would simply carry the waters of the ocean up and down with it, and there would be no sensible tidal rise and fall of water relatively to land.[61] Prof. G. H. Darwin, in the series of papers already referred to, has investigated mathematically the bodily tides of viscous and semi-elastic spheroids, and the character of the ocean tides on a yielding nucleus.[62] His results tend to increase the force of Sir William Thomson's argument, since they show that "no very considerable portion of the interior of the earth can even distantly approach the fluid condition," the effective rigidity of the whole globe being very great.

(*c.*) Argument from relative densities of melted and solid rock.—The two preceding arguments must be considered decisive against the hypothesis of a thin shell or crust covering a nucleus of molten matter. It has been further urged, as an objection to this hypothesis, that cold solid rock is more dense than hot melted rock, and that even if a thin crust were formed over the central molten globe it would immediately break up and the fragments would sink toward the centre.[63] Recent experiments show that diabase (of density 3·017) contracts nearly 4 per cent on solidification, and that the resulting homogeneous glass has a density of only 2·717.[64] As has been already pointed out, the specific gravity of the interior is at least twice as much as that of the visible parts of the crust. If this difference be due, not merely to the effect of pressure, but to the presence in the interior of intensely heated metallic substances, we cannot

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[61] Lord Kelvin, Brit. Assoc. Rep. 1876, Sections, p. 7.

[62] Phil. Trans. 1879, Part 2. See also Brit. Assoc. Rep. 1882, Sects. p. 473.

[63] This objection has been repeatedly urged by Lord Kelvin. See Trans. Roy. Soc. Edin. xxiii. p. 157; and Brit. Assoc. Rep. 1870, Sections, p. 7.

[64] C. Barus, Phil. Mag. 1893, p. 174. It is nevertheless true that, from a cause merely mechanical, pieces of the original cold rock, though so much denser, will float for a time on the melted material. Ib. p. 189.