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RESEARCH ARTICLE

MARS COLONIZATION AND THE PERSPECTIVE OF THE QURANIC VERSES REGARDING THE WORD *ARD* (LAND)

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Abstract

There have been many attempts at colonizing Mars given the advancement of human knowledge and technology. As Muslims, we believe that the Quran and Hadith should guide humans as to how to conduct their life and to comprehend any issues regarding it. However, unfortunately there are still very few resources and studies regarding the idea of colonizing Mars based on an Islamic perspective. The main objective of this study is to analyse the correlation between Quranic commentaries with modern discoveries about Mars. The studies show that the word *ard* in the Quran can give the meaning of land and not specifically the planet Earth and there are commentaries on Quranic verses that indicate the existence of 'earths' other than the planet Earth that we are inhabiting. The Quranic perspective towards the physical properties of the word *ard* can serve as a benchmark on whether Mars can be considered as a land that humankind can colonize or not. For the current exploration and scientific advancement, there is no clear proof that the red planet has achieved the physical properties of the word land according to the Quranic perspective.

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Introduction:-

There have been many efforts on studying and attempting to colonize Mars since the 1960's (Zhang, 2021). Beginning with the spacecraft launched by NASA that took the first images of the red planet (Dunbar, 2019) to the recent 2021 operational rovers on the surface of Mars (Stein, 2021). This is majorly because of the fact that we are advancing in technology and scientific discoveries that enable us to have a better understanding about the red planet. In fact, experts and researchers of Mars believe that within 100 years, humankind could actually inhabit and colonize Mars with the advancement of technology (Davis, 2017).

However, as Muslims we believe that the primary source of guidance, which is the Quran and Hadith, shows how humans should conduct their lives and use it to comprehend any issues regarding it. There are still many questions to

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be answered regarding the Islamic perspective towards the idea of colonizing Mars. Unfortunately, there is a lack of resources and studies being done regarding this. As more scientific discoveries are being made regarding planet Mars, there must be a better clarification on how the Quran and Hadith can be used in comprehending this issue.

According to the Quranic perspective, there is no direct mention of the term Mars in the Quran. However, Allah uses the word *ard* in the Quran that is repeated 461 times that could be translated generally as 'land', even if many translations translated it as 'earth'. If the first translation is to be taken, then it is of importance to study the physical properties of 'land' as used in the Quranic verses and compare them with the current discoveries regarding Mars. The main objective of this study is to analyse the correlation between Quranic commentaries with modern discoveries about Mars. This is done by doing a thorough analysis on Quranic verses about *ard* that state the physical properties of a land according to the Quranic perspective. These physical properties of a land are then to be listed down and compared to current scientific findings regarding Mars. These results will give a clearer Quranic perspective about the idea of colonizing Mars.

Linguistic Commentaries on the Word *Ard*

The word *ard* (أرض) only comes up in the singular form and is repeated 461 times in the Quran. It also appears both in the form of a definite noun which is *al-ard* (الأرض) and indefinite noun *ard* (أرض). The word *ard* in the indefinite form can carry several meanings such as: (1) A land or country; (2) soil; (3) a piece of land; (4) a carpet; (5) anything that is low (Farid, 2006). According to Hans Wehr (1976), the word *ard* can imply the meaning: (1) land; (2) country; (3) region; (4) terrain; (5) soil; (6) estate. According to Ibn Manzur (1999) in his dictionary, *ard* refers to a place or land where people live on it. Meanwhile, al-Raghib al-Asfahani (2017) in his dictionary states that *ard* is anything that is the opposite of *al-sama'* (السماء) and usually denotes something that is at the lowest point. As for Masduha (2017), he explains the word *ard* as a place where it has all kinds of plants that can be eaten.

Meanwhile, based on the explanation from Abul Fadhl & Mehdi Mohaqqueq (2012), the word *ard* in the Quran refers to seven places: (1) land of paradise; (2) land of Mecca; (3) land of Madinah; (4) land of Egypt; (5) land of Jordan and Palestine; (6) land of Islam; (7) whole world. In the words of Samin al-Halabi (1996) in his dictionary, he explains that *ard* implies a lower dense body that is the opposite of the skies. The commentary summaries from linguists about the physical properties of *ard* are shown below:

Table 1:- Summary of the Meaning of *Ard* by Linguist.

Meaning of the Word <i>Ard</i>	Linguist	Dictionary
Land/Terrain	Farid, Malik Ghulam	<i>Dictionary of the Holy Qur'an</i>
	Hans Wehr	<i>A Dictionary of Modern Written Arabic</i>
	Abul Fadhl & Mehdi Mohaqqueq	<i>Kamus Kecil al-Quran</i>
Country	Farid, Malik Ghulam	<i>Dictionary of the Holy Qur'an</i>
	Hans Wehr	<i>A Dictionary of Modern Written Arabic</i>
Soil	Farid, Malik Ghulam	<i>Dictionary of the Holy Qur'an</i>
	Hans Wehr	<i>A Dictionary of Modern Written Arabic</i>
Anything that is low	al-Raghib al-Asfahani	<i>al-Mufradat fi Gharib al-Qur'an</i>
	Samir al-Halabi	<i>'Umdat al-Huffaz fi Tafsir Ashraf al-Alfaz</i>
Place where people live on	Ibn Manzhur	<i>Lisan al-'Arab</i>
Opposite to the skies	Al-Raghib Al-Asfahani	<i>al-Mufradat fi Gharib al-Qur'an</i>
	Samir al-Halabi	<i>'Umdat al-Huffaz fi Tafsir Ashraf al-Alfaz</i>
Place where plants grow	Masduha	<i>al-Alfaazh: Buku Pintar Memahami Kata-kata dalam al-Quran</i>

From these linguist commentaries, the word *ard* needs to be better understood by its original meaning. It is understood also that the word *ard* does not imply only to this planet Earth but anything that has the required physical properties stated by linguists for the meaning of the word *ard* in the Quran.

Exegesis Commentaries on the Quranic verse Regarding *Ard*

As mentioned earlier, there is no direct mention of the word Mars in the Quran but there are Quranic exegesis that comment on the existence of a planet similar to planet Earth. This is further explained by Quraish Shihab as he stated that not all the verses of the Quran give the meaning of Earth because there are verses that imply of a universe in the solar system that has not been completely formed yet.

These verses include surah Hud verse 7, surah al-Anbiya' verse 30, surah al-Sajadah verse 4, surah Fussilat verses 9-12 and surah al-Talaq verse 12 (Quraish Shihab, 2007). There is an explicit verse that denotes *ard* other than the planet Earth as stated in surah al-Talaq verse 12: "It is Allah who has created seven heavens and of the earth, the like of them. [His] command descends among them so you may know that Allah is over all things competent, and that Allah has encompassed all things in knowledge".

Abul A'la Maududi (1972) in his commentary regarding this verse stated that Allah has created several earths as He has created several heavens. Just as this earth that serves as land in which humans live on, so has Allah made and set other earths to serve the same purpose in the universe. He also stated that the early Quran exegesis, which is by Ibn Abbas, commented about inhabitants living in other places than Earth when man was not prepared to believe in such a statement.

Quraish Shihab (2007) commented on the number seven of the earth as stated in surah al-Talaq verse 12. He commented that the number seven is symbolic and are used by not just Arab people, but also by the Jews and the Romans. Thus, the verse gives meaning that there are many alike the planet Earth in the universe with no certainty of how many specifically there are. He deduced that there are other planets in this universe that has the same unique physical properties as planet Earth.

Al-Razi (1999) commented on this verse saying that there are seven planets that are moving in the seven heavens mentioned in the verse. The properties of the seven earths within the seven different heavens share the same physical properties as the Earth we inhabit today.

Al-Qurtubi (2007) summarized the commentaries done by past exegesis regarding this verse into two main groups. The first group which holds the majority of opinions from exegesis agrees on that Earth having its own form and describing the distance between one earth to the other is like the distance between the heaven and the earth. They also described that each Earth has its own inhabitants that is created by Allah. The second group is the opinion of al-Dahhak in which he says that the Earth mentioned overlaps each other without any distance from each other. However, according to al-Qurtubi, the first group holds the better explanation as it was stated in al-Turmudhi, al-Nasa'i and other exegesis.

Additionally, there are exegesis that give commentary in support of the fact there are other *ard* than the *ard* of this planet. There are also exegesis that goes against this fact, one of which is Ibn Kathir (2017). He noted that whomever interprets this verse to mean having seven lands then he has gone astray from its original meaning, engrossed in disputes and goes against the Quran and Sunnah.

On the other hand, there are also exegesis that give different commentaries regarding the seven *ard* in this verse. Quraish Shihab notes the commentary of Ibn Asyur in his tafseer where he interprets the seven *ard* to mean seven continents on this Earth which he categorized as: (1) Asia and Europe; (2) Africa; (3) Australia; (4) North America; (5) South America; (6) North Pole; (7) South Pole. But this view according to Quraish Shihab (2002) came at a time when there was no transportation to travel by sea that could sail through huge waves and long before the Asian and Europe continents were separated.

A thorough analysis on several commentaries of exegesis on surah al-Talaq verse 12 shows that there are commentaries that support there are other *ard* in the universe that have the same properties as the *ard* of planet Earth. As explained by several exegesis such as Qutb (2002) and Hamka (2015). The perception of this verse can be clarified as the understanding of the universe expansion with the help of scientific technology advancement.

Analysis on the Physical and Non-physical Properties of *Ard* in the Quran

The analysis of the word *ard* in the linguistic and Quranic point of view gives way to a need on detailing the physical properties about the *ard* that is mentioned in the Quran. These physical properties can serve as a benchmark

in determining whether Mars can be classified as *ard* that is accepted linguistically and indicated by the Quranic verse especially in surah al-Talaq verse 12.

An analysis towards 461 verses of the Quran containing the word *ard* is done to determine verses that describe the physical properties of *ard*. Verses of the Quran that are unrelated to the physical properties of *ard* are first determined and pretermitted according to their context. The analysis on 461 verses of the Quran regarding the word *ard* shows that there are 340 verses that can be categorized as not relatable to physical properties, as shown in the table below:

Table 2:- List of Quranic Verse Unrelated to Physical Properties of *Ard*.

Category	Quran Verse
History of the past	QS Yusuf 12:105; QS al-Rum 30:9; QS Ghafir 40:21,82; QS Ali 'Imran 3:137; QS al-An'am 6:11; QS Yusuf 12:109; QS al-Nahl 16:36; QS al-Hajj 22:46; QS al-Naml 27:69; QS al-Rum 30:9,42; QS Ghafir 40:21,82; QS Muhammad 47:10; QS Fatir 35:44
Doomsday	QS Ibrahim 14:48; QS al-Kahfi 18:47; QS al-Hadid 57:21; QS al-Haqqah 69:14; QS al-Buruj 84:3; QS al-Nisa' 4:42; QS al-A'raf 7:187; QS al-Mu'minun 23:112; QS al-Naml 27:87; QS al-Rum 30:25; QS al-Zumar 39:69
Angels	QS al-Isra' 17:95; QS al-Zukhruf 43:60
Human Behaviour	QS al-Baqarah 2:273; QS Ali 'Imran 3:156,191; QS al-Nisa' 4:97,101; QS al-Ma'idah 5:17, 26, 106; QS al-An'am 6:71,101; QS al-A'raf 7:146,168,176; QS al-Anfal 8:26, 67; QS al-Tawbah 9:2,25,74,118; QS Yunus 10:99; QS Ibrahim 14:8; QS al-Isra' 17:37; QS al-Kahf 18:84; QS Maryam 19:40,93; QS al-Anbiya' 21:21,105; QS al-Hajj 22:41; QS al-Mu'minun 23:79; QS al-Furqan 25:63; QS al-Qasas 28:5,6,19,39; QS al-Ankabut 29:39; QS Luqman 31:18; QS al-Ahzab 33:27; QS Fatir 35:43; QS Ghafir 40:75; QS Fussilat 41:15; QS al-Dukhan 44:29; QS al-Ahqaf 46:20; QS al-Jumu'ah 62:10; QS al-Mulk 67:24; QS Nuh 71:26; QS al-Jinn 72:10; QS al-Muzammil 73:20
Heaven	QS Ali 'Imran 3:133; QS Hud 11:107; QS al-Zumar 39:74
Faith in Allah	QS al-Baqarah 2:29, 117, 164; QS Ibrahim 14:19; QS al-Hijr 15:85; QS Yusuf 12:101; QS Ali 'Imran 3:190; QS al-An'am 6:1, 14, 73, 79; QS al-A'raf 7:54; QS al-Tawbah 9:36; QS Yunus 10:3, 6; QS Hud 11:7; QS Ibrahim 14:10, 32; QS an-Nahl 16:3; QS al-Isra' 17:55, 99; QS al-Kahfi 18:51; QS Taha 20:4; QS al-Anbiya' 21:16; QS al-Furqan 25:59; QS al-Naml 27:60; QS al-'Ankabut 29:61; QS Rum 30:8,22; QS Luqman 31:25; QS al-Sajadah 32:4; QS Fatir 35:1; QS Yasin 36:81; QS Sad 38:27; QS al-Zumar 39:5, 38, 46; QS Ghafir 40:57; QS Fussilat 41:9; QS al-Shura 42:11, 29; al-Zukhruf 43:9; QS al-Dukhan 44:38; QS al-Jathiyah 45:22; QS al-Ahqaf 46:3, 4, 33; QS Qaf 50:38; QS al-Tur 52:36; QS al-Hadid 57:4; QS al-Talaq 65:12; QS al-Baqarah 2:107, 116, 255, 284; QS Ali 'Imran 3:5, 109, 129, 180, 189; QS al-Nisa' 4:126, 131, 132, 170, 171; QS al-Ma'idah 5:17, 18, 120; QS al-An'am 6:6, 12, 75; QS al-A'raf 7:158, 185; QS al-Tawbah 9:116; QS Yunus 10: 55: 66: 68; QS Hud 11:20, 123; QS al-Ra'd 13:41; QS Ibrahim 14:2, 38; QS al-Nahl 16:52, 77; QS al-Isra' 17:102; QS al-Kahf 18:14; QS Maryam 19:65; QS Taha 20:6; QS al-Anbiya' 21:19, 56; QS al-Hajj 22:64; QS al-Mu'minun 23:84; QS al-Nur 24:42, 64; QS al-Furqan 25:6; QS al-Shu'ara' 26:24; QS al-'Ankabut 29:22; QS al-Rum 30:25, 26, 27; QS Luqman 31:20, 26; QS al-Sajadah 32:5; QS Saba' 34:1; QS Fatir 35:44; QS al-Saffat 37:5; QS Sad 38:66; QS al-Zumar 39:67; QS al-Shu'ara' 42:4, 12, 29, 49, 53; QS al-Zukhruf 43:85; QS al-Dukhan 44:7; QS al-Jathiyah 45:27,36, 37; QS al-Fath 48:7, 14; QS al-Dhariyat 51:23; QS al-Najm 53:31; QS al-Hadid 57:2, 5; QS al-Saff 61:1; QS al-Jinn 72:12; QS al-Naba' 78:37; QS al-Buruj 85:9; QS Saba' 34:9; QS al-Ra'd 13:16; QS al-Nur 24:57; QS al-Rum 30:18; QS al-Zukhruf 43:84; QS Saba' 34:22; QS Fatir 35:13; QS Sad 38:10; QS al-Baqarah 2:33; QS Ali 'Imran 3:29; QS al-Ma'idah 5:40,97; QS Yunus 10:18; QS al-Ra'd 13:33; QS al-Kahf 18:26; QS al-Anbiya' 21:4; QS al-Hajj 22:70; QS al-Furqan 25:8; QS al-Naml 27:64, 75; QS al-'Ankabut 29:52; QS Saba' 34:2; QS Fatir 35:38; QS al-Hujurat 49:16, 18; QS al-Hadid 57:4; QS al-Mujadalah 58:7; QS al-Taghabun 64:4
Role of Successor (<i>khalifah</i>)	QS al-Baqarah 2:30; QS al-An'am 6:165; QS al-A'raf 7:129; QS Yunus 10:14; QS al-Nur 24:55; QS al-Naml 27:61; QS al-Ahzab 33:72; QS Fatir 35:39; QS Sad 38:26
Specific	QS al-Ma'idah 5:21,33; QS al-A'raf 7:100, 110, 128, 137; QS Yunus 10:78, 83; QS Yusuf 12:9,

Places	21, 56, 80; QS Ibrahim 14:13; QS al-Isra' 17:76, 103, 104; QS Taha 20:57, 63; QS al-Anbiya' 21:71, 81; QS al-Shu'ara' 26:35; QS al-Qasas 28: 4, 57; QS Luqman 31:34
Prostration	QS Ali 'Imran 3:83; QS ar-Ra'd 13:15; QS al-Nahl 16:49; QS al-Isra' 17:44; QS al-Hajj 22:18; QS al-Nur 24:41; QS al-Naml 27:25; QS Fussilat 41:11; QS al-Shu'ara' 42:5; QS al-Jathiyah 45:13; QS al-Rahman 55:29; QS al-Hadid 57:1; al-Hashr 59:1; al-Jumu'ah 62:1; QS at-Taghabun 64:1
Corruption	QS al-Baqarah: 11,27,60,205,251; QS al-Ma'idah 5:31-33,64; QS al-A'raf 7:56,74,85,127; QS al-Anfal 8:73; QS Yunus 10:23; QS Hud 11:85,116; QS Yusuf 12:73; QS al-Ra'd 13:17; QS al-Isra' 17:4; QS al-Kahf 18:94; QS al-Mu'minin 23:71; QS al-Shu'ara' 26:15,183; QS al-Naml 27:48; QS al-Qasas 28:77,83; QS al-'Ankabut 29:36; QS Sad 38:28; QS Ghafir 40:26; QS al-Shu'ara' 42:27,31; QS Muhammad 47:22

However, the rest of the 121 verses of the Quran that contain the word *ard* are relatable to the physical properties of *ard*. These verses regarding the physical properties of *ard* make up 28% of the entire 461 verses of the Quran regarding *ard*. The 121 verses can be categorized as follows:

Table 3:- List of Quranic Verse Related to Physical Properties of *Ard*.

Category	Quran Verse
Geomorphology (surface, mountains, soil composition, different types of rock)	QS al-Baqarah 2:22, 36; QS an-Nisa' 4:97, 100; QS al-An'am 6:35; QS al-A'raf 7:74; QS Yunus 10:101; QS Hud 11:61; QS al-Ra'd 13:3, 4; QS al-Hijr 15:19; QS al-Nahl 16:13, 15; QS Taha 20:53; QS al-Anbiya' 21:30, 31; QS al-Hajj 22:65; QS al-'Ankabut 29:56; QS Luqman 31:10, 16; QS al-Zumar 39:10; QS al-Zukhruf 43:10; QS Qaf 50:7; QS al-Dhariyat 51:48; QS al-Najm 53:32; QS al-Rahman 55:10; QS QS al-Taghabun 64:3; QS al-Mulk 67:15; QS Nuh 71:19; QS al-Mursalat 77:25; QS al-Naba' 78:6; QS al-Nazi'at 79:30; QS al-Ghashiyah 88:20; QS al-Shams 91:6
Living Place	QS al-An'am 6:11; QS al-A'raf 7:10,24; QS Yunus 10:24; QS Ibrahim 14:14; QS al-Naml 27:61; QS Ghafir 40:64
Organism (plant & animal)	QS al-Baqarah 2:61, 71, 267; QS al-Ma'idah 5:25; QS al-An'am 6:38; QS Yunus 10:24; QS Ibrahim 14:26; QS al-Nahl 16:65; QS al-Kahf 18:45; QS al-Hajj 22:5,63; QS al-Shu'ara' 26:7; al-'Ankabut 29:63; QS al-Rum 30:19, 23, 50; QS Luqman 31:27; QS al-Sajadah 32:27; QS Saba' 34:14; QS Fatir 35:9; QS Yasin 36:36; QS al-Zumar 39:21; QS Fussilat 41:39; QS al-Jathiyah 45:5; QS al-Hadid 57:17; QS Nuh 71:17; QS at-Tariq 86:12
Resources (water & food)	QS al-Baqarah 2:164, 168; QS Ali 'Imran 3:91; QS al-Ma'idah 5:36; QS Hud 11:44; QS al-A'raf 7:73, 96; QS al-Anfal 8:63; QS Yunus 10:31, 54; QS al-Mu'minin 23:18; al-Qamar 54:12; QS al-A'raf 7:73; QS Hud 11:44, 64; QS Yusuf 12:55; QS al-Ra'd 13:17, QS al-Hijr 15:39; 18; QS al-Nahl 16:73; QS al-Isra' 17:90; QS al-Kahf 18:7; QS al-Anbiya' 21:44; QS al-Mu'minin 23:18; QS al-Ahzab 33:27; QS Saba' 34:24; QS Fatir 35:3; QS al-Zumar 39:47; QS Ghafir 40:29; QS al-Qamar 54:12; QS al-Hadid 57:10; QS al-Munafiqun 63:7; QS al-Ma'arij 70:14; QS al-Zalzalah 99:2
Earth's Interior	QS al-An'am 6:59; QS Yunus 10:61; QS al-Nahl 16:45; QS al-Qasas 28:81; QS al-'Ankabut 29:40; QS al-Rum 30:3; QS al-Sajadah 32:10; QS Saba' 34:3, 9; QS Qaf 50:4; QS al-Rahman 55:33; QS al-Waqi'ah 56:4; QS al-Hadid 57:22; QS al-Mulk 67:16; QS al-Muzammil 73:14; QS al-Fajr 89:21; QS al-Zalzalah 99:1

Verses regarding the geomorphological properties are the largest in number compared to the other categories of physical properties with a total of 33 verses. Geomorphological properties refer to the topographic features created by physical, chemical, or biological processes that happen on the land. According to the Quran, the *ard* must have these geomorphological features:

- Vastness of land like in surah al-Nazi'at verse 30: "And after that He spread the earth".
- Varieties of rocks like in surah al-Nahl verse 13: "And [He has subjected] whatever He multiplied for you on the earth of varying colours. Indeed, in that is a sign for a people who remember".
- Composition of soil like in surah al-Ra'd verse 4: "And within the land are neighbouring plots and gardens of grapevines and crops and palm trees, [growing] several from a root or otherwise, watered with one water; but We make some of them exceed others in [quality of] fruit. Indeed, in that are signs for a people who reason".

The analysis also shows that having abundant resources is a necessity for a place to be considered as an *ard*. This is shown in the Quran by having 32 verses that are related to this importance. The Quran also mentions specific resources such as:

- Source of water like in surah al-Mu'minun verse 18: "And We have sent down rain from the sky in a measured amount and settled it in the earth. And indeed, We are Able to take it away".
- Food like in surah al-Baqarah verse 168: "O mankind, eat from whatever is on earth [that is] lawful and good and do not follow the footsteps of Satan. Indeed, he is to you a clear enemy".
- Gold like in surah Ali 'Imran verse 91: "Indeed, those who disbelieve and die while they are disbelievers - never would the [whole] capacity of the earth in gold be accepted from one of them if he would [seek to] ransom himself with it. For those there will be a painful punishment, and they will have no helpers".

The Quran also mentions that organisms such as plants and animals can live on the *ard*. There is a total of 30 verses regarding organisms. Organisms that are specifically mentioned in the Quran are plants and animals such as in surah al-An'am verse 38 and surah al-Hajj verse 63, respectively.

- Animals: "And there is no creature on [or within] the earth or bird that flies with its wings except [that they are] communities like you. We have not neglected in the Register a thing. Then unto their Lord they will be gathered".
- Plants: "Do you not see that Allah has sent down rain from the sky and the earth becomes green? Indeed, Allah is Subtle and Acquainted".

Furthermore, there are also verses of the Quran that mention the interior properties of *ard* and the activities that happen inside it. There is a total of 17 verses on these properties and some of which are as follows:

- Interior properties like in surah Qaf verse 4: "We know what the earth diminishes of them, and with Us is a retaining record".
- Earthquakes like in surah al-Muzammil verse 14: "On the Day the earth and the mountains will convulse and the mountains will become a heap of sand pouring down".

The final property that the Quran mentions is that the *ard* must be a place human beings can live in. There are 7 verses that mention about this property and one of it is in surah Ghafir verse 64: "It is Allah who made for you the earth a place of settlement and the sky a ceiling and formed you, and perfected your forms and provided you with good things. That is Allah, your Lord; then blessed is Allah, Lord of the worlds". The analysis from 461 verses of the Quran that mention the word *ard* found that there are physical properties associated with this term. In order for Mars to be accepted as one of the interpretations of *ard* and to consider the idea of colonizing the red planet, it must fulfil the physical properties that are summarized as follows:

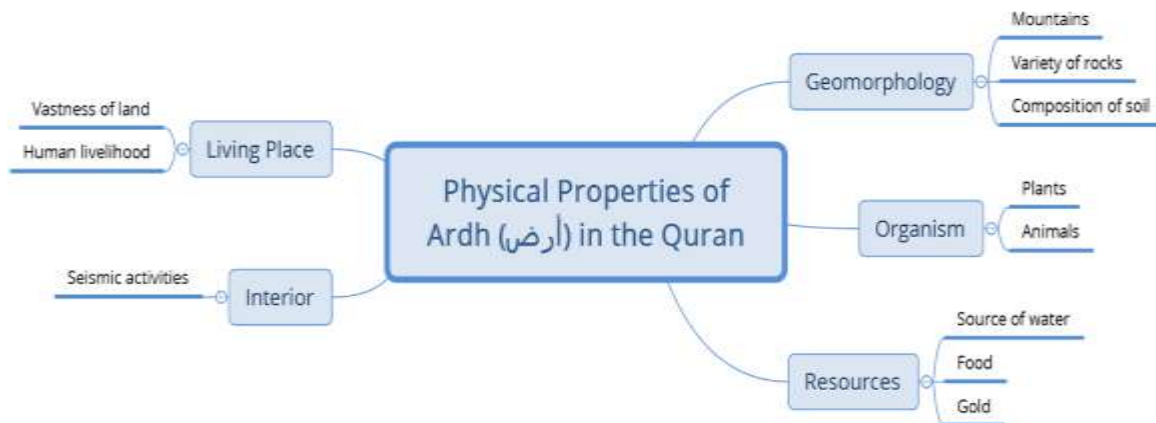


Fig 1:- Physical Properties of *Ard* in the Quran.

Compatibility of Martian Physical Properties to the Quranic Verse

The Quran can serve as a benchmark to indicate whether Mars is a potential planet that human beings can inhabit and colonize or not. With the five physical properties as summarized above, a study on the current findings and understanding of the red planet that is known today are analyzed to determine the compatibility of it towards the Quranic wisdom for human beings to follow.

a. Resources

The most important aspect to consider for colonization is the resources available on the planet, primarily water. This is not just emphasized scientifically but also in the Quran through several verses such as in surah al-Baqarah verse 164. Scientific studies show that water is accessible not on the surface but rather below the surface of Mars and in the polar regions of the planet (Schulze & Davies, 2012). Researchers found out that there are three sources of water: frozen water in the polar caps, water bound molecule-by-molecule in mineral crystals and massive amounts of water frozen in solid form mostly hidden underground (Hartmann et al., 2005). However, the problem present on the Martian surface for water flow is maintaining the liquid state of water for daily use. Scientists are still working on different models and designs on answering this question such as using inclined pipe, sifter, funnel, conveyor belt and focused light (Wiens et al., 2001).

The red planet has also been found to have mineral ore that can be extracted. Although any plans for mining could not be done yet, scientific methods have been used to predict what ore and how much of it exists, and where it could be found. For instance, volcanic provinces on Mars have been detected to have similar ore forming minerals and processes as Earth. This means that potential mineral ore formation such as copper, silver and gold could be detected in Martian volcanic provinces (Ciążela, 2020). In fact, NASA reports in a close-up image taken by a Mars Exploration Rover Spirit that there are signs of a mineral called hematite on the surface of Martian rocks. However, there is one commercial resource that is known to have a massive amount of it on Mars which is Deuterium. This material is not only used to power first and second generation fusion but also to power the nuclear industry today. The abundance of Deuterium on Mars is even larger compared to Earth which is 833 out of every million hydrogen atoms compared to Earth which is only 166 out of every million (Hartmann et al., 2005).

b. Geomorphology

Since 1971, Mars was discovered to have a geomorphology similar to Earth such as having volcanoes, lava flows, sand dunes, layered sediments, canyons, polar ice, craters, fractures, clouds and fogs (Hartmann et al., 2005). Further exploration was done in 1997 whereby it was found that the Martian soil was sterile, with no organic molecules but modest abundance in sulphates and salts that is suggested to originate from evaporated salty waters (Hartmann et al., 2005). The lack of water and vegetation cover on the planet makes the surface loose of sediments and results in the planet being surrounded by dust (Antoniadi, 1975). Unlike Earth whereby our sand is dominated by minerals of Quartz, Mars aeolian sand is dominated by basalt (Jiyan & Zhibao, 2016).

The types of rocks on the Martian planet are somewhat similar to the types of rocks on Earth, mainly igneous and sedimentary rocks (Singer & McSween, 1993). The Martian crust is thick in mafic composition and there is no data indicating the existence of ultramafic rocks or intermediate to felsic composition just like what is found on the terrestrial continents (Michael & Jonathan, 2010). Besides that, sedimentary mountains also formed on the Martian planet and the tallest sedimentary mountain that has been detected is located at Valles Marineres (Kite et al., 2016). Scientists also classified sedimentary rocks into three categories whereby the youngest sedimentary unit is called the 'Thin Mesa' units that are dark toned in colour (Kite et al., 2016).

c. Organism

The Quran particularly refers to animals and plants when associated with verses regarding *ard*. When it comes to plants, the Martian environmental conditions such as the soil composition is inappropriate for plant growth. This is due to the high concentration of aluminum oxide that can be toxic to plant growth. Meanwhile the lack of nitrogen in Martian soil further inhibits plant growth (Ramos et al., 2019). However, alternatives have been suggested by Mars scientists such as building a greenhouse that is suitable for plant growth on Mars. There are many variables that need to be considered to build a greenhouse on Mars such as atmospheric pressure, wind and dust, temperature, and light levels (Bucklin et al., 2004). Ideally, plant growth on Mars would make it sufficient to provide food for humans to colonize.

Animals, on the other hand, have not been scientifically recorded to be on Martian planet although there have been claims of an animal-like rabbit and ground squirrel to be identified in NASA rover images. However, NASA explains the images are most likely caused by the sun and shadows that formed on the many rocks that cover the surface of the planet (DeVore et al., 2018). But even so, many scientists still believe that there is a potential possibility that organisms could live on Mars despite its thin atmosphere, high levels of radiation and temperature (Dass, 2017). There are evidence of continuous bacteria and fungi growing on the Martian planet (Dass,

2017). Furthermore, researchers concluded that microbial life is likely to survive the transportation of major asteroid impacts from Earth to Mars or vice versa (Schulze & Davies, 2012).

d. Interior

Studies show that early Mars had similar environmental conditions as the early creation of planet Earth because both of it originated under similar conditions (Schulze & Davies, 2012). One distinct difference between the interiors of Mars and Earth is that Mars has no evidence to indicate it has plate tectonics while Earth does. Although fault features such as extensional, compressional, and strike-slip faults are observed on Mars, none of the geological features can indicate clear signs of plate tectonic movements (Barlow, 2008). This is mostly due to the lack of seismic data that is currently available to study in depth about the interior part of the planet (Barlow, 2008).

Although, the presence of volcanic and tectonic features on Mars suggests that there have been previous and continuously occurring seismic activities. Data images and studies about the strain rates were derived from slips along the surface faults. These data give evidence that Mars remain seismically active with an estimation of 14 seismic events of equivalent magnitude 4 or greater occurring each year (Barlow, 2008).

e. Living Place

The Quran gives reference to the word *ard* as being a place that is sustainable for human beings to live on. With the current understanding towards the red planet, there are no clear signs yet that the planet is habitable for human beings to colonize given that there are many factors and risks that needs to be considered to do so.

Factors that sustain human beings to colonize Mars need to be sustainable for a prolonged period. Among them are the agricultural and industrial sectors that are considered essential to provide a long-term environment for the Martian life (Zhang 2021). Furthermore, public infrastructure such as roads and houses are also considered essential for long term survival on Mars. Such advancements and developments could only be made possible if the local resources can be discovered, extracted and refined to be used by Martians (Levchenko et al., 2018). Thus, future technologies need to be developed to figure out techniques for extracting water out of soil, building large-scale greenhouse agriculture, making ceramics, metals, glasses and plastics out of local materials and constructing large pressurized structures for human habitation and industrial and agricultural activities (Zubrin, 2019).

Risk and difficulties that may arise from Mars colonization should also be taken into consideration. Some of which that have been predicted and are in need for a solution are resource depletion, pandemics because of unknown Martian diseases, transportation, and exchange breakdown from Earth to Mars, sub population, unsustainable development, and irregular food production

Conclusion:-

The Quranic perspective towards the idea of colonizing Mars is based on the understanding towards the word *ard*, that is, it does not only imply to Earth but gives meaning towards something more general that can also indicate other places. Besides that, the majority of exegesis commentaries on verse 12 of surah al-Talaq further supports that there are other *ard* than the planet Earth that is inhabitable. Thus, a benchmark on five physical properties of *ard* is obtained by analysing 461 verses of the Quran regarding *ard* which is related to geomorphology, resources, organisms, interior and living place. These benchmarks were compared to the current understanding of the planet Mars and seemed to show that most of the physical properties are aligned with the physical properties mentioned in the Quran. However, with extensive research, the findings and understanding towards Mars are still needed to ascertain whether Mars can be taken as one of the *ard* in the Quran based on the five physical properties as deduced from this study.

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