

Scientific Explanation of Hail Based on Verse 43 of *Surah al-Nūr* from the Noble Qur'an

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ABSTRACT:

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Hail is an atmospheric rainfall with a complex mechanism. The Greeks were among the pioneers of knowledge in ancient times and they termed "hail" as "frozen rain" (Anaximander) and "instant freezing of water and moisture" (Aristotle, n.d.). These two meanings are inconsistent with current scientific facts. The Noble Qur'an is the most authentic text to encourage Muslim believers to think about creation and strengthen their faith in the eternal power of the Creator. For instance, the mechanism of hail falling has been expressed in the verse (Q.24:43) with specific and gradual indications.

In this research, first, by library method, different explanations of this verse were obtained from valid interpretive sources and then, the scientific findings of meteorologists and climatologists on hail were extracted from reference scientific texts on atmospheric sciences. In the third stage and based on comparative method, the scientific rules were placed next to interpretations to test the novelty and degree of the allusions of this verse.

We found that the stages of hail falling included: "invisible water vapor rises from the sea," "water vapor ascends into the atmosphere," "reaching the condensation stage," "cloud formation," "convergence of ascending currents," "formation of cumulonimbus cloud," "growth of hailstones during successive ascents and descents by adsorption and freezing of ice needles," and finally "their fall down over ground" respectively. Meanwhile, the steps in the Noble Qur'an are mentioned in verse (Q.24:43) in the

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following order: “clouds movement slowly,” “clouds convergence,” “clouds accumulation,” “the formation of mountain-like clouds,” and “hail falling from the clouds.” The results also showed that likening cumulonimbus cloud in the verse (Q.24:43) to “mountain” have four respects that were beyond the comprehension of the people at the time of the revelation of the Qur’an. Nowadays, these features are known to stationary and satellite meteorological instruments. These four characteristics are “cloud layer temperature,” “their constituent phase,” “troughs and ridges inside the cloud” and “cloud height up to the tropopause.” Based on these four characteristics, the Noble Qur’an considered the cloud of cumulonimbus as similar as “mountains.” Meteorologists divide any cumulonimbus cloud into three floors, including cold at the bottom, super-cold at the top and intermediate in the middle. We find these three floors in the same way in the high mountains. These floors are the current rivers (liquid phase), snow and ice reserves (solid phase) and in the middle region a combination of two liquid and solid phases, namely water and ice. Images from the cumulonimbus from above the atmosphere show dark and deep valleys and light and raised ridges. The fourth feature is to be said, none of the surface phenomena are as high as the mountains. Finally, meteorological findings show that it is the only cumulonimbus that rises from the ground to a height of 12,000 meters and more.

KEYWORDS: The Qur’an, Scientific Miracle, Atmospheric Sciences, Hail falling Mechanism.

I. Introduction

Atmospheric phenomena have a special place in the Qur’an where they are mentioned in many verses. A study entitled “Extraction and Classification of Climatic References to the Holy Quran” found that the Qur’an has mentioned or spoken about atmospheric phenomena more than 150 times (Ghyasi, 2016, 42). Among the various atmospheric phenomena, rainfall is the main source of water for various uses such as drinking, agriculture and industry. Rain has more abundance (Khodabakhsh, 2009, 103) and is very useful (Emadzadeh, 1983, 367). Hail, meanwhile, is a generally rare and harmful phenomenon. Nowadays, one of the challenges of atmospheric science is to figure out how atmospheric precipitation occurs, among which hail shows a more complex mechanism. Among the damaging atmospheric and even terrestrial phenomena, hail is comparable to earthquakes (Yuan et al, 2011, 3). China Meteorological Agency, for example, estimated hail damage in 2012 at \$4.55 billion. The damage is much more than tropical storms in this country

(Khazaei, 2019). In another example, it is said that after the hail on September 11, 2010 in the city of Gorgan, Iran, the insurance companies had to pay 4,850 million Rials to cover the damages incurred in the poor neighborhoods of the city (Khoshhal et al., 2016, 22). In this research, an attempt has been made to test and explain the novelty of the references of the Noble Qur'an to the mechanism of hail falling in the verse (Q.24:43) by a comparative method and by scientific logic.

2. Background Research

Researches about hail may fall into two categories. The first category includes mainly historical sources written by non-Muslims. They were reviewed in the present study for short, long, direct and sometimes indirect references. The second category include the studies conducted by Muslim scholars to explain the scientific references of the Qur'an to the subject of atmospheric sciences.

From the first category, perhaps the earliest sources come from Greece where Greek scholars were relatively more concerned about atmospheric phenomena. These include the definition of wind as "the movement of air" by Anaximander (Horstemier, 2005) and the Greek idea of the existence of multiple gods to blow and create winds in different directions (Garber, 2008). Related to the term meteorology, Fallah (2011, 293) believes that the Greeks, who in ancient times were among the pioneers of atmospheric science, said, "Everything that is seen in the sky is a meteor or air" whether it is a meteorite or a hailstone. Since then, it has taken many years for scientists to distinguish between sky projectiles such as meteors and atmospheric projectiles such as hail. Aristotle (n.d.) is introduced as the founder of meteorology by writing a book to the subject. He attributes rain to cooling of the air in a place where the amount of water vapor increased over time. Aristotle is said to have spoken of the formation of large raindrops, the effect of the droplets joining together. In a treatise attributed to him, the forced entry of moisture into the upper part of the cloud and its freezing is mentioned as the reason and origin of hail. Some of the Greek conceptions of world phenomena are remarkable.

These include the notion of many suns and their rising and setting each day from east to west (Nazari, 1995) and the inversion of humans if they go to the southern hemisphere (Barati, 2007). It was generally believed that in each hemisphere, there were three climates: warm at the equator, cold at the poles and temperate at mid-latitudes.

Therefore, the lack of proper understanding of the mechanism of hail in this period is not surprising. Of course, in later periods and during the heyday of Islamic civilization, these views evolved from their simple and sometimes unrealistic form. During this period, Islamic scholars such as Muḥammad al-Maqdisī (Nazari, 1995, 36) divided the world into fourteen climatic regions in the 4th/10th century.

Now, the purpose of this article is to extract the exact references of the Noble Qur'an about hail and provide scientific explanations for them. These references can indicate the trans-temporal and super-human nature of the text of the Qur'an. From the second category, some scholars acknowledge that the Noble Qur'an is not a book of natural sciences, though some atmospheric phenomena such as winds ('Ali, 2012, 91), rain (Rahmdel, 2005, 14; Hajikhani & Jalilian, 2017, 25) and clouds (Alavimehr & Sadeghi, 2014, 13) have been explained in the Noble Qur'an. In the case of hail, less independent research was obtained. In some of these researches (Ghyasi, 2016, 42), the researcher has reached verse (Q.24:43) to translate it and explain the summary and stages of this event based on today's knowledge.

Meanwhile, Rostami and Shahinpur (2015, 25) in a study, by regularly presenting the views of Qur'an translators, have discussed the slips of translators in translating two verses of the Noble Qur'an, including verse (Q.24:43). In this study, accurate references are made to hail-specific clouds, including the super-cold cloud. In another study, Najafi (2015, 1), examining a quote from Kamil Najjar, claims: "mountains of hail in the sky are not acceptable." In the current research and consistent with new scientific findings, the wonders of the Noble Qur'an will be discussed.

3. *Data and Method*

The method of this study is library type, the findings are presented in three sections: historical, Qur'anic and scientific. We have expanded these stages including to "search and classify of ancient believes," "search and classify of different annotations," and "present and accommodating of new results in atmospheric sciences." These three stages were essential because of the following notes:

- The necessity of the first stage was to determine what the level of knowledge of the people was at the time of the descent of the Qur'an. For example, how does the interpretation of the phrase *yuzjī saḥāban*' in 24:43, meaning "driving clouds slowly," fit into the Greek view on the origin of winds?

- In the second stage, what was the commentators' explanation of the words and phrases of the verse for the audience? For example, what justification have the commentators provided for likening the cloud to a mountain in the phrase *min al-samā' min jibāl*?¹
- In the third stage, to what extent do the explanations of the expressions of this verse, given by the commentators, correspond to the indisputable findings of meteorologists and climatologists?
- How can the commentators' statements be based on the indisputable findings of meteorologists and climatologists from the collection of references in this verse? For example, the commentators' explanation of the phrase *min jibāl* as "the collapse of a mountain of hail on the ground" was presented to today's findings to make it clear that the meaning of "mountain" here is "the volume of hail" or "structural features of the cloud." Basically, what are the scientific characteristics of mountains that the Noble Qur'an has preferred to liken clouds to mountains?

In the course of this research and after all the three stages, the miracles of the Noble Qur'an in this verse need to be extracted according to the following criteria:

1. The scientific aspect presented in the verse should be explicit and obvious.
2. The novelty of the interpretation of the Qur'an should not be compromised by the scientific findings of the time of revelation.
3. The scientific interpretation presented in the verse is compatible with today's scientific findings.

4. Results and Discussion

Prior to the revelation of the Holy Qur'an, human findings about the mechanism of hail formation were limited. The advances in meteorology instruments during World War I and World War II revealed more facts about atmosphere, including the type of hail-clouds and their mechanism. "The movement of clouds by wind," "the convergence of clouds," "their condensation and accumulation," "the likeness of these clouds to mountains," and "Hail falls from the cloud" are five facts that the Qur'an (Q.24:43) refers to as the signs of divine omnipotence. It seems that the first three were visible for people from earliest times but the last two facts were revealed by modern science. The Arabic word *barad* "hail" is mentioned only once in the Qur'an (Q.24:43).

.I . مِنَ السَّمَاءِ مِنْ جِبَالٍ

أَلَمْ تَرَ أَنَّ اللَّهَ يُرْسِطُ السَّحَابَ ثُمَّ يُؤَلِّفُ بَيْنَهُ ثُمَّ يَجْعَلُهُ رُكَّامًا فَتَسرى الْأُودُقُ مِنْ خَلَالِهِ وَ يُنَزِّلُ مِنَ السَّمَاءِ مِنْ جِبَالٍ فِيهَا مِنْ بَرَدٍ فَيُصِيبُ بِهِ مَنْ يَشَاءُ وَ يَصْرِفُهُ عَنِ مَنْ يَشَاءُ يَكَادُ سَنَا بَرْقِهِ يَذْهَبُ بِالْأَبْصَارِ (النور/43)

Have you not regarded that Allah drives the clouds, then He composes them, then He piles them up, whereat you see the rain issuing from its midst? And He sends down from the sky hail, out of the mountains that are in it and He strikes with it whomever He wishes and turns it away from whomever He wishes. The brilliance of its lightening almost takes away the sight.

Based on meteorological science, hail formation stages begin with the ascent warm and humid air during an unstable day. After ascending, the humid air reaches the stage of water vapor condensation and it appears as a cumulus cloud, a set of thin droplets. Convergent winds grow cumulus clouds and as it pushes them together, it turns them into cumulus congestus. The result of the cumulus congestus clouds merging and their climbing is cumulonimbus cloud that is a hail cloud (Fig.1).

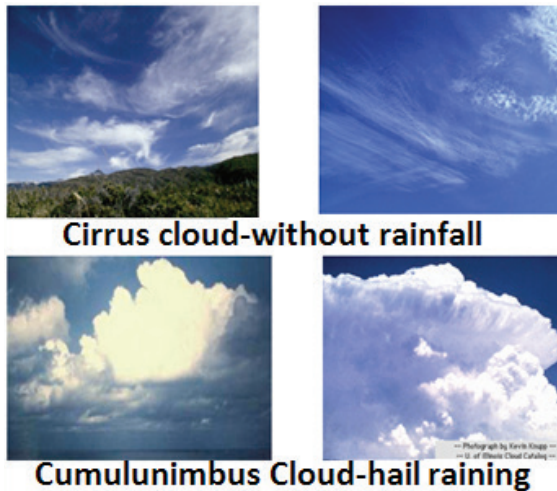


Fig.1 Difference between cumulus and stratus clouds (Strahler & Strahler:1992)

The base or lower part of the cumulonimbus cloud is very watery and close to the ground surface. Although, Najafi (2015, 1) has called the hail-cloud extremely cold and icy, but the base of the cloud has a temperature above 0°C. In fact, this is the lowest floor of the cloud. In the upper layer of the cloud, the second floor, the temperature is between zero and -40°C (Fig.4).

There is a combination of liquid droplets and ice needles in this floor. All these droplets and needles are floating. These are constantly screwed up and down by air currents. This cloud rises to a height of 12 to 13 thousand meters. In this floor, which is the third floor, the temperature is -40°C . Only icy needles are seen here. The droplets of the lower floor, even if they are distilled, that is, free of any dust and impurities, cannot keep themselves freezing in this floor.

In this class, icy droplets and icy needles undergo two processes. One of these processes is rimming and it means sticking together and the other process is amalgamation, i.e., to become mass. Thus, the primitive nuclei of hails form. Sometimes, ice needles join together and they form groups. They fall down into second or even the first floor, crush due to surface melting and come in the form of seeds. If these seeds return to the second and then third floors, they freeze, attract more ice needles, and grow further. These ups and downs can be repeated over and over again.

These movements are performed among the three classes of cumulonimbus by high-speed and powerful air currents. The speed of the currents may reach up to 175 km/h (Bal et al, 2014). Every time that the hailstones go up and attract ice needles, one ice and transparent layer takes over and every time that it goes down, it melts slightly from the outer surface and takes an opaque layer on it and they look like onions. By splitting large hailstones, its alternating transparent and opaque layers look like onions (Fig. 2).

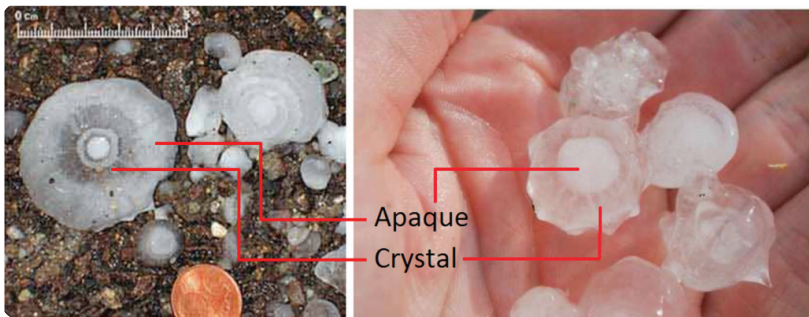


Fig.2 The morphology of hailstone (Media-bom, 2018)

4.1. Qur'anic Explanation

The words and phrases considered in interpretive sources in terms of position and meaning are presented in Table 1. The most important of them which related to hail include: the slow movement of clouds (*yuzjī saḥāban*), their

convergence (*thumma yu' allifu baynahu*), accumulation and density of clouds (*thumma yaj'alūhu rukāman*), the height of this uplift (*min al-samā'*), the likeness of a cloud to a mountain (*min jibāl*) and falling hail (*min barad*).

Table.1 The terminology and semantics of the verse

Word	Root	Meaning and source
يُزْجِي <i>yuzjī</i>	z-j-w	Drive and push something slowly (al-Farāhīdī, 1991, 165; al-Rāghib, 1993, 378; Ibn Manzūr, 1995, 354)
سَحَابًا <i>sahāban</i>	s-h-b	Clouds, whether rainy or rainless (al-Rāghib, 1993, 399)
رُكَّامًا <i>rukāman</i>	r-k-m	Accumulating parts of something on another parts (al-Farāhīdī, 1991, 369; al-Rāghib, 1993, 365; Ibn Manzūr, 1995, 251)
يُؤَلِّفُ <i>yu'allifu</i>	'a-l-f	To bring together, to join (al-Rāghib, 1993, 81)
الْوَدَقِ <i>wadqa</i>	w-d-q	Rain, whether intense or mild (al-Farāhīdī, 1991, 198; al-Jawharī, 1990, 249; Ibn Manzūr, 1995, 373)
السَّمَاءِ <i>al-samā'</i>	s-m-w	Height, Elevation (al-Farāhīdī, 1991, 318)
جِبَالٍ <i>jibāl</i>	j-b-l	Mountains, Accumulation of something along with height (al-Rāghib, 1993, 185)
بَرَدٍ <i>barad</i>	b-r-d	Cold, Frozen rain, hail (al-Farāhīdī, 1991, 28; al-Rāghib, 1993, 116)
سَنَا <i>sanā</i>	s-n-w	Light emission from a high place (al-Muṣṭafawī, 1989, 242)

The stages that we find about hail formation and its precipitation are presented in table 2.

Table.2 *The stages of hail formation and its precipitation in the Noble Qur'an from the viewpoint of the commentators*

Stage	Phrase	Meaning	Source
First stage	أَمْ لَمْ تَرَ... يُزْجِي سَحَابًا	Did you not know ... drive the clouds slowly	al-Ṭūsī, 2010, 466; al-Ṭabrisī:1993, 323; al-Farāhīdī, 1991, 165; al-Rāghib, 1993, 378; Ibn Manzūr, 1995, 354
Second stage	يُؤَلِّفُ بَيْنَهُمْ	The bond between cloud fragments and the formation of large, single piece	al-Ṭūsī, 2010, 466; al-Ṭabrisī, 1993, 233
Third stage	ثُمَّ يَجْعَلُهُ رُكَّامًا	Compression of clouds on top of each other	al-Ṭabrisī, 1993, 233
Fourth & fifth stages	فَتَرَى الْوَدْقَ ... وَيُنزِلُ مِنَ السَّمَاءِ ...	Rain coming out of the clouds ... And hail falls ...	al-Ṭūsī, 2010, 466; al-Ṭabrisī, 1993, 233; al-Zamakhsharī, 1998, 246

In the following, what the commentators have said about this verse has been categorized (Table. 3). Their views are different and the difference alone is clear evidence that the meaning of the verse was beyond the level of knowledge of the people at the time of revelation.

Table.3 *The classification of interpretations of commentators about hail falling*

Class	Interpretation	Source
Early commentators	1. Falling hail mountains from sky 2. Hail falling on mountains from sky 3. Some hail-mountains in sky similar to craggy mountains 4. Hail falling as much as several mountains on ground 5. The mountain is an allusion to the density of hail 6. The mountain is an allusion to the multiplicity of clouds	al-Ṭabarī, 2004, 828; al-Ṭūsī, 2010, 447; al-Zamakhsharī, 1998, 246 last one:Rustami & Shahinpur, 2015 quoting Ibn 'Āshūr:73
	Clouds like mountains	al-Ṭabrisī, 1993, 232
Recent commentators	1. Clouds like high mountains 2. Filled with sleet (ice pellets) 3. Hail falling from mountains in sky	Ṭanṭāwī, 2004, 12-55; Sayyid Quṭb, 1993, 2523; Makarem, 1997, 505; Najafī quoting Kāmil Najjār, 2015, 153

The last phrase or stage about hail falling in the verse is about lightning and its ultra-violet rays (*yakādu sanā barqīhi yadhhabu bi-al-absār*).¹ This stage indicates the occurrence of lightning (electricity) in clouds containing hail. Because the commentators normally saw lightning in the clouds, they considered “sky” or “cloud” as the antecedent of the third person singular pronoun *-hi* in *barqīhi* interpreted it as follows: the intensity of the lightning in the sky is such that it may blind the eyes (al-Ṭabarī, 2004, 290; al-Ṭabrisī, 1993, 233; al-Ālūsī, 1994, 383; Ṭanṭāwī, 2004, 12-55; Sayyid Quṭb, 1991, 2523; Makarem, 1997, 505). However, according to the rule, the antecedent of the pronoun *-hi* in *sanā barqīhi* may be to the closest word, *barad*, so this phrase can mean lightning caused by hail.

4-2. Scientific Results

Based on principles of meteorology and climatology, we find the mechanism of hail falling in stages as below.

- Slow motion of the clouds in the eyes of the ground observer (*yuzjī*):
The Earth’s atmosphere with an approximate mass of 5.15×10^{15} is composed of various layers with distinct temperature characteristics (Allaby et al., 2006). Although the lowest layer of the troposphere is the most humid and the formation of a hail-cloud requires a lot of water vapor – in fact much more than the general condition. The huge water vapor of the lower atmosphere becomes warmer and warmer during sunny and unstable days in the lowest layer of troposphere. This instability shows itself in the form of invisible bubbles and a lot of small and scattered cumulus clouds appear around noontime.
- Joining the clouds (*yu’allifu*):
Cumulus clouds gradually change to cumulus congestus ones and they all converge to a point with low pressure at the center. The ground observer may not see the convergence due to the low horizon and limited visibility. The ground observer sees the movement of clouds in and out of each other and sometimes even against each other and at different speeds. Hence, the gradual movement of clouds can be witnessed in two ways. One is observation by one pointing down camera on one satellite located above the troposphere layer and the other is designing the cloud mosaic hour by hour (Fig. 3).

1. يَكَادُ سَنَا بَرَقِهِ يَذْهَبُ بِالْأَبْصَارِ

(The brilliance of its lightening almost takes away the sight).

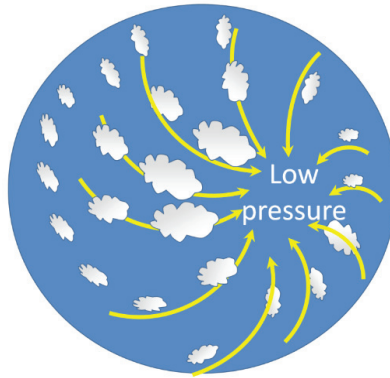


Fig.3 *Gradual movement of clouds on humid air currents with convergent model and their growth (observer from above)*

- Accumulation and density of clouds (*rukāman*):

Cloud formation is not enough for raining unless they join together and grow vertically. Clouds cannot grow vertically unless a factor elevates them from their below and another pulls them up from the atmosphere. The lifting agents of clouds on ground surface are air-masses and mountains. The lifting agent from above the atmosphere is divergence. However, growing clouds are condensing involuntarily. Next, the tiny droplets join to form larger ones. The process which may be compared to squeezing a wet cloth, extracts the water absorbed in the fabric.

According to Omidvar (2003, 48) and Akbari (2005, 16), one million tiny droplets in the cloud must join to form one rain droplet. Also, the collision among droplets is rare because the distance among droplets is about 500 times their diameters. According to Linacre and Greets (1997, 432), different processes cause the droplets to come together in the clouds and make them heavier to the point of falling.

- Formation of a massive cumulonimbus cloud (*min jibāl*):

The convergence and divergence conditions below and above the cloud cause cumulus congests to grow taller and change to cumulonimbus clouds. Kramer (1993) calls it a massive and tower-shape cloud and Houze (1993, 573) calls it hail maker. In these conditions, we find its height more than 10 thousand meters. Really, this is the height of tropopause. This huge pillar bears a structural resemblance above all to the high mountains and based on this structure, hailstones are formed inside the cloud.

In other words, as we find the reserves of “water,” “water and ice” and “ice” on the slopes of high mountains, respectively, from the foot of the mountain to the summit, the same is true of the cumulonimbus cloud. On the lowest floor, “water droplets,” on the middle floor, “water droplets and icy needles” and in the highest class, as Australler & Australler (1992, 592) point out; we find “ice needles” in the form of anvil (Fig. 4).

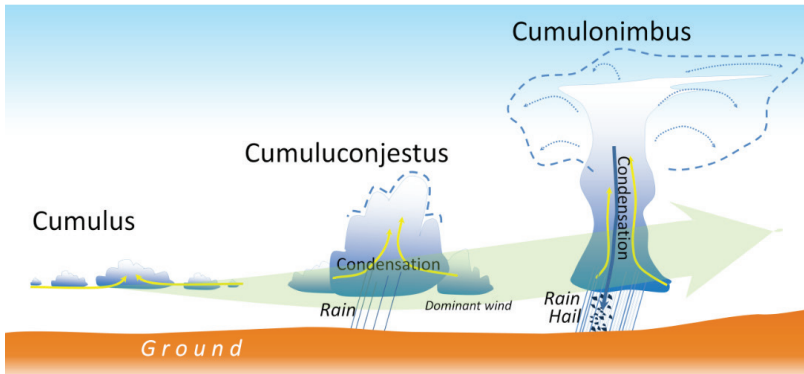


Fig.4 Gradual change of horizontal motion (*yu'allifu*) to vertical motion (in hail cloud) (Pidwirny et al, 2018; primitive sources: Dacre et al., 2012)

Atmospheric science findings indicate that among the various floors of cumulonimbus clouds, numerous air currents, both strong and weak and varying both in ascending and sometimes descending are blowing. Close-up images show one body resembling very large mountains with deep, dark valleys.



Fig.5 Amplitude of hail clouds from the observer's point of view above the atmosphere

- Hail falling (*fiḥā min barad*):

Atmospheric science findings show that every time a frozen drop of water travels from the lower floor to the middle or upper floor, many icy needles stick to the surface and thus the hailstone increases in volume.

When the rising current is unable to support the weight of the hail, the hail overcomes the fall and strikes according to the Qur'an. In many cases, just as a hailstone travels downhill, it enters a stronger ascending current in the middle floor and even the lower floor and returns to the top and it is possible to increase growth. This process may be repeated many times and even make a hailstone, the size of a baseball. In this case, even casualties can occur (Fig. 6).

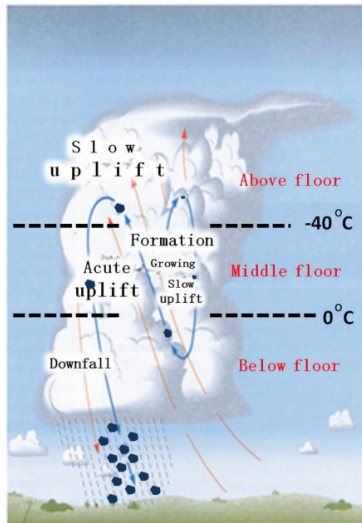


Fig.6 Hail grain growth within the cumulonimbus cloud

- Lightning and thunder (*sanā barqihī*):

Another feature of cumulonimbus clouds is the occurrence of terrible lightning and thunderstorms. Lightning is generally defined as the discharge of electrical charge in the atmosphere. William (1999, 21) suggests that the collision between falling particles and suspended particles, transfer positive charges to fine and light particles and negative charges to heavier particles and cause the lower part of the cloud to be negative and the upper part to be positive.

4-3. Comparison of Scientific and Qur'anic Findings

Scientific findings about the mechanism of hail formation and precipitation, based on Table 4, corresponds to the expression of the Noble Qur'an in the verse (Q.24:43). Regarding the disagreement of the commentators, it is not acceptable for mountains to rise in the sky and fall on people. Until now, the greatest celestial object landing, not on people but in a desert and not of ice, but of stone and not in the shape of a mountain, but in the shape of a comet has happened. What can be obtained from presenting these findings on the verse (Q.24:43) shows the miracle and modernity of the interpretation of the Qur'an from 1400 years ago.

Table.4 Correspondence of the references of the Noble Qur'an in (Q.24:43) with scientific findings

Stages of hail in science	Hail in the Qur'an	Important words
Gradual convergence of scattered cumulus clouds	أَلَمْ تَرَ أَنَّ اللَّهَ يُزْجِي سَحَابًا Dispersal of scattered clouds	يُزْجِي Pushing and driving something
Establishing a link between them	ثُمَّ يُؤَلِّفُ بَيْنَهُ And the link between them	يُؤَلِّفُ Brings together, connects
Dominance of vertical upward movements over horizontal convergent movements and conversion of cumulus to cumulus congestus and finally cumulonimbus	ثُمَّ يَجْعَلُهُ رِجَامًا Cloud density	رِجَامًا Density and accumulation
Growth of droplets and their transformation into droplets by the process of convergence and apparent rainfall from the point of view of the ground observer	فَقَتَرَى الْوَدْقَ يَخْرُجُ مِنْ حَلَالِهِ Raining	الْوَدْقَ Rain
Formation and growth of hailstones in reciprocating motions among the below and up floors and into the long slopes of the massive cumulonimbus cloud and finally their downfall on the ground	وَيُنزِلُ مِنَ السَّمَاءِ مِنْ جِبَالٍ فِيهَا مِنْ بَرَدٍ Hail collapses from mountain- like clouds	بَرَدٍ Frozen rain (hail) جِبَالٍ Gathering of the mountain السَّمَاءِ Height
Lightning in the cloud for two reasons: 1. Induction of electric charge inside the cloud 2. Induction of electric charge on the surface of hail grain due to the coexistence of hail and ice crystals	يَكَادُ سَنَا بَرْقِهِ يَذْهَبُ بِالْأَبْصَارِ Electricity and electric field during hail	سَنَا propagation of the ray of light from a high place, taking into account the reference of the pronoun "hu" in sanā barqihī to al-samā, saḥāb or barad

5. Conclusion

It caused the commentators to fail to understand the meaning of the phrases in the verse and as a result, differences and sometimes confrontations arose between the interpretations. These findings can be divided into two categories. The first category is the findings that scientists had before the era of the revelation of the Qur'an about the mechanism of hail. An example of this is the expression "hail from the highest part of the cloud from Greece." The second category is the findings that Muslim scholars have had from the verse. "Ice mountains colliding in the sky and hail falling due to the crushing of part of these mountains," "large amounts of hail accumulate on the ground" and "hail falling on the mountains" are among these findings (Fig. 7)

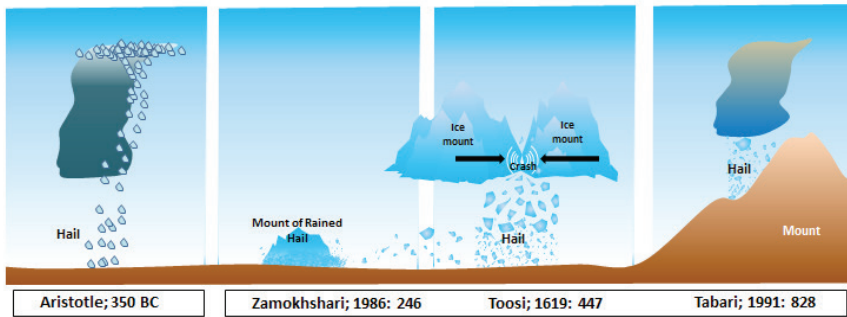


Fig.7 Approaches to how hail falls from ancient Greece and the early commentators of the Noble Qur'an

What is stated in (Q.24:43), about the mechanism of hail in the Noble Qur'an, it can be gradually explained by the findings of today's atmospheric sciences. These steps include "moving the clouds slowly," "clouds convergence," "their density," "mountain-cloud formation," and "raining hail from it." Researchers showed that the verse contains scientific hints unknown until the revelation of the Qur'an. Formation of a cloud body of three floors from the bottom of "liquid," "liquid and solid" and "solid," respectively and its similarity in the same order to the high mountains from the foot of the slope to the summit includes "flowing rivers," "flowing rivers and snow and ice masses" and "integrated masses of snow and ice" conform to the findings made possible by advances in geology, hydrology, geography and meteorology.

These findings could reveal the secret of comparing this cloud (*sahāban*) to a mountain (*jibāl*) (Fig.7). Matching the stages of hail with expressions in 24:43, hail can occur partially and rarely in atmospheric systems of

fronts, especially cold fronts, but in the same systems, the two stages of “slow movement of clouds” and “their convergence” respectively are *yuzjī* and *jibāl* and the process takes a few days. This movement and convergence in convective systems begin in the early hours of the morning, it peaks in the afternoon with the formation of the nimbostratus cloud.

Nowadays, on the one hand, with the help of technologies such as accurate imaging and sending satellites to higher levels of the atmosphere, simplicity and weakness of Greek historical explanations and the shortcomings and sometimes inaccuracies of Qur’anic interpretations related to the mechanism of hail are identified.

On the other hand, the accuracy of the Qur’anic expression in (Q.24:43) about the mechanism of hail is shown. This atmospheric process occurs in specific stages and in about two to four hours. In this process, water vapor accumulated in the lowest layer of the atmosphere manifests itself in the form of cumulus clouds. These clouds converge, then join together and then condense in a column like a mountain. This accumulation allows hailstones to form, float and grow within the three layers of the column of cumulonimbus cloud. The last stage is the dominance of hail weights over the strength of ascending currents and thus the beginning of hail falling. By reflecting on the formation of rain and hail and applying the Qur’anic studies related to the verse (Q.24:43), the cases of its scientific miracles are specified as follows:

1. In the first part of the verse, the stages of rain and hail formation include cloud drift, the link between clouds and lateral and stacking clouds is expressed. We find, given the following statements, no one has addressed it before:
 - If the word *saḥāb* means cloud in singular, the verse refers to the bond and accumulation of the internal components and droplets of the cloud and the formation and precipitation of rain. Hence according to the scientific confirmation and the impossibility of seeing this phenomenon by individuals, the verse has a miracle.
 - If *saḥāb* is the plural of the word *saḥaba*, there are two possibilities regarding the meaning of the verse:
 - The verse describes the stages of rain and hail formation, which scientifically in this case, after the accumulation of cumulus clouds and the formation of cumulonimbus, rain and hail occur consecutively. The miracle of this statement is also evident. Scientifically, it does not always rain before hail. The verse refers to the separate formation and precipitation of rain and hail. In this case, the ascent of *wa yunazzilu min al-samā’* will be a turning

- point to *fatarā al-wadq*. Thus, the miracle of the verse is about the stages of formation in both phenomena. According to the theory of “permissibility of using the word in more than one meaning in the Qur’an” both cases can be correct. In other words, the Qur’an conveys both meanings in one word.
2. The phrase *wa yunazzilu min al-samā’ min jibālin fihā min barad* refers directly to hail from mountains in the sky. This reference is consistent with the scientific explanation of the descent of hailstones from tower-shaped and mountain-like clouds called cumulonimbus. Also nowadays, the amplitude of the clouds with deep valleys and prominent ridges is notable. This fact has been revealed by flying above them and preparing satellite images. Hence, the scientific miracle of this noble verse is certain.

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