Rediscovering Pluto

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On 18 February 1930 Clyde Tombaugh discovered Pluto. On 14 July 2015, Pluto was rediscovered through the *New Horizons* mission. The surface of Pluto possesses a fascinating variety of features (figure 1). Astronomers have long wished it were possible to get better information on Pluto, but the wait is now over. Pluto has long raised a number of challenging questions for scientists. Now with the new information from the *New Horizons* mission, much of the science of Pluto has to be rethought. Pluto and its companion Charon turn out to be much more geologically interesting than expected. Though time is needed to digest the new information, there are hints of creation implications from Pluto already that are consistent with other bodies in the solar system, such as moons of the outer planets.

The *New Horizons* mission itself will help us understand the outermost region of our solar system. The *New Horizons* spacecraft travelled for nine years to reach Pluto. To reach such a distant object, *New Horizons* was launched from earth at a greater speed than any other spacecraft to ever leave earth's orbit. The spacecraft travelled at a speed of 15 km per second on its way to Pluto.[1] Thus, *New Horizons* was only able to make one pass by Pluto. It simply wasn't possible to include enough fuel in such a spacecraft to slow it down enough to orbit Pluto or make more than one pass. The *New Horizons* spacecraft is said to be about the size of a grand piano and is packed with a variety of scientific instruments. There is an ultraviolet imaging spectrometer for gas measurements, a special multispectral imaging system for various mapping operations, an infrared spectrometer, a radiometer (for gas measurements), a solar wind detector, a particle spectrometer, a dust collector, and a very high resolution CCD imager with a telephoto lens for taking high quality photos.

The Pluto system

Pluto has five known moons that orbit it as well as other small objects that orbit the sun in or near its orbit (called Plutinos). The largest object orbiting Pluto is Charon (pronounced like 'Sharon'). Pluto and Charon both orbit a centre of gravity located about one eighth the distance from Pluto to Charon. Pluto has a spin axis tilted 122.5 degrees relative to the ecliptic plane (defined by earth's orbit), making it oriented similar to Uranus.[2] Pluto's orbit around the sun is inclined by about 17 degrees with respect to the ecliptic. Charon orbits Pluto with the same orbital period as the spin period of Pluto—approximately 6.4 earth days.[2]

Significant discoveries have already been made by *New Horizons* regarding Pluto and Charon, though data will continue to be transmitted back to earth for months. There are interesting gas phenomena occurring on Pluto and there is evidence of geological activity on the surface. On 10 July 2015, before its closest approach, the NASA team posted a news release saying "Houston, we have geology".[3] This is a loaded statement that implies surprise and challenges to prior assumptions about Pluto. Pluto has often been compared to some of the icy moons of the outer solar system, especially Triton (at Neptune). Scientists have tended to assume that small objects would lose their internal heat after over four billion years and thus they could not still be geologically active. When they are found to be active, it is often assumed that the energy to drive geological processes comes from tidal heating from the planet the moon orbits. But Pluto is not a moon and thus tidal effects cannot be a source of internal heat. In a solar system only several thousand years old, energy could still be dissipating from creation. Scientists may try to appeal to radioactive minerals heating Pluto, but being a relatively small body with a density less than 2.0 g/cm^3, radioactive isotopes are likely to be in short supply. (Note that Pluto was redefined to be a 'dwarf planet' in 2006 by the International Astronomical Union.[4]) Following are some of the important things observed at Pluto by the *New Horizons* spacecraft. Note that these are early results and much more data will be received from the spacecraft in coming months.

- Pluto is losing very large quantities of nitrogen into space. In a NASA Media Briefing on July 17, 2015 one of the researchers said an early estimate was that 500 tons of Nitrogen were escaping Pluto every hour.
- Pluto was found to be somewhat larger than previous estimates. It's diameter is now measured as 2,370 km.[5] This means its density has been revised downward and it has more ice than previously thought.
- The surface has a variety of 'zones' of different characters. There are dark regions along its equator that have more craters, and yet much of the surface is covered with ice and possesses few craters.
- There are other mysterious structures on part of the surface thought to be mounds bounded by crevices. These are referred to by geologists as 'polygonal features'.
- Pluto has mountain ranges. One of the ranges has been compared to earth's Rocky mountains and another to the Appalachian mountains in height. These mountains are believed to be made of water ice.
- Charon (measured to be 1,208 km in diameter) also has an icy surface

that is geologically interesting. It has large canyons and varied terrain.

Ices present on the surface include nitrogen, carbon monoxide, methane, and ethane with nitrogen being the most abundant. (Solid ethane was detected on Pluto in 1999 by the Subaru telescope, with its infrared spectrometer.[6]) The ices on Pluto tend to sublimate (turn directly to gas), especially nitrogen and carbon monoxide. The gases may move across the surface, possibly in a seasonal manner. There may be nitrogen or organic snow. Since Pluto's orbital period is 248 earth years, surface and gas processes probably vary over periods of several decades, as Pluto traverses its orbit.[7] Hazes were observed by *New Horizons* at altitudes of approximately 120 km above Pluto. This puts hazes at a higher altitude than existing models support, according to one scientist.[8] Organic compounds could form from ultra-violet light driving chemical reactions in the gases above the surface and the products from these reactions could make a dark deposit on the surface. As of this writing, without the detailed spectra, it is uncertain what the dark material on the surface is but scientists tend to assume it is a mixture of organic ices, probably including tholins. There is also a dark region near the North Pole of Charon but little data is available on this as yet.

Pluto's surface includes light regions where ice appears fresh as well as dark areas. Some areas have significant topography, with mountains up to to 3,500 m (11,000 ft) in height (figure 2). A large circular or heart-shaped white region (figure 1) has been named the Tombaugh Regio after Clyde Tombaugh, who discovered Pluto. The dark regions on the surface seem older since they possess more impact craters. But much of the surface shows very few craters, which again implies geological activity or some resurfacing phenomena at work. In a region on the edge of the Kuiper belt with a number of small objects in its vicinity including Pluto's five known moons, Pluto was expected to possess more craters. Ice layers on the surface may also be moving. There are also round or polygonal structures on the surface that have apparently been filled with ice. The 'polygonal features' have been seen on other bodies in the solar system, such as near Mars' polar caps. There has been significant debate by geologists on the origin of these structures. They are not likely to be impact structures, but may suggest uplift from below, or perhaps contraction of blocks of ice, or perhaps even convection phenomena under the surface.

Figure 1. Mosaic of Pluto from the *New Horizons* spacecraft, taken 13 July 2015 from a distance of 768,000 km. Prominent 'heart' shaped region is the Tombaugh Regio. NASA/Johns Hopkins University Applied Physics Laboratory/Southwest Research Institute.

Conclusions

When something new is discovered or seen for the first time, such as the photos of Pluto from New Horizons, it is natural for there to be some speculation from both scientists and others about implications of the new information. Both evolutionists and creationists have a tendency to interpret things in terms of their own world view. Thus secular scientists look at the surface of an object in our solar system like Pluto, with few craters and they may say it has a 'young' surface. But to someone with a secular evolutionary viewpoint, 'young' may mean a few hundred million years, based on models of cratering rates, for example. But to a young-age creationist, 'young' means only several thousand years. A secular scientist may not assume Pluto formed when the solar system formed, necessarily, but they will assume a much older age than a young-age creation viewpoint. To a scientist, age assumptions then determine the kind of processes that are considered to be likely for explaining the object. In my experience, if there is good quality data, over a period of years research tends to expose problems with evolutionary scientific models. Thus, for Pluto, creationists should watch

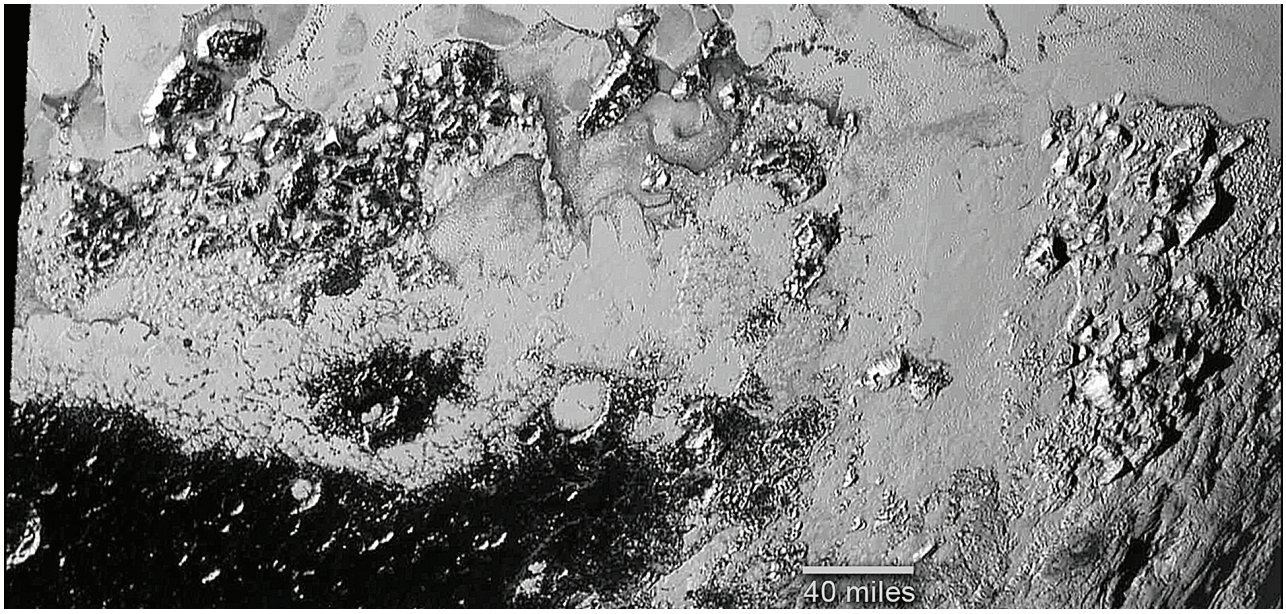

Figure 2. Mosaic close-up of Sputnik Planum area, West of Tombaugh Regio, on Pluto. Taken on 14 July 2015 from 77,000 km. NASA/Johns Hopkins University Applied Physics Laboratory/Southwest Research Institute.

the research for the next several years and see where it leads. We should not jump to conclusions too quickly based on too little information. But we can make analogies between Pluto and other similar objects we know of in our solar system, such as moons of the outer planets.

The *New Horizons* spacecraft will continue to send data back to earth for many months to come. The atmospheric and geological phenomena at Pluto are likely to challenge existing theories. Pluto is obviously an active and interesting world which has been partially resurfaced by a variety of processes. In my own research on various solar system objects, a young age creation view often has advantages in explaining surprising observations.[9,10] Energy sources such as radioactive heating, exothermic chemical reactions such as serpentinization, and electrical currents have all been considered for various moons in the outer solar system. These have often been calculated to be inadequate energy sources to explain the active processes occurring in moons such as Europa (Jupiter), Enceladus (Saturn), and Ariel (Uranus).[9] If the solar system were created only several thousand years ago, atmospheric and geological processes could still be 'active' from creation. But over billions of years some processes essentially 'run down' and thus should not be still active. This approach may be applicable to Pluto. However we must first understand better the periodic seasonal processes that may affect Pluto. Scientists and others are making comments about Pluto's surface being 'young'. It could be even younger than most scientists imagine. It is exciting that there are still surprises for us in what God created.

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