

Origin of Earth's oceans: An assessment of the total amount, history and supply of water

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Earth has liquid water on its surface, which makes the Earth unique at least in our solar system. The presence of water on Earth has played important roles in shaping the solid regions of the planet as well as in the origin and evolution of life. Here we address the following three fundamental aspects of Earth's water [1]; (1) the quantity of water on the surface and in the interior that Earth possesses, (2) the length of time that surface oceans have been present, and change in the ocean volume throughout the Earth's history, and (3) the mechanism(s) by which this water was supplied or generated. The water content in the Earth's mantle can be estimated to be from one to ten times the present ocean mass [2]. Although it is difficult to estimate the water content in the Earth's core, recent high-pressure experimental work indicates copious amounts of hydrogen in the core [3]. We discuss how the water amounts in each budget were determined through study on the cooling process of magma ocean [4]. The Earth's surface oceans appear to have existed since very early in the Earth's history, perhaps even since the Earth's formation [5]. Several possible water sources and supply mechanisms have been proposed [6,7], in association with theories regarding planet formation in our solar system. Here we review the above issues related to the origin of Earth's ocean together with our works [8,9].

[1] Genda (2016) *Geochem. J.* **50**, 27–42. [2] Hirschmann (2006) *Annu. Rev. Earth Planet. Sci.* **34**, 629–653. [3] Nomura et al. (2014) *Science* **343**, 522–525. [4] Hamano, Abe, Genda (2013) *Nature* **497**, 607–610. [5] Wilde et al. (2001) *Nature* **409**, 175–178. [6] Morbidelli et al. (2000) *Meteorit. Planet. Sci.* **35**, 1309–1320. [7] Ikoma & Genda (2006) *Astrophys. J.* **648**, 696–706. [8] Genda & Ikoma (2008) *Icarus* **194**, 42–52. [9] Genda & Abe (2005) *Nature* **433**, 842–844.