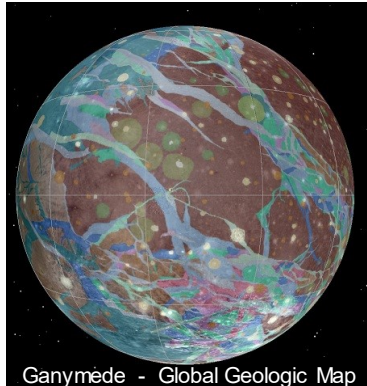


Introduction : The cause of global Expansion Tectonics : A global impact event and a mantle that contains volatiles, in particular water/ice

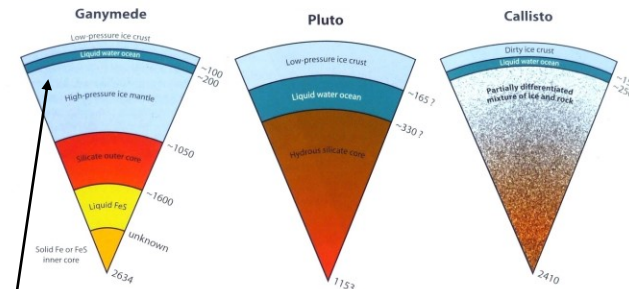
High concentrations of volatiles in the mantle of certain planets & moons may be the driving force for their rapid expansion, after a global impact event has caused extensive fractures in their crust. → The global impact event and the fractures in the crust are the trigger, which initiate the expansion of the planet or moon through abrupt decompression of the mantle. Then the **volatiles** in their **mantle** e.g. **CO₂, H₂, SO₂, H₂S...** → **but especially H₂O (ice)** cause the rapid expansion of the mantle, and the formation of ice-crusts, oceans & atmospheres on the surface. → as seen on **Earth, Mars, Ganymede, Enceladus & Pluto** etc. (see this study !). The **H₂O** may be present in different shells of high-pressure-ice (e.g. **Ice-X & -XI**) or present as water in the mantle, and it may go through a phase-transition, e.g. towards an ice-type with a lower density, after the impact event !



Ganymede - Global Geologic Map

Jupiter's moon Ganymede is definitely one of the most obvious examples of global expansion tectonics. **It is easy noticeable that the (old) brown colored areas represent fragments of a sphere which drifted away from each other !** The fragments of these shattered (older & smaller) sphere seem to get pulled apart from each other by an expanding sphere (→ the expanding mantle) underneath. The cause of the fractures in the old (brown-colored) crust and the trigger of the expansion tectonics was a global impact event ! (see page 20 in this study !) And the substance which is driving the obvious expansion of the moon must be **H₂O** ! Because the mantle of Ganymede mostly consists of Water & Ice in the state of different high pressure ice-types (**I - XI?**) ! (see diagram & P.20) The expansion only slightly increases the moon's moment of inertia

Figure 3.15 Idealized interiors of selected icy bodies (depths in kilometres). Comparatively minor differences in history, composition, and location have produced a wide range of internal structures and geological processes in the larger satellites and dwarf planets. (Various sources.)

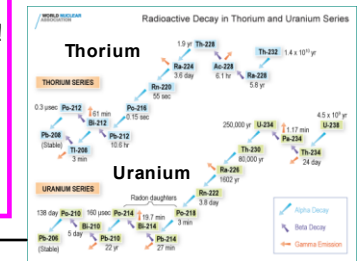


Inner structure of Ganymede, Pluto & Callisto

Table 2.5 : Average Chemical Composition in % of Continental and Oceanic Crust

	Continental Crust			Oceanic Crust
	Upper	Middle	Total	
SiO ₂	66.3	63.5	53.4	60.6
TiO ₂	0.64	0.69	0.82	0.72
Al ₂ O ₃	15.4	15.0	16.9	15.9
FeOT	5.04	6.02	8.57	6.71
MgO	2.48	3.59	7.24	4.66
MnO	0.10	0.10	0.10	0.10
CaO	3.59	5.25	9.59	6.41
Na ₂ O	3.27	3.39	2.65	3.07
K ₂ O	2.80	2.30	0.61	1.81
P ₂ O ₅	0.15	0.15	0.10	0.13

Composition of Earth's mantle in weight percent			
Element	Amount	Compound	Amount
O	44.8		
Mg	22.8	SiO ₂	46
Si	21.5	MgO	37.8
Fe	5.8	FeO	7.5
Ca	2.3	Al ₂ O ₃	4.2
Al	2.2	CaO	3.2



The number of atoms increases during radioactive decay !!

Important indicators which support the Expansion Tectonics Hypothesis (→ see description below) :

- 1) Earth's mantle contains **0,5 – 2 wt% H₂O** . But because the mass of water (H₂O) in the mantle is poorly constraint, the real value could be much higher !
- 2) A comparison of Earth's **mantle** with the mantle of other planetary bodies with high concentrations of H₂O on their surfaces (see diagram), indicates that the **wt% of H₂O in Earth's mantle** maybe considerably under-estimated !
- 3) Different analyses indicate that Earth's radius is expanding with 4 to 15 mm/y This means Earth's diameter increased by **2000-7500 km** in the last **250 Ma** !
- 4) The 12 km "**Kola super-deep Borehole**" showed that at depths >7 km the rock is extremely fractured and saturated with H₂O & Hydrogen from deeper sources !
- 5) The **H₂O** in Earth's mantle may be **super-critical** & behave like a gas ([Study1](#), [http://](#))
- 6) **Helium-3** and **Tritium** detected on Mauna Loa / Hawaii indicate the production of **Hydrogen-3 (Tritium)** by **ternary fission** in Earth's core. See : <https://books.google>

Other interesting information: [Study1](#), [Study2](#), [Study3](#), [Study4](#), [Study5](#), [Study6](#), [Study7](#), [Study8](#), [Study9](#)

Hypothesis : → A scenario for the expansion of a mantle, which is causing Global Expansion Tectonics :

- 1.) First we consider a crust of a planet or moon which is stable (→ undamaged by big impacts) for a long time period (> 200 Ma). Underneath this stable crust, which is acting like the wall of a pressure vessel, **volatiles** accumulate within the **mantle** material over a long time. These volatiles may be produced by different processes inside the mantle. At the beginning the mantle material of the planet or moon contains these volatile components in a dissolved state. However, pressure and temperature in the mantle increase over time, because more and more volatiles accumulate within the mantle material, and because **radioactive decay** is constantly adding heat. The solubilities of the volatiles depend on pressure, temperature and the composition of the mantle material. When solubility decreases below volatile concentration, the volatiles will start to exsolve and start to expand the mantle material.
- 2.) At this point the mantle material is super-saturated with these volatiles. And with further increasing pressure within the mantle material, finally the point will be reached where the pressure in the mantle exceeds the pressure caused by the **lithostatic load** (weight) of the crust. This is the point when tensile stress will start to build up inside the crust material of the planet or moon, which allows the pressure within the mantle to increase even further ! (→ like in a pressure vessel). This build-up of stress in the crust can go so far, that the crust is close to fracturing through tensile stress ! In this state the crust will be very vulnerable to impact events !! The **extremely fractured rock** found at depths >7 km maybe proof of this !! (Note that Earth's mantle contains at least 0,5 - 2 % H₂O !)
- 3.) If one or more large impactors are hitting the crust of the planet or moon in this state, the fracturing of the crust will be particularly extensive because it was already close to fracturing through increased tensile stress. And as soon as the crust is fractured by the impact(s) the mantle material will start to expand rapidly. Because volatile solubility in the mantle material (**magma**) decreases through the rapid pressure drop in the mantle, caused by the fracturing of the crust, more and more gas will exsolve !! And the mantle expands faster and faster because of the expanding mantle material. Heat from the impact event is contributing to this process !
- 4.) A self-accelerating process is initiated which only stops when a new equilibrium is reached between the decreased pressure in the mantle and the pressure produced by the new (thinner) overlying crust, which is caused mainly by gravity and not by the constraint of a closed spherical shell (a pressure vessel wall) anymore. Because of the expansion the mantle-density dropped considerably

Expansion Tectonic Earth models :

From **James Maxlow** & other geologists and geo-physicists which support this Theory :

Web-Links : [L1](#), [L2+L3](#), [L4](#), [L5](#), [L6](#), [L7+L8](#), [L9](#), [L10](#)



Isotope	Heat release [W/kg isotope]	Half-life [years]	Mean mantle concentration [kg isotope/kg mantle]	Heat release [W/kg mantle]
²³⁸ U	9.46 × 10 ⁻¹¹	4.47 × 10 ⁹	30.8 × 10 ⁻⁶	2.91 × 10 ⁻⁶
²³⁵ U	5.69 × 10 ⁻¹¹	7.04 × 10 ⁸	0.22 × 10 ⁻⁶	1.25 × 10 ⁻⁶
²³² Th	2.64 × 10 ⁻¹¹	1.40 × 10 ¹⁰	124 × 10 ⁻⁶	3.27 × 10 ⁻⁶
⁴⁰ K	2.92 × 10 ⁻¹¹	1.25 × 10 ¹⁰	36.9 × 10 ⁻⁶	1.08 × 10 ⁻⁶