

NEWS PODCAST ASTRONOMY 101 ABOUT FOLLOW SEARCH

## COMING FULL CIRCLE ON WATER IN THE COSMOS

Editor's note: This story was originally posted 25 Jan 2014, but it's now graduated and become part of Astronomy 101! Please be aware that any references to events that seem current may not actually reflect events happening right now.

"...the most self-evident explanation from the markings themselves is probably the true one; namely, that in them we are looking upon the result of the work of some sort of intelligent beings. . . "

- Percival Lowell, 1894

It's been a remarkable journey. If, just recently, one were to become aware of our scientific endeavors in space, she might take for granted the abundance of water in our solar system. After all, it hardly seems that a week goes by without the discovery, here or there, of some new source. This week it was freshwater seas on ancient Mars; last week it was jets of water on the asteroid Ceres. A month ago it was geysers on Jupiter's moon Europa. A partial list might include:

- Earth (duh!)
- The Moon

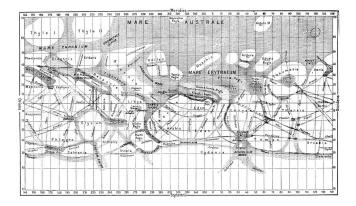
- Mercury
- Europa
- Enceladus
- Ceres
- Mars
- Comets

If this new observer was William Herschel or Percival Lowell. such a list may have seemed practically inevitable. But, select virtually person who lived in the last sixty years, and the result would be nothing short of astonishment. How did we make such a transformation, not once, but twice? It's a fascinating story.

Ancient scientists largely believed that the celestial bodies were perfect: flawless spheres of some sort of flawless crystalline material. It wasn't until Galileo turned his telescope towards the Moon that scientists realized that these cosmic bodies were rather more like our own planet than their imagined heavens. With Galileo's experimental techniques and Isaac Newton's mathematical genius, the modern scientific method was born. The new science would consist of data and hypotheses, grounded in the physical world and supported by a structure of mathematics.

Galileo's simple telescope would be refined and expanded. Some sixty years later, Newton himself would produce the first precursor to the modern telescope. These instruments would lead to the discovery of new celestial bodies; Uranus in 1781, Ceres in 1801, and Neptune in 1846. But, perhaps more importantly, bigger and better telescopes allowed never-before-seen views of the planet Mars. In 1659, the first surface features of another planet were identified. Our love affair had begun.

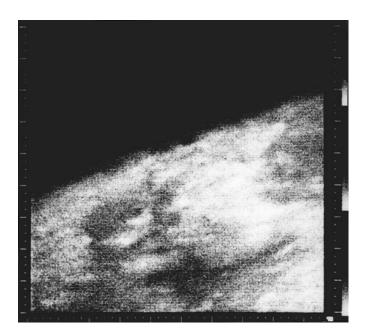
By the dawn of the twentieth century, telescopic observations of the Red Planet were reaching their peak. Maps, like the one seen here, began to accurately chart some features of the Martian surface as we know it today. Much of the nomenclature used to discuss Mars today dates to this era. But these observations still had their limits. Straining eyes appeared to catch glimpses of straight lines - a feature rarely seen in the natural world. Issues with translation, uncertain maps, and a desire to draw comparisons with the Earth led some to interpret these features as canals. The conclusions then were obvious: if Mars has canals, it must have copious surface water. But what about the redness of the planet?



Map of Mars drawn by Giovanni Schiaparelli. He completed it in 1886. The lines denote "canals" on Mars.

Wouldn't a water world like Earth be blue? It was here that science ended and fantasy began. Percival Lowell, entranced by these "canals," published a series of popular science book in the first decade of the twentieth century the purported to detail the creatures and ecology of Mars. He postulated that Mars was a dying planet - its canals a

desperate attempt to ferry water to a failing civilization. They were complete fiction. Nonetheless, the public ate it up. Lowell's vision of Mars would dominate for fifty years.



The first spacecraft image retuned from another planet. (Image credit: NASA)

The year 1965 shattered all of that. The American spacecraft *Mariner 4* returned the first close-up images of Mars in July. The results were unambiguous: Mars was a desert. Images returned from the Moon had shown the same thing. Suddenly the Earth seemed unique. Water was fleetingly rare in the cosmos and our planet seemed to have the lion's share.

In the 1970s, the Viking landers only confirmed these notions. Observations from the surface of Mats showed it to be dry and devoid of life. The Apollo astronauts had found the same on Mars. Landings by the Soviet Union on Venus showed it to be even more harsh. In 1990, the *Voyager I* probe sent back the image known as the Pale Blue Dot. Never before had the Earth seemed so fragile.

But, once again, our viewpoint was changing. *Mariner 9* and *Viking* had uncovered features on the surface which could have formed through erosion. In 1996, the *Mars Global Surveyor* orbiter reported the first discovery of water-formed minerals. Perhaps at one time in the past Mars had indeed been a wet world. More recently, Spirit, Opportunity, and Curiosity have further established Mars' wet past.

Our story, though, wouldn't start to come full circle until 2001. *Mars Odyssey*, peering down from orbit with its spectrometer, made the remarkable discovery that the soil of Mars did, in fact, contain water *today*. After that, the floodgates (no pun intended) were opened. *Cassini* soon after found jets of nearly pure water shooting thousands of kilometers into space at the moon Enceladus. *Phoenix Mars Lander* would dig trenches and expose ice near the Martian pole.



Water ice uncovered by the *Phoenix Mars Lander* propulsion system. (Image credit: NASA)

While it's now clear that Earth is indeed alone in the solar system when it comes to surface water, oceans believed to exist under the surfaces of Europa and Enceladus mean that we're far from the only body with substantial water today.

So, it turns out we're not exactly back where we started. There are no sentient races on other worlds. No canals and no War of the Worlds. But the solar system is a far more dynamic place than it appeared fifty or sixty years ago. The Earth, it seems, is not alone after all.

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