



Did a Mega-collision dry the interior of Venus?

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Venus is of a similar size and composition to Earth, and has a much hotter surface temperature. The strength of the near surface rocks on Venus though is estimated to be much higher (rather than weaker as expected from the hotter temperature) than on Earth; based on slow relaxation of craters, high correlation between topography and gravity, etc. Therefore I argue that the difference in strength is due to the fact that the interior of Venus is much drier than Earth, where water weakens rocks.

How is it that Earth's interior is much drier than Venus? Planets form in the final stages by the impacting together of major proto-planets. The leading idea for Earth-Moon involves a large glancing impact, which would have led to substantial, but probably not total melting. I propose that one mechanism to dry Venus is for it to have suffered a huge head-on collision of two proto-planets in its formation. The high energy of such an impact should have been enough to totally disrupt both bodies, while numerical simulations demonstrate that head-on collisions produce no satellites. As a result of the large collision water and iron would get intimately mixed and would rapidly react, releasing the hydrogen from the water. At low pressures it would be released to hydrogen gas which would be light enough to escape the assembling planet, and possibly released to iron hydride at very high pressures which would end up in the core. Therefore once the final planet assembled, its silicate portion would be virtually devoid of water. A simple test will be to see whether there are any hydrated minerals on the surface of Venus, which are predicted to be stable if they exist. If this hypothesis is correct they should be absent or very rare.