sustained the same conclusion, stating that "if it were true that the earth is a fluid ball coated with a crust, that crust must be of fabulous rigidity to resist the tidal surgings of the subjacent fluid" (1888). At the same time, according to the same authority, the weight of the water of a high flood-tide probably occasions, owing to the elasticity of the crust, "a local elastic yielding along the coast-line of continents"; and "there is reason to believe that such flexure has actually been observed by a delicate form of level on the coast of the Bay of Biscay." Newcomb favors the same conclusion in a paper discussing the cause of the periodic variations of latitude (1893).

O. Fisher, of Cambridge, England, questions the above conclusion from the tides (1892). Basing his mathematical calculations on an investigation by Darwin of the tides upon a yielding earth according to the canal theory, he obtains the result, that the height of the tide for a liquid earth would be only a fifth less than that for a rigid earth, and suggests, as the difference is so small, that the existing tides may have just the height appropriate to a liquid interior. He observes, further, that the heat generated within the earth by the tides in the earth's mass from their commencement — calculated by Darwin to be sufficient "to give a supply of heat, at the present rate of loss, for 3560 millions of years" — would have been only to a small extent expended or wasted, and that, through convection currents, it keeps the liquid layer in fusion, and prevents the crust from growing thicker. Other considerations have led Fisher to make the thickness of the crust about 18 miles. The conclusion of Fisher is objected to by G. F. Becker, on the basis of calculations which lead him to the conclusion that "for a fluid earth the canal theory and the equilibrium theory give the same result, viz.: no relative tide." He adds, that "on any theory of the tides, the existence of semi-diurnal tides indicates an earth presenting great resistance to deformation" (1893).

2. *Earth-shaping.* — Whether solid to the surface or not, the earth is believed to be so far fluid-like in its mass as to admit of adjustments to gravitational pressure through molecular flow, if not through a liquid layer, and to owe its shape primarily to the principle of gravitational equilibrium, as if liquid. This view of adaptation to gravitational pressure was recognized geologically by Herschel in his Appendix to Babbage's Ninth Bridgewater Treatise (1837), where he attributed changes of level to "changes in the incidence of pressure on the general substratum of liquefied matter which supports the whole," and argued therefrom that the rise in level going on in Scandinavia might be caused by the accumulation of sedimentary deposits over the adjacent ocean bed. The earth's interior liquidity was then generally admitted. In 1888, C. E. Dutton proposed the term *isostasy* for "the condition of equilibrium to which gravitation tends to reduce a planetary body irrespective of whether it be homogeneous or not," that is, whether solid to the surface or partly liquid beneath it, and whatever its constitution.

The rate of adjustment to changing load would necessarily be very slow in a solid globe, in which it could take place only through molecular flow in