Mars, The Blue Ecosynthesis

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Terraforming was once solely the province of science fiction. In the 1930s, Olaf Stapledon wrote of electrolyzing a global sea on Venus in order to prepare it for human habitation in "Last and First Men." Jack Williamson coined the term "terraforming" in the 1940s in a series of short stories.

And in 1951, Arthur C. Clarke gave the concept wide exposure with his novel, "The Sands of Mars." Kim Stanley Robinson picked up the terraforming torch in the 1990s with his epic trilogy - "Red Mars, Green Mars, and Blue Mars."

Scientists began to think seriously about terraforming in the 1960s, when Carl Sagan published several articles dealing with the possibility of terraforming Venus. NASA astrobiologist Chris McKay prefers the term "ecosynthesis" to terraforming, since the chance to recreate Earth-like conditions will be technologically challenging.

"I don't think we can terraform Mars, if terraforming is, as it was originally defined, making Mars suitable for human beings," says McKay.

"But what we could do is make Mars suitable for life. Human beings are a particular subset of life that require particular conditions. And it turns out oxygen in particular is very hard to make on Mars. That is, I think, beyond our technological horizons - it's a long time in the future. But warming Mars up, and restoring its thick carbon dioxide atmosphere, restoring its habitable state, is possible. It's sort of a stretch of the word

terraforming, but if you want to call that terraforming, that's possible. Bob McElroy coined the phrase "ecosynthesis" for that, and I think that's a better word."

Illustrator Thierry Lombry has produced some of the most fascinating and detailed visualizations showing how the martian landscape might be modified over hundreds or thousands of years.

Mars, the red.

Today Mars is a cold world, dry and arid. Its dust could be toxic, carcinogenic, and allergenic. It is an inhospitable world.

The mean temperature is below freezing, but it varies from -125°C in winter to +20°C at the equator in summer. Due to the low pressure of the atmosphere and the cold, the soil is compact, and at night carbonic frost covers the red rocks.

Fallen rocks, fractures, partly buried craters and extinct volcanoes are the sole traces of surface activity. Winds and tempests pull dust into the atmosphere, giving it a pink-orange color.

Mars, the brown. The next millennium.

Five hundred years after terraforming, billions of tons of photosynthetic bacteria and greenhouse gases have been injected in the atmosphere. Mirrors angled to intensify sunlight, along with the engineered explosions of several volcanoes, have re-warmed the surface.

The temperature rises, melting any subsurface water. This water turns craters into lakes and ponds, and rivers snake across the surface. Atmospheric dust slowly falls back to the ground, giving the sky a more bluish color. The air is not breathable yet. The first settlers explore the

planet.

Mars, the blue. The next epoch.

Hundreds to thousands of years pass, depending on the intensity of terraforming efforts.

The only frozen subsurface water is in the polar regions. The mean temperature is 10°C, and reaches 35°C in summer at the equator. In the top tens of centimeters underground, the temperature remains above freezing, even in winter.

The sky is blue, rivers and lakes have invaded the planet as in ancient martian times past. The ground is verdant, covered with thick moss and lichens, and even some grasses adapted to temperate conditions.

Life has acclimatized. Now shrubs, flowers and even insects or fishes could survive. However, terraforming efforts have to be maintained because Mars is too small to retain its atmosphere.

The air is breathable, so explorers do not need oxygen masks. Mars the blue can begin to sustain the first human settlements.