Mars Locations

Baseline Information:

- Access to Water
  - Drinking
  - Water Extracts
  - Energy for Crops
  - Radiation Shielding
  - Further access to Oxygen

- Protection from Solar Radiation

- Temperature variations in altitude and latitude

- Landing and Evacuating requirements

Designated Locations to Avoid:

- Polar Regions

- Volcano Tops

- Basins

- Small Craters

Possible Colonization Sites:

- Acidalia Planitia

- Eberswalde Delta

- Gale Crater

- Gusev Crater (Columbia Hills)

- Herbrus Valles

- Holden Crater

- Jezero Crater

- Mawrth Vallis

- Medusae Fossae Formation (MFF)

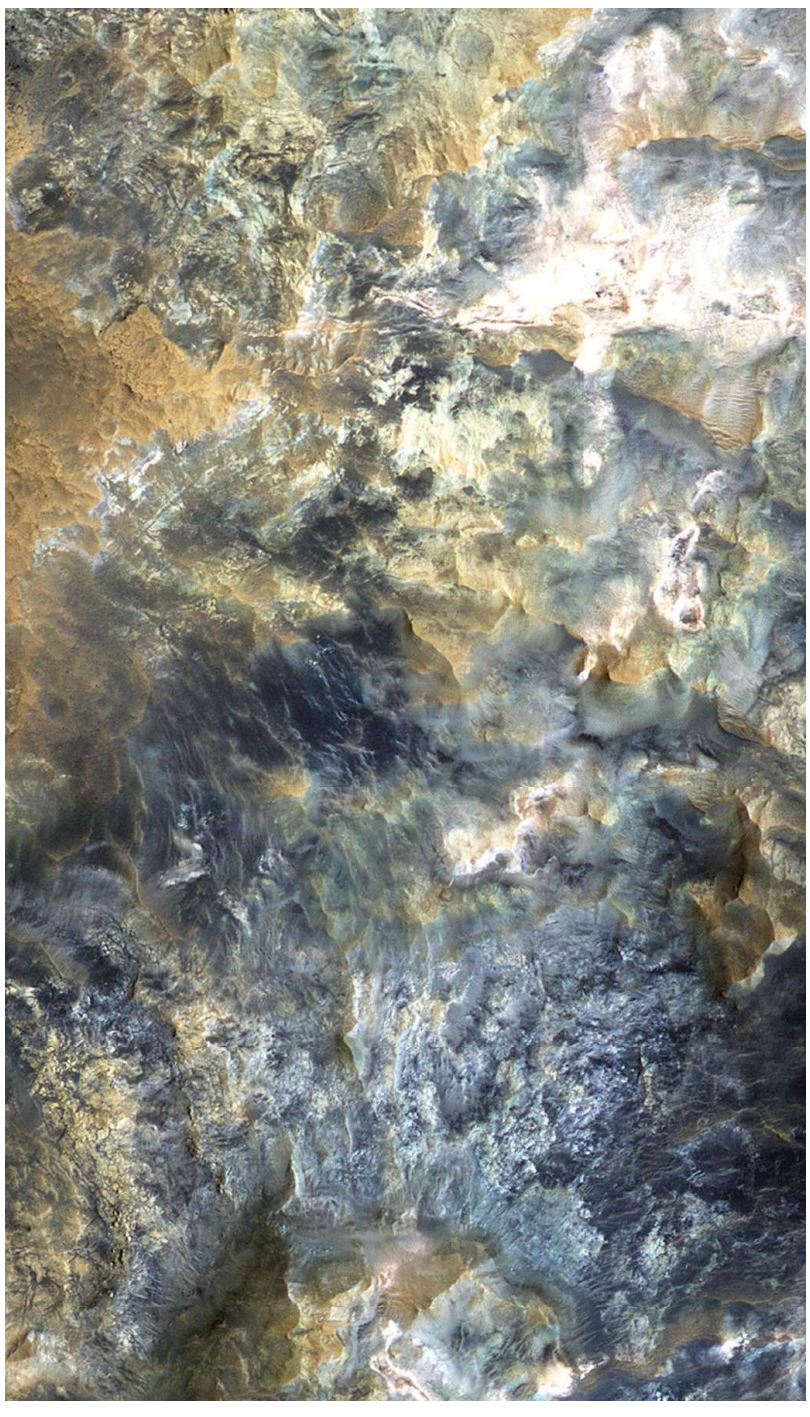
- NE Syrtis

- Nili Fossae

- Protonilus Mensae Region

- SW Melas

- Valles Marineris



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Baseline Information:

- Access to Water

Humans need to consume **64 ounces of water a day** to sustain an adequate lifestyle, resulting in needing **23,360 ounces of water per Terrestrial cycle (TC)**, or **43, 968 ounces per Martian cycle (MC)** (687 days). Other uses such as hydrating a human's skin and bathing will also need to be taken into consideration when estimating the total amount of water needed per person annually. An average bath takes about 40 gallons, assuming one bath is taken per week, over 2,100 gallons of water will be used per TC. All in all, each human will on average need to consume about **2,300 gallons of water (TC)** (128 ounces = 1 gallon), or **4,275 gallons of water (MC)**. This number can be cut substantially with a communal bathing system, less frequent baths, or other means or hydrating one's skin and washing one's body without using water as the primary source.

Water has five primary sources on Mars:
Sheets of Water Ice
Water Rich Hydrated Minerals
Underground Aquifers
Recurring Slope Lineae
Atmospheric Humidity

Sheets of Water Ice and Water Rich Hydrated Minerals tend to be the most consistent and efficient ways of capturing water, as of our human knowledge in the year 2022. T**he Northern Plains of Mars** have easy access to large sheets of Ice below the surface, requiring the crew to only have to dig a few meters to reach this wealth of resources.

The type of crops that will be the most efficient in a martian landscape is TBD. Calculations can then be made on how much additional water will be needed annually in order to provide a sustainable food supply for a crew.

Water can be stored in many different ways, one of which is by acting as another **layer of insulation** for bodies of architecture on the surface. The *Marsha Project*, proposed by AI Space Factory in 2019, utilizes this line of thinking in their 3D printed habitats (https://www.aispacefactory.com/marsha). This not only reduces the amount of lethal solar radiation that could penetrate the structure of the architecture, but it also acts as an independent reservoir for all of the designed space.

A surplus of water could also result in another method of **manufacturing Oxygen**. Additional Oxygen is always a welcomed sight on Mars, as its use spans from giving breathable air to providing more fuel for exploration trips or return voyages back to Earth. The process by the Oxygen is extracted from the water and then contained is TBD.

- Protection from Solar Radiation

Mars' lack of a magnetic field, as well as an atmosphere that is not nearly as thick as Earth's means that proper negation of solar radiation is near the top of the list in order to produce a sustainable habitat. Ideas such as using the **Martian Regolith in order to provide additional shelter** to on surface structures have been proposed, as well as using isolated water reservoirs to achieve the same goal. However, understanding the benefits and pitfalls of different locations that the planet has to offer is crucial to maximizing the energy that the Sun can provide, while not enabling solar radiation to cause harm to inhabitants or equipment.

- Temperature variations in altitude and latitude

Higher latitudes in the Martian landscape are dangerous, with temperatures as low as **-220 degrees F** in the winter. This is 275 percent lower than the average temperature on the planet which is about **-80 degrees F** or -60 degrees C. However, near the equator the temperature can rise to a sunny **70 degrees F** during the summer months, allowing for conditions that are comparatively livable to some regions on Earth. In this way, **permanent habitation near the poles is almost impossible**, as the winter months would quickly deteriorate any equipment and wither crops. The equator offers the most generous temperatures as it pertains to human comfortability, as well as the highest percentage of direct sunlight that can be used as **solar energy** to power a plethora of devices and automatons.

- Landing and Evacuating requirements

Establishing a robust landing site that can be used to safely complete a mission is an essential step towards developing a working and self-sustainable system. **A minimum of 15 kilometers (9.5 miles)** will be needed to function as a safe landing zone. This means that the terrain should be solid and flat enough to serve as a natural landing pad. Future alterations can be made arbitrarily to increase the probability that future payloads have a higher chance to land safely. A **geographically lower site** provides more of an atmosphere than that or an average or elevated location. Ergo, there is a lowered amount of hostile radiation, as well as the fact that **parachutes and braking systems will be more effective** due to the thicker air.

Similar to Earth, the equator of Mars offers a better location to re-launch missiles from. The spin of the planet around its axis is faster along the equator, essentially **providing a velocity boost** to departing ships if engineered correctly. Thereby saving fuel for the journey back to Earth.

Designated Locations to Avoid:

- Polar Regions

Despite a heavy amount of water located in the polar caps as ice, the conditions are too treacherous to form a permanent residence here. **Temperatures can reach a low of -220 degrees F,** along with stronger winds that will quickly erode any structures or equipment placed in these locations.

- Volcano Tops

Volcano tops, such as Olympus Mons, are natural landmarks that should be utilized for geographical tracking. However, the **higher elevation results in thinner air**, in an atmosphere that is already thin compared to Earth's, as well as i**ncreased levels of radiation** which can be deadly to the human body and other forms of equipment if left unattended.

- Basins

The lower altitude of a basin seems to be a promising factor in establishing a permanent residence, unfortunately the **higher wind speeds** coupled with **increased levels of dust** issue a volley of problems. These problematic aspects being an increase in **machines being clogged** with dust (life-support filters) as well as further **breathing problems** for humans.

- Small Craters (100 km, 62 miles, or less)

Craters and canyons as a whole are relatively good locations for permanent habitation. However, smaller craters **restrict future exploration** due to their hazardous terrain around the edges, as well as evoking similar effects to a basin.

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Mars Locations

Possible Colonization Sites:

- Acidalia Planitia

- Eberswalde Delta

- Gale Crater

- Gusev Crater (Columbia Hills)

- Herbrus Valles

- Holden Crater

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- NE Syrtis

- Nili Fossae

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- Valles Marineris

Possible Colonization Sites:

- Acidalia Plantia

Located in the **Northern Lowlands** (between the Tharsis volcanic province and Arabia Terra to the north of Valles Marineris, centered at 49.8°N 339.3°E), Acidalia Plantia is a **large basin** where Whitney lived in *The Martian*. Large sediments of iron and magnesium remain here, further **geological research** could be a primary mission objective from this location.

- Eberswalde Delta

Located in the **Southern Highlands** (to the North of Holdon, centered at 24°S, 33°W), the Eberswalde Delta is a portion of the **Eberswalde Crater** which measures **65.3 km in diameter**. Since this location is on the current grounds of an ancient delta, high erosion rates will be an issue. However, a possible upgrade in building materials could be found here through the fusion of watered down clay and volcanic ash that has been congealing over a long period of time. Further research into **Mars' history of water** and what that means for the future of colonization is a possible mission goal from this location.

- Gale Crater

Located in the Northwestern part of the **Aeolis Quadrangle** (5°24 S 137°48 E / 5.4°S 137.8°E), **Gale Crater is a 154 kilometer (96 mile) dry lake**. The crater offers **Aeolis Mons**, a 3.4 mile tall peak, as well as the destination for **Curiosity's 2012 mission**. This site was chosen by NASA for curiosity due to the low altitude that it offers, as well as the possibility to study Mars' history of shifting from a **wet to a dry planet**. The crater is expansive, allowing for plenty of exploration, but this would still be an area that a rover has already had ample amount of time to gather data on.

- Gusev Crater (Columbia Hills)

Located in the **Aeolis Quadrangle** (30 S 24 E / 14.5°S 175.4°E), **Gusev Crater is a 166 kilometers (104 miles)** wide. The crater is home to evidence of mineral springs, mostly a **series of basalts** that include olivine, pyroxene, plagioclase, and magnetite. This information became prevalent when the **Spirit Rover investigated this territory in 2010**. Similar to the Gale Crater, Gusev Crater allows for a long range of exploration revolving around **Mars' hydro thermal environment**, but at the cost of revisiting a well documented location.

- Herbrus Valles

Located in the **Amenthes quadrangle** (20.2° N latitude and 233.4° w longitude), Herbrus Valley is a series of troughs and valleys that **spans 317 kilometers (196 miles)**. Herbrus Valles provides engagement with the **Martian Subsurface** as well as additional research regarding Mars' history regarding floods and current post ice-age situation. A location that provides low altitude and ready access to **water ice from the extensive cave networks** that lie within, Herbrus Valles is a legitimate candidate for martian settlements.

- Holden Crater

Located in the **Southern Highlands**, more specifically the **Margaritifer Sinus quadrangle** (MC-19) (0° to 45° west longitude and 0° to 30° south latitude), the Holden Crater is **140 kilometers wide (87 miles)** and is part of the **Uzboi-Landon-Morava (ULM)** system. Since the site has a history of water from the ULM, large **deposits of clay** and other traces of **microbial life** would be the focus of a mission deployed here.

- Jezero Crater

Located in the **Syrtis Major Quadrangle**, more specifically in the **Isidis Planitia Region** (18.38°N 77.58°E) and is about **45 kilometers (28 miles)** in diameter. NASA's **Perseverance and Ingenuity** project touched down in the Jezero Crater during its mission in 2021. The relatively flat land and historical **lake-bed sediments** made this an excellent location for a rover mission. However, even though the site is just north of the equator, the limited space in the crater and fact that research has already been conducted at this location makes it a hard sell for a permanent colonization.

- Mawrth Vallis

Located in the **Oxia Palus quadrangle** (between the Southern Highlands and Northern Lowlands) (22.3°N, 343.5°E), Mawrth Vallis is a **valley with an altitude approximately two kilometers below datum**. Due to the lower elevation, this site has an **abundance of mineral and clay (phyllosilicate) deposits**, as well as the Mawrth Channel, which features a nearby 200 meter high plateau with many exposed layers.

- Medusae Fossae Formation (MFF)

Located in the **Amazonis Planitia Region** (between the Tharsis and Elysium volcanic centers) (170 and 240°E (120–190°W), **the MFF is an enigmatic deposit** located along the equator. This span stretches more than **5,000 kilometers** (3,106 miles), straddling the highland - lowland boundary. The inner stretch which spans 621 miles is relatively a mystery due to the heavy cloud of dust that floats above the designated area. The surrounding landscape of the MFF includes **softer ground** which is easily eroded, and easily buried through. This is important due to the fact that a **high volume of resources** and building materials can be crafted from the nearby volcanic ash and sediments.

- Northeast Syrtis

Located between the **Isidis Basin and Syrtis Major** (18°N,77°E), NE Syrtis contains diverse **aqueous minerals** that could be regarded as an important mission prerogative. A plethora of minerals appear here including clay, carbonate, serpentine and sulfate, olivine and high-calcium and low-calcium pyroxene. These minerals allowed for microbes to flourish at one point, and with proper research could unveil telling information about the martian landscape.

- Nili Fossae

Located in the **Syrtis Major Quadrangle** (22°N, 75°E), Nili Fossae is a group of concentric grabens that have been eroded and partly filled-in by sediments from the nearby **Isidis Basin**. A discovery from NASA's 2008 Mars Reconnaissance Orbiter showed a large portion of **carbonate minerals** in the region as well as other significant iron oxides. A mission here would begin to pave the way for the future of geological research as it pertains to Mars.

- Protonilus Mensae Region

Located in the **Ismenius Lacus quadrangle** (43.86° N and 49.4° E), and is described as having **fretted terrain** (flat plateau-like surfaces) from a history of glacier activity in the area.

- Southwest Melas Chasma

Located in the Valles Marineris canyon system (Coprates quadrangle), east of Ius Chasma (9.8°S, 283.6°E), the canyon boasts to be the largest known in the solar system. A focus on the clay material provided in the chasm, as well as an emphasis on advancing the study of astrobiology, would be seen as the main mission objectives for a long term colony here.

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Mars Locations

Possible Colonization Sites:

- Acidalia Planitia (01)

- Eberswalde Delta (02)

- Gale Crater (03)

- Gusev Crater (Columbia Hills) (04)

- Herbrus Valles (05)

- Holden Crater (06)

- Jezero Crater (07)

- Mawrth Vallis (08)

- Medusae Fossae Formation (MFF) (09)

- NE Syrtis (10)

- Nili Fossae (11)

- Protonilus Mensae Region (12)

- SW Melas (13)

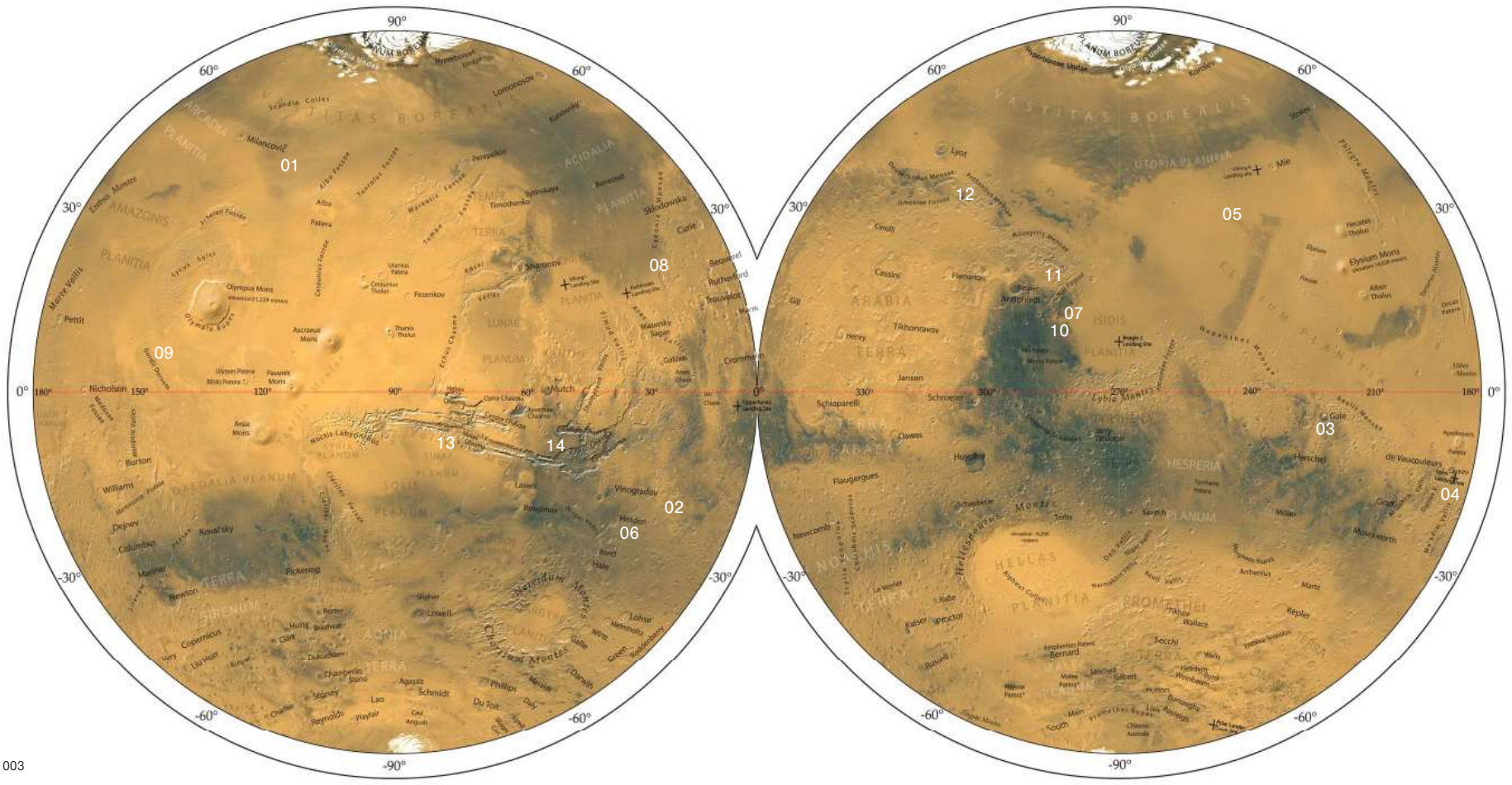
- Valles Marineris (14)

Possible Colonization Sites:

- Valles Marineris (The Grand Canyon of Mars)

Located east of the **Tharsis region** (13°54 S 59°12 W / 13.9°S 59.2°W), Valles Marineris is a system of canyons that stretches more than **4,000 kilometers** (2,500 miles), with an average **width of 200 kilometers** (120 miles). Near the equator, the canyon encompasses nearly a quarter of Mars' circumference. **An average of 32 degrees F** situates the site at nearly 110 degrees F above the average temperature of the planet. The low altitude (up to 7 kilometers deep, 23,000 feet) caters to humanities' needs of a **denser atmosphere** as well as **lower levels of solar radiation**. Spring deposits have been projected to be located a few meters under the surface of Valles Marineris, giving way to a potential water source, also creating a livable area for microbial life.

Mars Shaded Relief and Surface Coloration Map



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Mars Locations

Sources:

Image 001: *The Colors of Mawrth Vallis*_NASA

Image 002: *Mawrth Vallis Martian Mosaic*_NASA

Image 003: *Mars Shaded Relief and Surface Coloration Map*_Ralph Aeschliman

Image 004: *Topography of Mars*_NASA

Image 005: The Planet Mars_HellofromtheMoon

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https://en.wikipedia.org/wiki/Melas_Chasma

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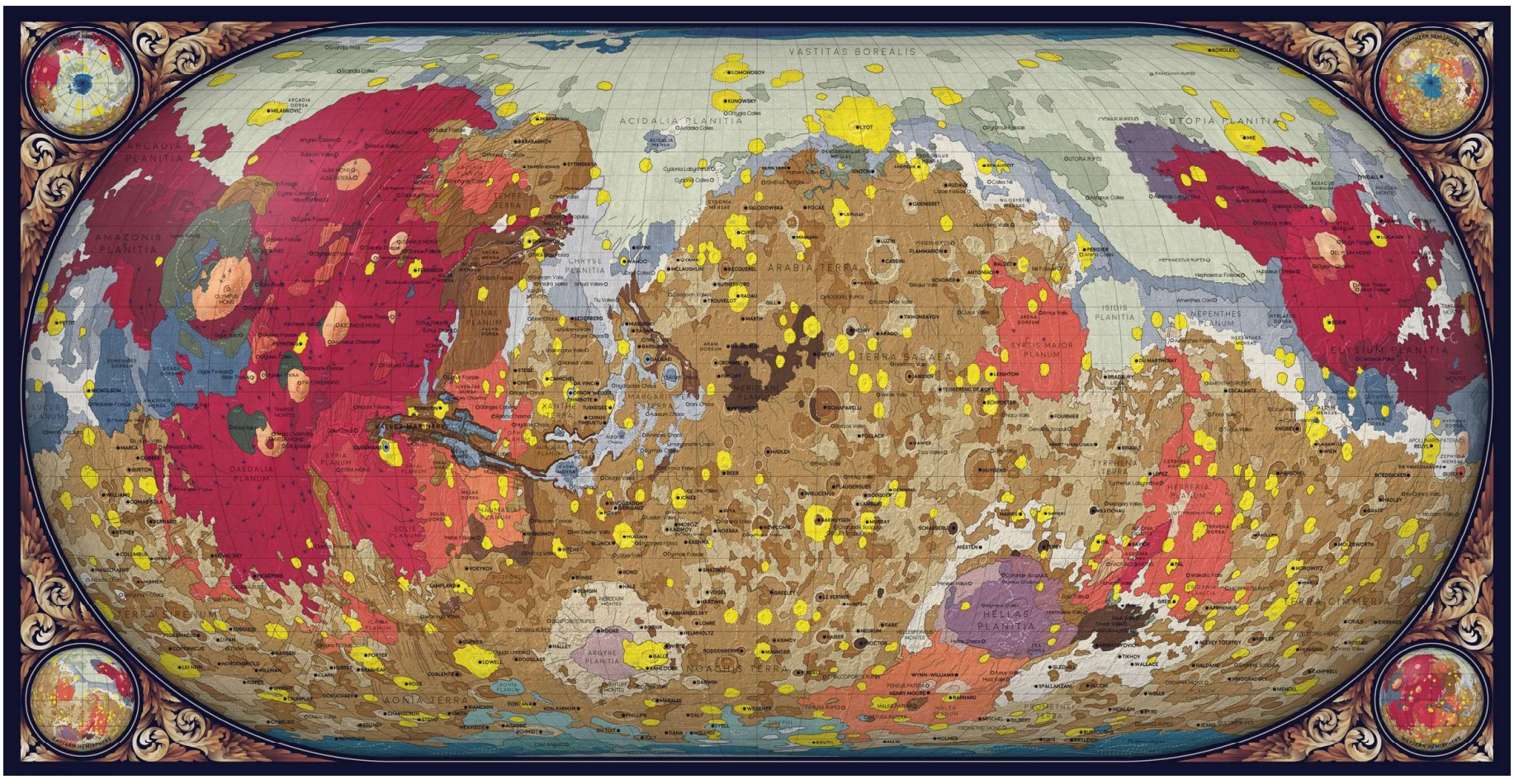

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