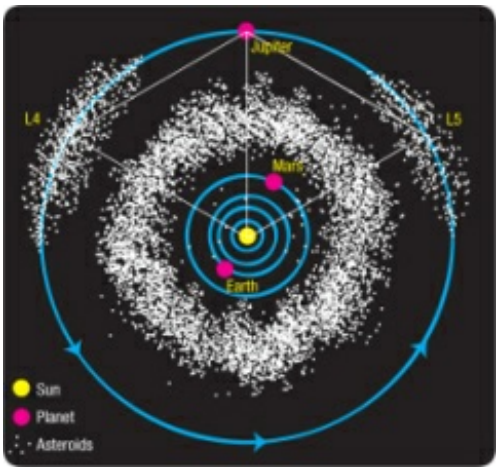
Water beyond the belt

NASA, two days ago (March 12, 2015), confirmed what planet-watchers have known for years. Ganymede, the largest moon of Jupiter, has a thick layer of ice, with an ocean beneath. Ganymede becomes the third large moon in the solar system to harbor such vast amounts of liquid water. And once again, NASA and those who work the Science Beat indulge themselves, speculating about Life Beyond Earth. Well, NASA might have good reason to find life on these three moons. But that reason would never occur to them. The subglacial oceans of Ganymede and Europa (moons of Jupiter) and Enceladus (moon of Saturn), and their respective ice coverings, likely came from Earth. And this water likely brought living things with it.



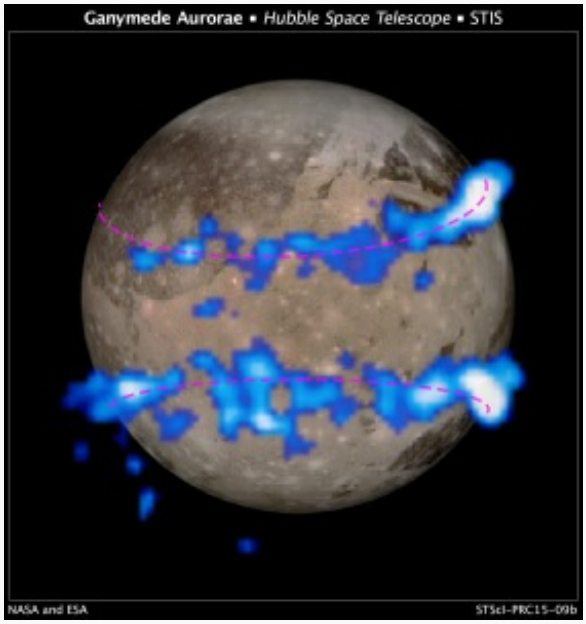
Large moons of Jupiter and Saturn

Galileo Galilei first discovered the four largest moons of Jupiter: Io, Europa, Ganymede, and Callisto, in order from innermost to outermost. The first three even have a 1:2:4 orbital resonance. All four bodies undergo tidal stresses, as does any large moon. Io comes close enough to Jupiter to pump its insides hot enough for them to melt and erupt in great sulfurous volcanoes. But Europa and Ganymede are far enough away to stay cold.

Enceladus, one of the eight largest moons of Saturn, also has a subglacial ocean. But water often spews out in jets rapid enough to turn to plasma. The ESA spacecraft Cassini confirmed this by passing through one of these jets. Cassini confirmed something else: those jets have a salt concentration similar to that of the oceans of earth.

The Christian Science Monitor yesterday carried the story of NASA's announcement about Ganymede. (Last year they also carried this story about Europa.) Ganymede, unique among planetary satellites, has a magnetic field strong enough to measure. Its magnetic field interacts with that of Jupiter. This produces auroras. These auroras tend to rock, but less than one might suppose from Jupiter's field alone. Some feature of Ganymede dampens this rocking. The most likely candidate: a subglacial ocean.

NASA calculates Ganymede has a 95-mile thickness of water ice. Deep to this lies a 60-mile-deep liquid water ocean. If those figures hold, Ganymede alone could hold more liquid water than Earth itself. Next question: where did this water come from?



NASA Hubble Space Telescope images of Ganymede's auroral belts (colored blue in this illustration) are overlaid on a Galileo orbiter image of the moon. The amount of rocking of the moon's magnetic field provided evidence that the moon has a subsurface saltwater ocean.

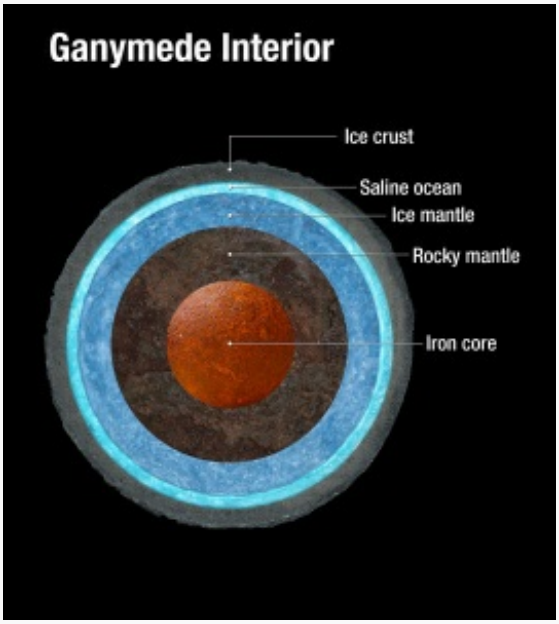
Where *did* the water come from?

Walter T. Brown (Center for Scientific Creation, Phoenix, Ariz.) has long suspected the water and ice of Enceladus came from earth during the Global Flood. He cites the composition of the plasma jets from the Enceladus south pole. He also says he believes Enceladus, as irregular as it is, is a captured asteroid.

Enceladus and Europa share surface features in common: stripe-like markings on the surface. (NASA calls these "tiger stripes" on Enceladus.) The stripes of Europa and Enceladus differ only in their apparent color. Brown believes each of these are seams where water might occasionally escape. This causes the ice to "wrinkle." The "wrinkles" show up as the stripes.

If the vast subglacial water on Europa, Ganymede and Enceladus came from earth, the original subcrustal ocean of earth held many times the volume of water in the ocean today. Brown has no problem with this. He guessed the subcrustal ocean must be three-quarters of a mile deep. It must be that deep or deeper, to hold enough water to dilute the original surface ocean 1:1. (The average deuterium-to-protium, or D:H, ratio of the comets is about 2:1.) But his Hydroplate Theory never set a *limit* on the depth of those subcrustal waters.

In fact, he said today, the deeper the subcrustal waters were, the more easily they could have cracked the fifty miles of rock that lay above them. After that, those waters could more easily have eroded the fifty-mile cliff faces for four hundred miles inland, and removed nearly thirty miles of rock from the floor and ceiling of the subcrustal (or intra-mantle) chamber. This produced a heavy jet of water, rock and mud that flew straight up into space. He estimates four percent of the earth's mass escaped on that day, fifty-three hundred years ago (give or take a hundred). The escaping mass persists as the comets, the asteroids, the meteoroids, and the trans-Neptunian objects. To that he would add the water on Enceladus, Europa, and now Ganymede.



Cutaway view of Ganymede, showing the latest inferences about Ganymede's subglacial water. Credit: NASA/ESA/STSci

Why have those waters stayed liquid? From tidal pumping. In fact Brown agrees with those who believe the icy covering of Europa is relatively thin. Which would make sense. Europa lies inside Ganymede, with a month half that of Ganymede. The orbits "pump" Europa's ocean twice as often. Naturally Europa would stay warmer than Ganymede, warm enough to keep its ice thin.

For this reason the mission controllers of the Galileo spacecraft ditched it on Jupiter, so it would never risk cracking the ice on Europa and contaminating the ocean. Brown laughs at the "ethical" reason the controllers gave for the move. But he agrees they had a valid scientific reason: any life in the waters of Europa, or Ganymede, or Enceladus, would come from earth. Better not to introduce such life more recently!

But Brown has little patience for the theory that liquid water originated beyond the "habitable zone." One should never assume even liquid water originated everywhere one might find it. Especially if the one habitable planet suffered a violent event and spewed out a twenty-fifth part of its mass to the far reaches of its system.