist; then the sun acts on it, and from it a humid vapour [*bukhār*] and a dry vapour are generated. … The dry vapour is the matter of all winds [*al-riyāh*].	The earth by its nature is dry, but when it rains it becomes moist, the sun acts in it and extracts from it a humid and a dry exhalation [*bukhāran rutban wa yābisan*]. Dry exhalation is wind [*al-rīh*]…	For the earth is in itself dry but contains much moisture because of the rain that falls on it; with the result that when it is heated by the sun and its own internal fire, a considerable amount of wind is generated both outside it and inside, and this sometimes all flows out, sometimes all flows in, while sometimes it is split up.

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Hunayn ibn Ishāq	Yahyā ibn al-Bitrīq	Aristotle
This dry vapour is generated in two ways: either a vapour escapes from the earth upwards, or it is generated from beneath the earth. Vapour by nature moves upwards. When it moves [looking for] an exit upward, and meets a hard soil, it cannot come out, then it is agitated beneath the earth and an earthquake is formed by this (ed. Habbi-Najib, p. 100, 4–12).	Its beginning is in two ways: either an exhalation [*bukhār*] appears from the earth [in the form of] a wind ascending upwards [*rīhan sā'idan ila-l-'uluww*], or it is a wind inside the earth [*rīhan fī bātin al-ard*]; and it becomes agitated here. Owing to that agitation, an earthquake occurs (ed. cit., p. 65, 3–11).	For even fire when conjoined with wind is blown to flame and moves quickly. So the cause of earth tremors is… wind, which causes them when the external exhalation flows inwards (II, viii. 365b21–366a5).

Hunayn shares with Yahyā the explanation of the dusty colour of the sun, the references to solar and lunar eclipses and the explanation of earthquakes in eclipses of the moon, the mention of the north and the south winds to explain floods after an earthquake and the horizontal and vertical movements of the earth resulting from different winds.

In addition, Hunayn – like Yahyā, but at odds with Aristotle – distinguishes between floodwaters and water from sources, which are partially retained in the earth, and between turbid and very hot waters. Unlike Yahyā, Hunayn strictly follows the order of Aristotle's text. These facts could indicate a pre-existing version to which both authors referred. Bio-bibliographers, who do not mention Yahyā's version,[7] refer to a translation by Abū Bishr Mattā ibn Yūnus that has not survived. But this does not help because Abū Bishr lived between 870 and 940, later than Yahyā and Hunayn. Ibn al-Nadīm (d. 995) relates a paraphrase of the *Meteorologica* to the even later Abu 'l-Khayr al-Hasan b. Suwār (d. ca. 1017).[8] As far as we know, the only earlier possible source remains a Greek compendium of the original work with its Syriac version, probably made by Sarjīs of Rish'aynā (d. 536) on the basis of an Alexandrian model, mentioned by Petraitis.[9]

Avicenna's explanation of earthquakes

Avicenna discusses earthquakes in Chapter 4 of the section on natural sciences in his famous *Kitāb al-Shifā'*, the 'Book of healing' (in the sense of 'healing of soul

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from ignorance', just as Avicenna describes how to cure the body in his *Canon of Medicine*), in which Aristotle's doctrines are set out, often in an original way.

According to Avicenna, an earthquake is caused by the movement of some parts of the earth, caused by a 'windy body' (*al-jism al-rīḥī*) that originates beneath the earth. Like Aristotle, he identifies a vaporous, windy or fiery (*bukhārī rīḥī aw nārī*) body as the main cause of an earthquake. After this brief introduction, Avicenna examines the doctrines of Democritus, Anaximenes and Anaxagoras before returning to Aristotle, whose ideas he introduces with some significant modifications.

In the introductory lines, for example, only one possibility is selected from those given by Aristotle: that earthquakes originate beneath the earth. This is considered the main cause of earthquakes, which is different from Aristotle. And water bursting from the earth as a result of earthquakes is introduced as a useful effect because it results in the formation of water sources; this may be borrowed from the original additions in Hunayn's summary. The same consideration is repeated at the end of the chapter to give a religious conclusion. The dangerous effects of earthquakes, such as fires and loud sounds, are also noted. Immediately after this, Democritus' theory is related to water as one of the causes of earthquakes – a possibility denied by Aristotle.

When the 'real' second cause of an earthquake, with its origin 'above' the earth, is approached, Avicenna links it to the fact that mountains break into pieces. This theory is attributed to a certain 'Arakimas', who from the context must be Anaximenes, even though Aristotle's report of his theory is different in that it refers to the breaking of the earth (*tēs gēs*) because of drought or heavy rains, an issue that Avicenna accounts for later.

Having mentioned the noises preceding earthquakes, Avicenna adds that a proof that the main cause of an earthquake is congested winds is that earthquakes diminish when wells and pipes are dug to increase the space for winds and vapours. Lastly, Avicenna emphasizes the variety of earthquakes in terms of their strength at the beginning and the end.

Avicenna often reflects the influence of Yahyā and Hunayn. When, for example, he explains, following Aristotle, why wind is the most important motive power, he lists all the possibilities linked to the four elements as does Yahyā, who, contrary to Aristotle, refers explicitly to *ustuqusāt*, 'elements'. He is also prone to the terminological confusion noted above, speaking first of '…a body made of vapour or smoke … like wind' (*jism bukhārī dukhānī… ka-l-rīḥ*) from beneath the earth – where the example of jars shows that Avicenna is thinking of 'air' – then of a 'windy body, made of fire or not' (*al-jism al-rīḥī, nāriyyan kāna aw ghayr nārī*) and then of a 'body made of air' (*al-jism al-hawā'ī*) that belongs 'to the dominion of that which is made of wind, of vapour or of smoke' (*an yakūna fī ḥukm al-rīḥī wa-l-bukhārī wa-l-dukhānī*), all of which point to the Greek *pneuma*.

Avicenna also mentions the 'elongated clouds' heralding an earthquake. He refers to eclipses as possible causes of earthquakes, and his explanation

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subsumes those by Yahyā and Hunayn. Avicenna also develops Aristotle's notion of horizontal and vertical shocks determined by different winds, on the basis of Yahyā and Hunayn.

Hence, Avicenna adds many new details to the *Meteorologica* and ignores Aristotle's points in only a few cases, such as the persistence of shocks in cases of severe earthquakes, the link between earthquakes and tidal waves, the local character of earthquakes but not of winds, and the infrequency of earthquakes in islands far out at sea.

Fakhr al-Dīn al-Rāzī's explanation of earthquakes

There are, as one might expect, a number of similarities with Avicenna in Fakhr al-Dīn al-Rāzī, who deals with earthquakes in his *Mabāhith al-mashriqiyya*, 'The oriental queries', a juvenile philosophical work. When he reports Anaximenes' theory, for example, which he does anonymously (perhaps because he was unable to identify Arakimas), he introduces it as an example of the second cause of the origin of earthquakes, following Avicenna:

Fakhr al-Dīn al-Rāzī	Avicenna
As to the cause that is above the earth, it is because small [pieces] of mountains fall and then the earth is shaken by an earthquake. This cause happens in two times: when rains are many or few. As to their abundance, it is because when the small pieces become moist, their division some from others is easier. While when [rains] are scarce, [it is] because when the small pieces dry, their crumbling is easy (ed. Tehran, vol. II, p. 206, 11–14[10]).	Sometimes, there are for earthquakes causes above the earth, like a mountain to which it happens that small or big of its parts fall down violently so that the earth is shaken by an earthquake, like that seen by the man called Arakimas… This man said that for this [reason] earthquakes happen in two times: when there are many and few rains. The great quantity of rains makes it necessary the soaking of the small parts and of mountain peaks, and moistens them, which leads to their division and falling; as to the small quantity of rains, it is because it implies by necessity a dryness that breaks (the earth) into small fragments, and breaking into small fragments facilitates the separation of that which was united (ed. Montasir, p. 16, 5–11).[11]

Like Avicenna, Fakhr al-Dīn also mentions the excavation of wells as an expedient to liberate vapours (*al-abkhira*; *al-riyāh wa-l-abkhira* in Avicenna) to reduce the occurrence of earthquakes.

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In spite of these common themes, Fakhr al-Din leaves out many issues referred to by Avicenna, perhaps because his chapter is shorter than those of Avicenna and Aristotle. He omits the advantages and damage brought about by earthquakes, the kinds of cloud formed in earthquakes, the seasons in which earthquakes occur more or less often, eclipses, references to the human body and the different strength and kinds of earthquakes.

Nonetheless, and despite the fact that he omits many Aristotelian elements, Fakhr al-Dīn's treatment of earthquakes is much closer to Aristotle than was Avicenna's. He is the only author among those considered to preserve the initial three-fold distinction made by Aristotle in that he resumes his arguments with: 'The cause of earthquakes [can be] either under the earth, or above it, or [something] composed of both of them'. Fakhr al-Dīn relates the opposition of winds to this 'third' explanation of the earthquakes, which had been introduced by Aristotle through the verb *merizesthai*, 'to split', with reference to *pneuma*:

Fakhr al-Dīn al-Rāzī	Aristotle
As to the cause composed [of the two mentioned], what is above and under the earth is that which [happens], when the smoky vapours [*al-abkhira al-dukhāniyya*] that are under the earth try to rise upwards, but it is impossible for them, either because cold has thickened the surface of the earth – as [happens] at night and at early morning – or because the heat dries and thickens it – as it [happens] at midday – or because there are here opposite winds [*riyāh mutamāni'a*] that hinder those vapours from rising upwards (ed. cit., pp. 206, 19–207, 1).	There is, however, nothing inexplicable in the fact that some earthquakes occur when a wind is blowing; for we sometimes see several winds blowing at the same time, and when one of these plunges into earth the resultant earthquake is accompanied by wind. But these earthquakes are less violent, because the energy of their original cause is divided (II, viii. 366a8–13).

Conclusion

Although our research goes against the initial hypothesis, because Fakhr al-Dīn was much influenced by Aristotle, the sources confirm that he worked from the ideas of his predecessors, Avicenna in particular, in an original way: for example, it is significant that he considers earthquake noise from a scientific point of view rather than as damage related to earthquakes, as does Avicenna. On the other hand, he must have had at his disposal translations of Greek texts. I have

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elsewhere noted this with regard to the study by Fakhr al-Dīn of the science of embryology and the related doctrines of Aristotle and Galen.[12]

In terms of content, the introductory lines of his presentation are the closest to the brief account of earthquakes in Epistle 19 *On minerals* by the Ikhwān al-Safā', the 'Brethren of Purity', who wrote the oldest encyclopaedia of sciences in the Middle Ages, a tenth century Muslim survey based on the view of Aristotle and others:

Fakhr al-Dīn al-Rāzī	Ikhwān al-Safā'
When under the earth a smoky vapour [*bukhār dukhānī*] is generated, hot, rich of matter, and the surface of the earth is thick, deprived of pores and passages, so when that vapour looks for an exit and this is not allowed due to the thickness of the surface of the earth, then it moves in itself and moves the earth; and sometimes it arrives, [ascending] upwards, to be so powerful so to split the earth; sometimes it develops into a burning fire [*nār muhriqa*]; and sometimes terrific noises and sounds are formed, that indicate the violence of the wind [*al-rīḥ*; Gr. *Pneuma*]… and this is the cause of the most of earthquakes (ed. cit., pp. 205, 19–206, 5).	As to the caverns, caves and chasms that [are found] inside the earth and mountains, when they have no escapes from which waters [may] come out, those waters remain imprisoned there for a certain time, and when the interior of the earth and the cavity of those mountains heat, those waters become there warm and thin, rarefied and become vapour, rise up and search for a wider space; … and if the external [part] of the earth has a strong density and is inaccessible, hinders [those vapours] from coming out, they remain imprisoned, agitated in those chasms in search for an exit; and sometimes the earth splits in a certain place, and those winds come out suddenly, their place sinks down, noise and crush are heard [following] to their [coming out] and an earthquake [may follow] (ed. B. Bustānī, vol. II, p. 97, 6–14).[13]

This comparison further confirms the hypotheses of the availability of a different version of Aristotle's *Meteorologica* from that by Yahyā ibn al-Bitrīq and of continuity in the scientific heritage from the translation period to Fakhr al-Dīn al-Rāzī.[14]

Notes and References

1. A simplified transcription system is used in the present article. Two editions of this work are available: Aristotelis *de Cœlo et Meteorologica*, Edidit et adnotatione critica auxit 'Abdurrahmân Badawi, Cahire, Maktaba al-nahda al-misriyya 1961 (= B), and C. Petraitis, *The Arabic Version of Aristotle's*

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Meteorology, A Critical Edition with an Introduction and Greek-Arabic Glossaries, Beyrouth, Dar el-Machreq 1967 (= P).

2. *Jawāmi' Hunayn ibn Ishāq… fī-l-āthar al-'ulwiyya li-Aristū*, taqdīm wa tahqīq al-Duktūr Yūsuf Habbī wa Hikmat Najīb, Baghdād, 1976.
3. See also C. Baffioni (1980) *La tradizione araba del IV libro dei 'Meteorologica' di Aristotele. Annali dell'Istituto Universitario Orientale di Napoli*, **40**, suppl. n. 23, pp. 1–104, on p. 10.
4. I read here with P: *al-haraka*; B: *al-rīh*.
5. P adds: *al-ustuqusāt* ('the elements').
6. Aristotle, *Meteorologica*, with an English translation by H. D. P. Lee Loeb Classical Library (London, Heinemann, Cambridge, MA: Harvard University Press, 1952)
7. Apart from Hājjī Khalīfa (1609–57). See C. Baffioni (1980) *La tradizione araba del IV libro dei 'Meteorologica' di Aristotele. Annali dell'Istituto Universitario Orientale di Napoli*, **40**, suppl. n. 23, on pp. 7 and 9.
8. See C. Baffioni (1980) *La tradizione araba del IV libro dei 'Meteorologica' di Aristotele. Annali dell'Istituto Universitario Orientale di Napoli*, **40**, p. 9, note 5.
9. See C. Baffioni (1980) *La tradizione araba del IV libro dei 'Meteorologica' di Aristotele. Annali dell'Istituto Universitario Orientale di Napoli*, **40**, p. 10.
10. Fakhr al-Dīn al-Rāzī, *Kitāb mabāhith al-mashriqiyya fī 'ilm al-ilāhiyyāt wa 'l-tabī'iyyāt*, Tehrān, Maktaba al-Asadī 1966, 2 vols., vol. II, pp. 205–207.
11. Ibn Sīnā, *Al-Shifā', La Physique V – Les Métaux et la Météorologie (al-Ma'ādin wa-l-Āthār al'oloyya)*. Texte Établi et Édité par le Dr. 'Abd El-Halīm Montasir Sa'īd Zayd 'Abdallāh Ismā'īl Revu et Précédé d'une Introduction par le Dr. Ibrahim Madkour… A l'occasion du Millénaire d'Avicenne, Le Caire, Organisation Générale des Imprimeries Gouvernementales 1965.
12. See C. Baffioni (2005) L'approccio scientifico all'embriologia nel commentario coranico di Fakhr al-Dīn al-Rāzī. In: R. B. Finazzi (ed.), *Del tradurre. Da Occidente verso Oriente come incontro di lingue e culture. Atti della giornata di studio su Traduzioni orientali e testi classici: lo stato della ricerca*, Brescia, 8 ottobre 2004 (Milano: ISU Università Cattolica, 2005), pp. 11–38.
13. B. Bustānī (ed.) (1957) *Rasā'il Ikhwān al-Safā' wa Khullān al-Wafā'*, 4 vols (Beirut: Dār al-Sādir).
14. We may add here that the Ikhwān al-Safā' appear to have been the source of many aspects of Avicenna's brief presentation of the origin of mountains, to which Fakhr al-Dīn al-Rāzī faithfully adheres.

About the Author

Carmela Baffioni is full professor of History of Islamic Philosophy at the Università degli Studi di Napoli 'L'Orientale'. She is member of the *Academia Europaea* (Section 'Classical and Oriental Studies'); founder member of the Section of Studies on Near East – Arabic Session of the Accademia Ambrosiana;

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