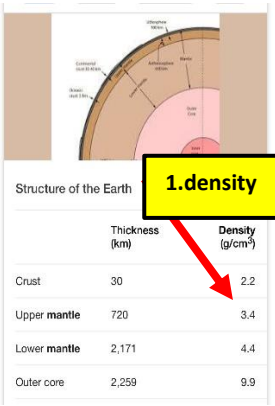
FLUIDS

Unit 18, Dr. John P. Cise, Professor of Physics, Austin Com. College, Austin Tx. USA

jpcise@austincc.edu , & New York Times, August 15, 2019, by Jo Ann Klein. Dedicated to GeoCivil Engineer Stephen McLandrich

In Super-Deep Diamonds, Glimmers of Earth's Distant Past

We can't dig to the center of the Earth, and we can't time travel. But if the universe could grant a consolation prize, it would be a super-deep diamond. **These sturdy, rare minerals travel hundreds of miles from Earth's mantle**, where they form, to the crust, where they are discovered. Along the way, they trap history in microscopic flaws. "Super-deep diamonds are just time capsules, basically," said Suzette Timmerman, a geochemist at Australian National University. She and her colleagues recently analyzed a set of super-deep diamonds from Brazil and found, preserved within them, helium from Earth's primordial past. Their work, published in Science on Thursday, is a further step toward understanding how the planet evolved since its coalescence from bits of rock and gas some 4.54 billion years ago. The finding also adds to the allure of diamonds: They are forever, and they are made entirely of the past.



1.density

2. Pressure(P) needed.

Under the duress of approximately 725,000 pounds per square inch, and at temperatures of 2000 – 2200 degrees Fahrenheit, a **diamond** will begin to form. The carbon atoms bond together to form crystals under this high **pressure** and temperature. Sep 15, 2016

Diamonds are formed deep within the **Earth** about 100 miles or so below the surface in the upper mantle.

3. Depth(h) in Mantle to form diamonds.

Diamonds from the Juína area of Brazil. Most formed in the mantle's transition zone, between 254 and 410 miles down.CreditGraham Pearson. Earth's mantle, some 1,800 miles thick, begins about 25 miles down and is sandwiched between the thin outer crust and the dense, iron core. This ancient rock stuffing makes up more than three-quarters of the planet's volume. But because it is inaccessible, scientists know little about it. Seismic studies have revealed how a convection current within the mantle allows its contents to circulate. Ocean island basalts — rocks that cooled after volcanic eruptions of magma from the mantle — have offered hints of the mantle's chemical composition. But neither source has revealed what the mantle is made of at any particular depth. That is partly because basalt is a cooled mixture of elements collected during its molten travels. It cannot be parsed. But a diamond does not change physically or chemically on its journey, and whatever it collects can be studied in isolation. **Diamonds form at different depths. As they do so, they trap minerals and fluids that contain carbon, water and noble gasses,** capturing snapshots of those environments. These "inclusions" are the flaws that make diamonds cloudy. For earth scientists, they are precious — microscopic parcels of ancient elements from specific times and places, perfectly preserved and protected.

Most diamonds form 100 miles or so below the surface.

INTRODUCTION: Pressure under any fluid(water, earth, air,…..etc.) is p = ρgh = Dh , where ρ = mass density, g = acceleration of gravity, h = depth, D = ρg = weight density. D_{MANTLE} from 1 above = 3.4 grams/cm.^{3} where 1 gram/cm.^{3} = 62.4 lb./ft.^{3} , from 3(upper right) h = 100 miles where 5280 ft./mile. 144 in.^{2} / ft.^{2}

QUESTIONS: (a) Find D_{MANTLE} in lb./ft.^{3} ?, (b) Convert 100 mile depth into ft.?, (c) Find pressure p in mantle (in units of lb./ft.^{2}) at depth of normal diamond formation at 100 miles?, (d) Find p in mantle in lb./in.^{2} ? (e) How well does your computation of p in (d) compare with Wikipedia stated pressure(see 2) needed to form diamonds?

ANSWERS: (a) 216.16 lb./ft.^{3}, (b) h = 528,000 ft., (c) p = 112,020,480 lb./ft.^{3} , (d) p = 777,920 lb./in.^{2}, (e) Wikipedia Article(see 2 above) said pressure needed to form diamonds was 725,000 lb./in.^{2}. Thus, computed pressure in (d) was a good approximation to said pressure needed to form diamonds at 100 miles deep in mantle.