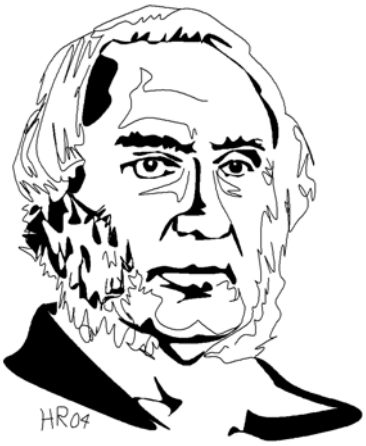
i4 Explanations of geotecture < buckling or drift? >

Even excellent Homer nods. —a line from Horace that became an axiom (used when, what is promoted is seen to have little to support it except that the establishment is presumed to approve).[1]

Alfred Wegener found more than coincidental, as had others, that the continental margins either side of the Atlantic match "as closely as the lines of a torn drawing would correspond if the pieces were placed in juxtaposition." The inference was that Atlantic ocean basin is an enormously widened rift. Cited as evidences of force-driven continental drift were 1) compressional features: the Cordilleran-Antillean fold mountains, which a westward push of the Americas could explain, and 2) tensional features: the oceanic trenches in the western Pacific, which a westward pull of Asia could explain. This was at a time when the geologists were reaching a consensus that orogeny, in all its instances, was evidence of a contracting Earth. Contraction theory (which tacitly presumes a young Earth for otherwise rock-creep relaxation of elastic strain makes nonsense of its notions), formulated in America by James Dana in 1847,[2] and in Europe by Léonce Élie de Beaumont (1798-1874),[3] explains that like the wrinkling of a drying apple, episodic crustal bucklings are due to Earth's cooling and shrinking. Continents emergent above sealevel, reveal Earth's crust to be sial. Presumably, the same sial is concealed beneath the oceans where it is down-buckled. Minority opinions for lateral displacement were in 1880 [4] by Heinrich Wettstein and independently in 1881 by Dutton—who was persuaded by **Osmond Fisher**'s (1817-1914) geophysical arguments[5] that a cooling shrinkage Earth are insufficient to explain the known compression of sedimentary sequences that their folding evidences. Indeed, nor is explained the lesser shortening by large-scale buckling that supposedly has made the land visible by raising it and has hidden the ocean floor by lowering it. To quote Mott. T. Greene: "The amount of shortening that the earth's radius would require, if it were the cause of all folding, was more than 700 miles. By assuming that the [oceanic] crust was more dense [rigid] than the continents, the radial shortening could be reduced by an order of magnitude, to a figure as small as 42 miles; this, however, was still too vast."[6]



Eduard Suess' influential textbook *The Face of the Earth*, compiled 1904 to 1909, standardized the contraction-buckling model. Its appeal was that flexings could account for onlap, lateral shifting, and offlap of epeiric seas and, at greater amplitude, for emergence or foundering of continents. In the extreme, fold mountains in orogenic belts were the result of irreversible crumplings.[7] In the contraction-buckling model, continent and ocean seesaw to replace each other. So the existence of deltaic sediments shed onto the present continents from directions of where there are now deep oceans can be explained easily. Also, to account for species distributions, land bridges can be made to appear or disappear on cue by buckling. Therefore, the paleontological record of the distributions of evolving species that suggests migration or isolation, poses no special problem.

Even as the concept of a cooling and shrinking Earth, as in Harold Jeffreys *The Earth*, 1924,[8] became ever more reasonable for its explanatory power, discovered radioactivity fomented a revolution. Heat produced by decay of radioactive elements in rock was a brutal fact that would not go away. With slowed cooling, the solid Earth has likely shrunk about 5%. Not to worry; Earth *expansion* (***Figure i4.1***) had become the theme of many papers, beginning with Roberto Manotvani's thought in 1889 [9] and map in 1909 [10] of this to account for the similarity of opposing Atlantic coasts. The Atlantic is like a let out seam in the clothing of a more corpulent Earth. In 1908, John Joly concurred that radioactive heat slows Earth's cooling and in 1925 [11] proposed that mountains result from vertical forces produced by radioactive heat.[12] In 1956, S. Warren Carey (were that he had been as Frege (***Footnote i4.1***) was!) began to champion the (false) Earth-expansion

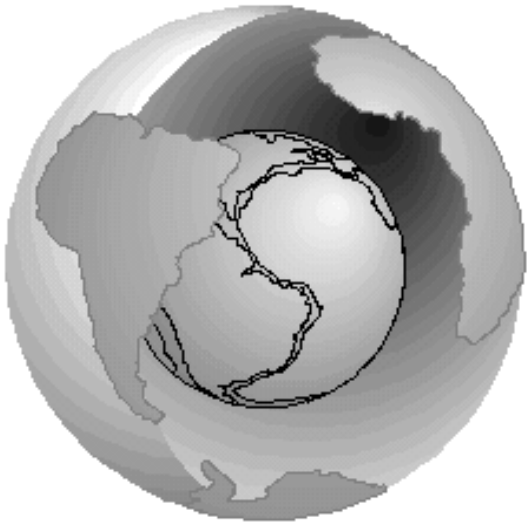
hypothesis to explain geotecture (and still did in: *Earth, Universe, Cosmos,* 2001).[13] Antithetically, the (inadequate and false) contraction theory was taught with conviction until the 1960s, early by geotectonicians Marcel Bertrand, T. C. Chamberlin and, when German professors were more formidable than God, by L. Kober [14] and H. Stille [15] who also stressed cratonic vertical-movements. Literature to explain Earth's geotecture was vast, diverse, and ingenious indeed when Lamoraal Ulbo De Sitter (1902-1980) in 1956 had warned in his now classic book *Structural Geology*: "Before we start on this excursion into the realm of conjecture I should like, however, to point out the extremely flimsy grounds on which such theories [on the causes of orogeny] are built. First of all we have seen hardly anything of Earth's crust below a depth of 2 km; secondly, only one third of the globe is open to geological investigation—the rest is ocean ..." [16] ❑

Footnote i4.1 **Grace under error** (*Excerpted from an essay by* Peter Tauber)

When the English mathematician and logician Bertrand Russell was working on his *Principia Mathematica*, he discovered a small problem with the work of his German colleague Gottlob Frege, and delicately so informed him. When Russell's letter reached him, Frege was putting the finishing touches on the second volume of a massive effort to build arithmetic from the principles of logic. Frege replied: 'Your discovery of the contradiction caused me the greatest surprise and, I would almost say, consternation, since it has shaken the basis on which I intended to build arithmetic.' Sixty years later, Russell wrote, 'As I think about acts of integrity and grace, I realize that there is nothing in my knowledge to compare with Frege's dedication to truth.'[17]

Figure i4.1 **A geometer's demonstration of Earth expansion (a false notion)**

S. Warren Carey, in the early 1950s, developed a convection theory of continental drift that was strikingly similar to the Hess-Dietz model of seafloor spreading proposed a decade later. However, in 1955 [18] he verified by a rigorous projection on the globe, the close 'fit' between South America and Africa (a decade before Bullard, who acknowledging Carey's priority, when he found for the same using a computer), but in making that fit "a yawning gulf appeared between Indonesia and Australia [that] belonged together." For such geometric reasons, Carey abandoned the "assumption that the Earth of Pangaea was the same size as the Earth today." He had found that, without distorting them, the continents fit neatly, as a mosaic, on an initially small-radius globe. Corroborating geological evidence that Earth has expanded since, is marshaled hopefully in *The Expanding Earth* 1976,[19] and belligerently (but did not Nietzsche say, "Convictions are more dangerous enemies of truth than lies"?) in *Theories of Earth and Universe: A History of Dogma in the Earth Sciences*,1988.[20] In the expanding-Earth hypotheses, continents separate by purely vertical movement and ocean floors spread out between. William Carnell Erickson in *Ever Since Wegener: A Brief History of the Expanding Earth Hypothesis*,1988,[21] reminds that: "According to H. W. Menard, a specialist in Pacific geology, 'the most troublesome aspect of the sea-floor spreading hypothesis was the absence of direct evidence of convergence. ... There was no problem if the Earth was expanding, but if it was not, enormous areas of old oceanic crust had to be plunging into the mantle along the line of oceanic trenches. It was generally expected that the sediment in trenches would show signs of this violent phenomena, but none could be found.'... In trench after trench, the sediments turned out to be completely undisturbed; and there were no outcrops from the subducted plates. Menard and his fellow oceanographer Maurice Ewing were mystified by all this. 'Neither of us believed for a moment in an expanding Earth, so we were left with a puzzle.'"[22]



A sketch of Klause Vogel's model [23] (at right) which showed that a, supposed, initial Earth of one half of the present radius, and with an enveloping sial crust, can be fractured into the present continents. The sial fragments are then moved radially outward. The widening gaps between these continents are filled in by a growing volume of sima, the upper surface of which is the ocean floor.

In this naïve model, 70 percent of Earth's present area (ocean floor) has come into being in the last 180 million years and seawater has emerged at a pace to keep the oceans basins filled just so. (Sensibly, there is little need to contemplate this model further.)