

Pluto's 'Demotion' - An Example of Science in Action

From the Education Committee of the Royal Astronomical Society of Canada (www.rasc.ca/education)

In August 2006, Pluto was demoted from full planet status because of a vote at the International Astronomical Union, the worldwide body of astronomers.

How can that happen to something textbooks still say is a planet? How can teachers explain that to students? In doing this, the way science works can be taught. Theories and classification systems get changed when experiments show they no longer work properly.

Originally, planets were defined as "wanderers" in the sky. With naked eyes we can see five: Mercury, Venus, Mars, Jupiter and Saturn.

Earth wasn't a planet because people believed everything went around us. Copernicus and Galileo convinced astronomers that we orbit the Sun like the others, raising the count to 6.

Even the earliest telescopes showed planets as disks rather than points of light. That's why planets give a steady light, rather than twinkle like stars.

About 400 years ago, Kepler found a relationship between the distance from the Sun and the time to make one orbit. Jupiter, with a 12 year orbit is 5 times farther from the Sun as we are. When astronomers measured the size of the solar system, they realized that Jupiter was a giant - 11 times our diameter.

About 225 years ago, Herschel found a slowly moving dot with a telescope. Given its 84 year period and the size of disk, it's about 4 times the diameter of the Earth. Uranus became the seventh planet.

Twenty years later, Piazzi found another moving dot. Ceres however only needed 4.6 years to make an orbit, so it was closer - somewhere between Mars and Jupiter. Ceres was probably about one tenth the size of the Earth. Ceres was called a planet, but then more objects like it were discovered. To keep the designation "planet" very special, astronomers decided to call objects like Ceres "Minor Planets". About a hundred thousand asteroids have since been discovered.

Most asteroids are potato shaped. They don't have enough mass to form into a spherical ball like the Earth and the Moon. Four billion years ago, the solar system had many more asteroids. The craters on every rocky body of the solar system show that many of these have hit planets, moons or other asteroids leaving fewer rocks in space.

The next planet was predicted mathematically. The path of Uranus didn't follow a regular pattern. Le Verrier predicted where another planet must be to cause the changes. After a few nights of searching, Galle found Neptune. Given its 165 year period, it is another gas giant about the same size as Uranus, but much farther away. Neptune made it 8 planets.

In 1930, Clyde Tombaugh noticed another slowly moving dot on two photographic plates. It was very different from the other 8: it was much smaller (half the diameter of Mercury), and the orbit was not roughly round like the other planets. It's affected by the much larger Neptune

because Pluto makes 2 orbits for every 3 of Neptune. In spite of that, it was called a planet, a decision many thought was a mistake.

After 1990, other bodies were found orbiting further away than Pluto. These Kuiper belt objects move very slowly. Eventually in 2003, Mike Brown found an object larger than Pluto. Then shouldn't this body, nicknamed 'Xena', deserve planet status?

This forced the International Astronomical Union to reconsider the definition of a planet. They wanted a definition which was general, but gives a reasonable number of planets. Some suggested a 2000 km diameter size (1/6 Earth's). Others argued that a planet is anything big enough that gravity forced the potato shape into a sphere. This could have added 3 bodies to the planet list - and probably many more as the shape of more asteroids gets determined.

After much discussion, the final planet definition included the requirement that it "cleared the neighbourhood around its orbit".

Any object orbiting the Sun at about the Earth's distance will eventually suffer one of three fates - hit the Earth, be pushed away, or end up in a related orbit to Earth's, such as the 3:2 relationship between Neptune and Pluto. While the process continues, we have mostly "cleared our neighbourhood".

Pluto, however, is so small that it hasn't affected other bodies near its orbit. Hence it gets demoted to "Dwarf Planet" status, meaning it is large enough that gravity makes it round, but too small to affect many other objects in its orbit. It was the first Kuiper belt object found, just as Ceres was the first asteroid.

This is an excellent example of how scientists classify things, and how definitions change with time as new discoveries are made. The widow of the man who discovered Pluto said he would have accepted the ruling "because he was a good scientist."