LETTERS TO THE EDITOR

Paul Lowman's contributions to illustrating concepts in global tectonics with world maps with Constant-Scale Natural Boundaries

Chuck CLARK, Architect
Atlanta, Georgia, U/S.A. 30307. rightbasicbuilding@gmail.com

"Hello, this is Paul . . ."

So began my introduction in 1999 to NASA's Paul Lowman. He answered his own telephone, let this outsider interrupt his work, and listened as I stammered that a colleague of his, NOAA tectonophysicist Dave McAdoo, had given me his name. I said I was an architect who had invented a novel way to make world maps, a way that seemed, even though I was not a scientist, to be well suited to current arenas of inquiry, "particularly plate tectonics."

We spoke for more than an hour, Paul intrigued by my verbal descriptions of world maps made with various types of natural boundaries, and I was intrigued by Paul's declaration that "he did not believe in plate tectonics." We mailed packets: Paul sent his Global Tectonic Activity Map and a treatise laying out his concerns with plate tectonics; I sent examples (**Fig. 1A**) of my maps, including one composed to illustrate "the Wilson cycle," a grand theory which McAdoo had described to me in detail after reviewing another of my early tectonically bound maps (**Fig. 1B**).

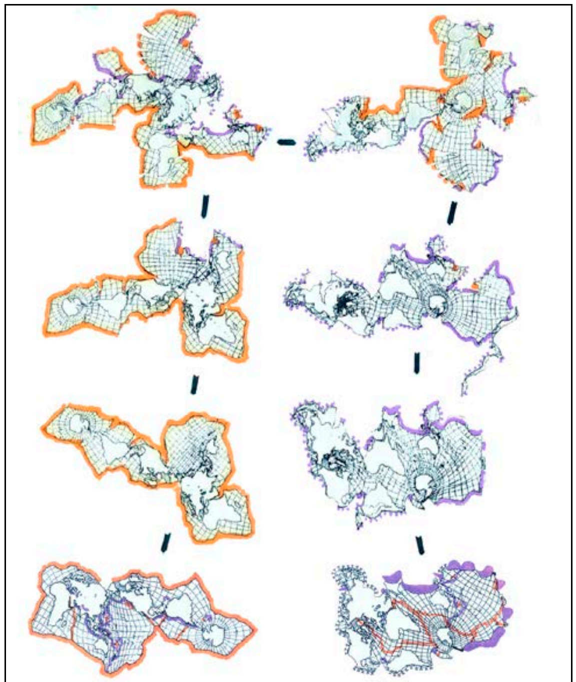

Figure 1A: Maps bounded by ridges (left) and by trenches (right)

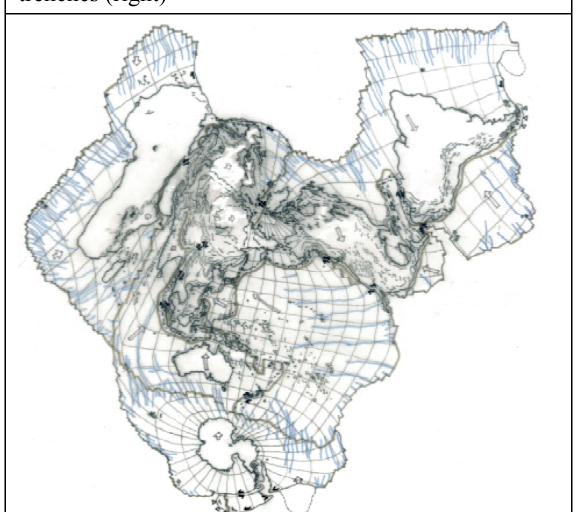

Figure 1B: Map not quite capturing the Wilson cycle

"Don't show that to McAdoo!" Paul said with jest. "It's all they need to make plate tectonics seem more plausible!" (**Fig. 2**).

Paul went on in more sober tones to counter argue for a map edged by the Pacific midocean ridge. "We know it's spreading at a much faster rate than the Atlantic ridge. It would make more sense to base the story on a map with the Pacific ridge as the edge."

I dutifully produced that map as well (**Fig. 3**), thinking that Paul would see merit in it, but no. He felt both ideas half-baked, neither one a legitimate illustration of reality. "When it all gets figured out," he offered, "we'll see that the continents have all along been pretty much where we see them now, with localized nudges and shifts."

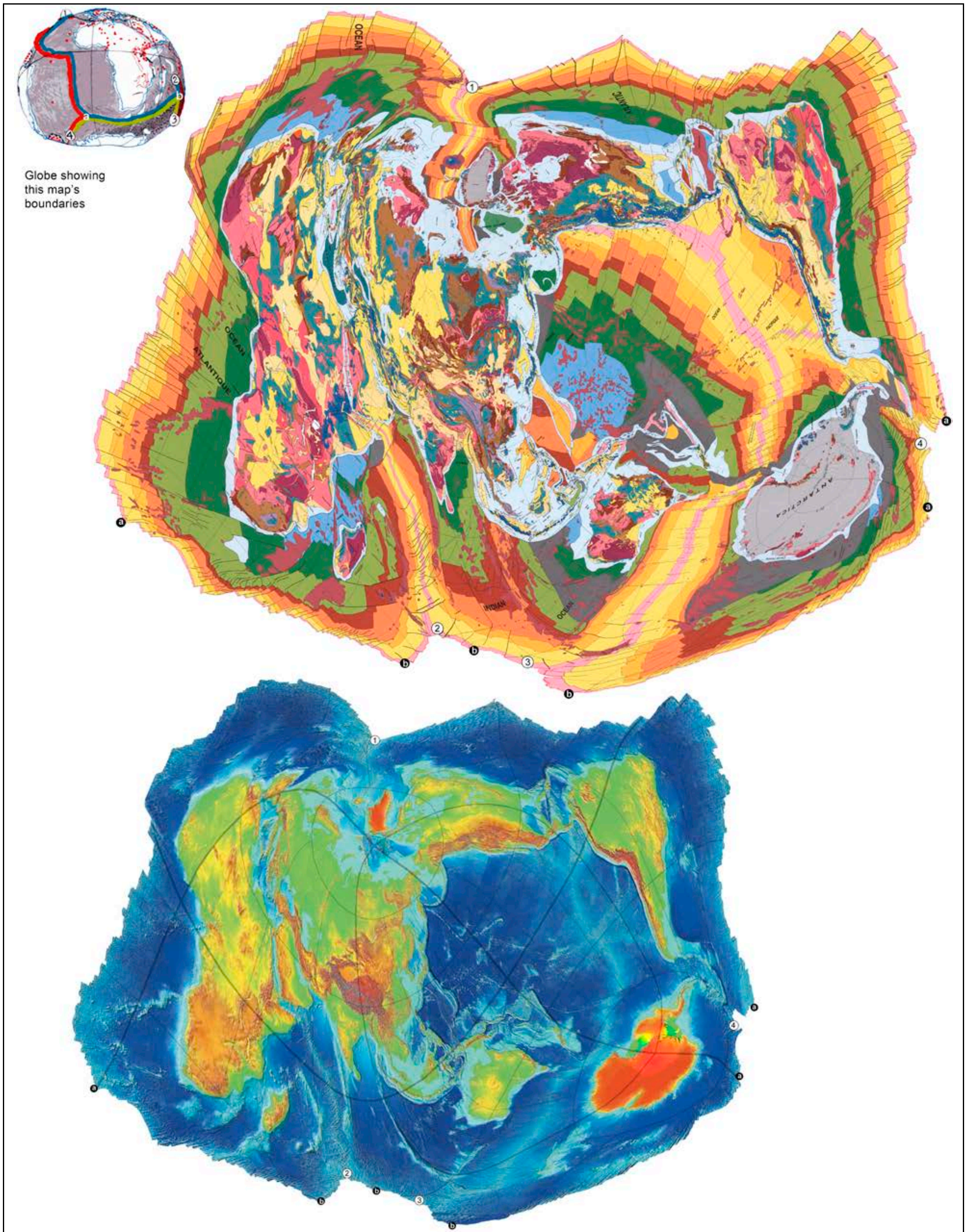

Figure 2: Map bounded by Atlantic Ocean and Indian Ocean spreading centers [2,3]

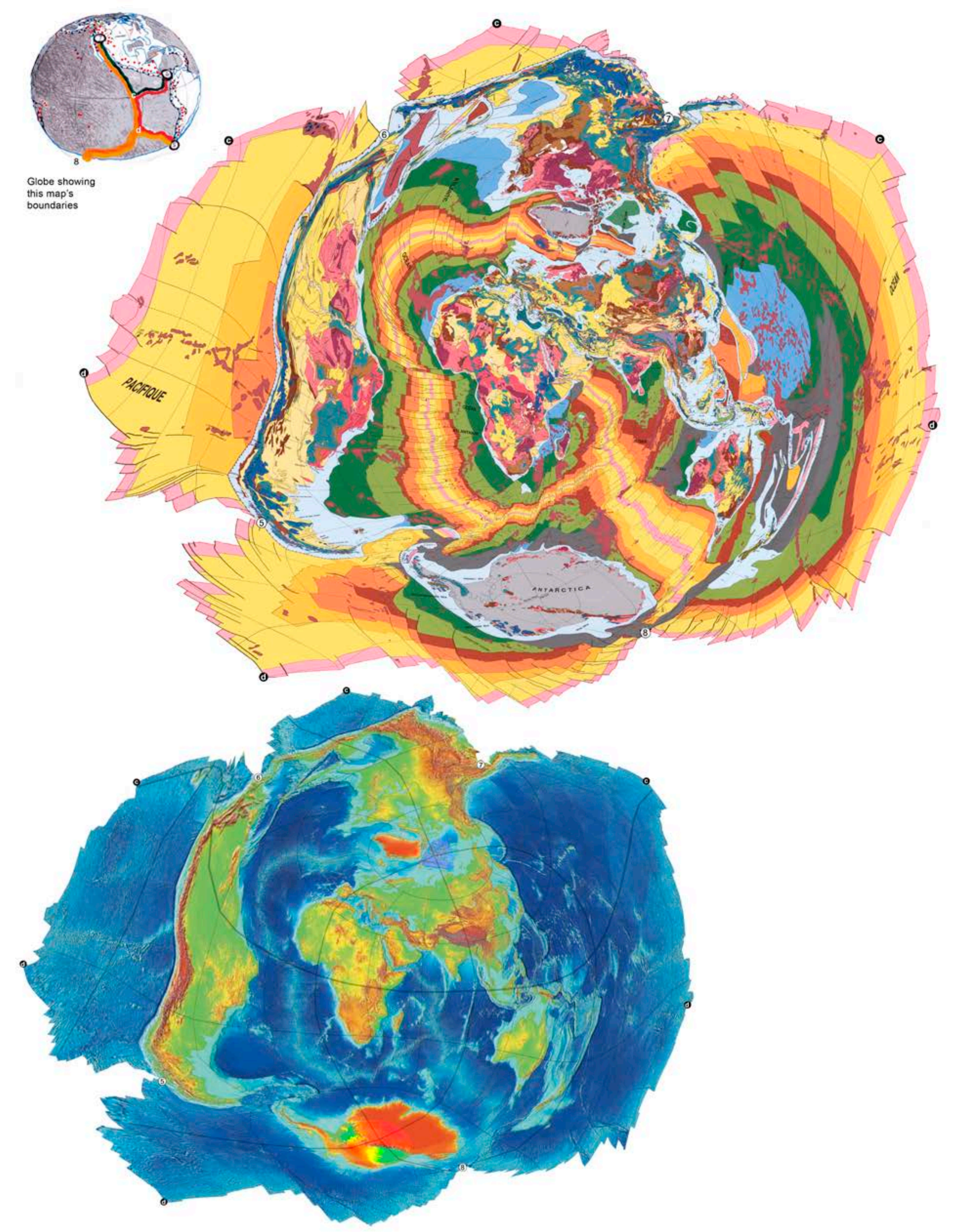

Figure 3: Map of Earth bounded by Pacific Ocean spreading centers [2,3]

I turned to the midocean ridge as a single entity, a thing impossible to visualize proportionately and uninterruptedly with orthodox map projections or with multiple views of a globe. Armed with a system that permits the map edge to follow any treelike boundary, whether extensive or limited, simple or branched, I took Paul's DTAM network and subtracted from it those lines constituting the midocean ridge—thereby ensuring that the ridge would be the map's central feature—and executed the analog plotting algorithm.

Paul was less than impressed with this effort as well (**Fig. 4**). He seemed to feel that the ridge was a relatively simple thing, compared to figuring out the continents, where the hypothesized phenomenon of subduction was not proving out.

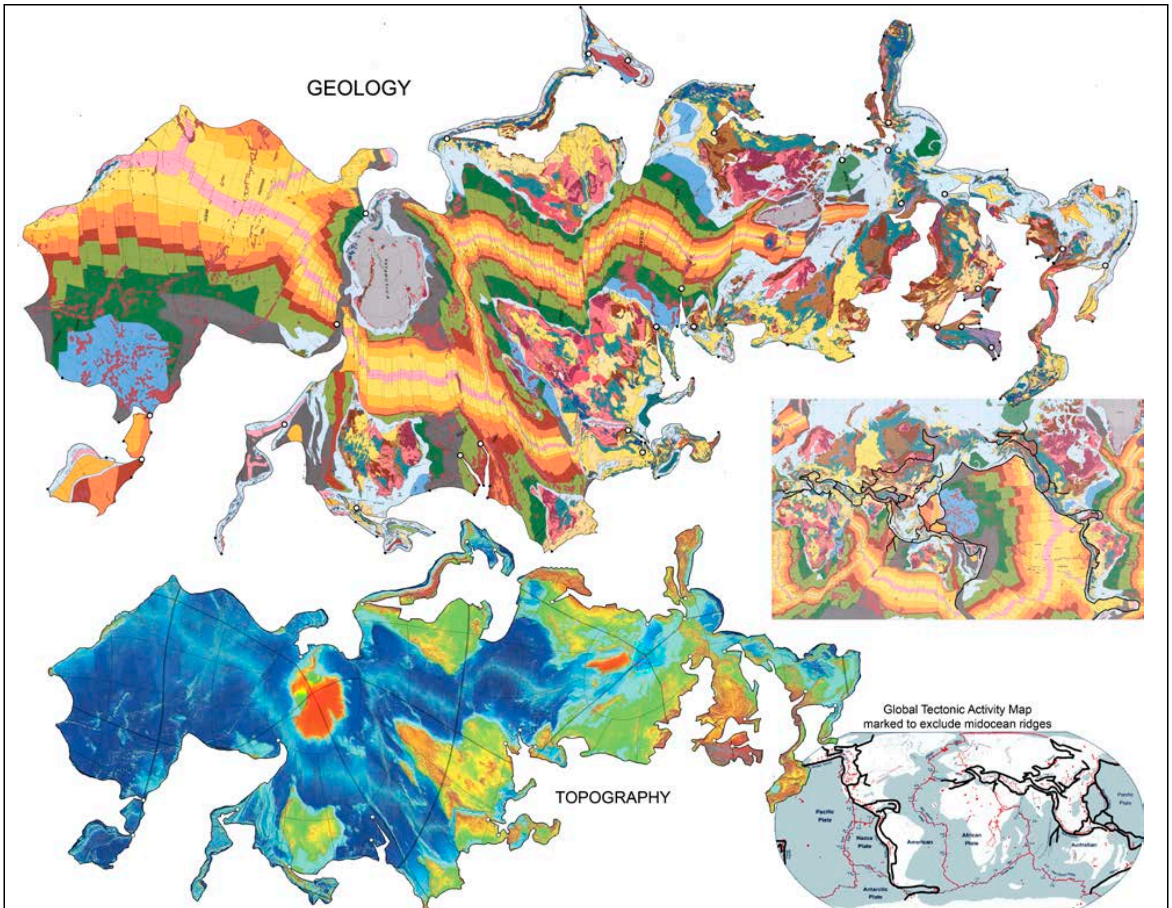

Figure 4: Map of Earth bound by tectonic activity less spreading centers [2,3]
This map employs an extravagance of borders to articulate, not merely preserve, edge-district proportions. If ridge-push is the driving force in global tectonics, this map focuses on beginnings, and the rest of the story is at the edges.

I wonder if a map as straightforward as **Fig. 5** might be worthy of contemplation from Paul's perspective, and I wonder what other networks the readership of NCGT might like to elevate to the critical cartographic position, i.e., the edge.

It may continue to surprise scientists that they can indeed compose world map(s) by cutting the surface along any treelike lines they wish. This has always been an accessible idea—think of peeling an orange—but a rigorous and practical organization of the metrical parameters has eluded us until the emergence of this formula: constant-scale natural boundary, which, on objects as diverse as planets, moons, asteroids, crania and molecules, appears to work like a charm.[1]

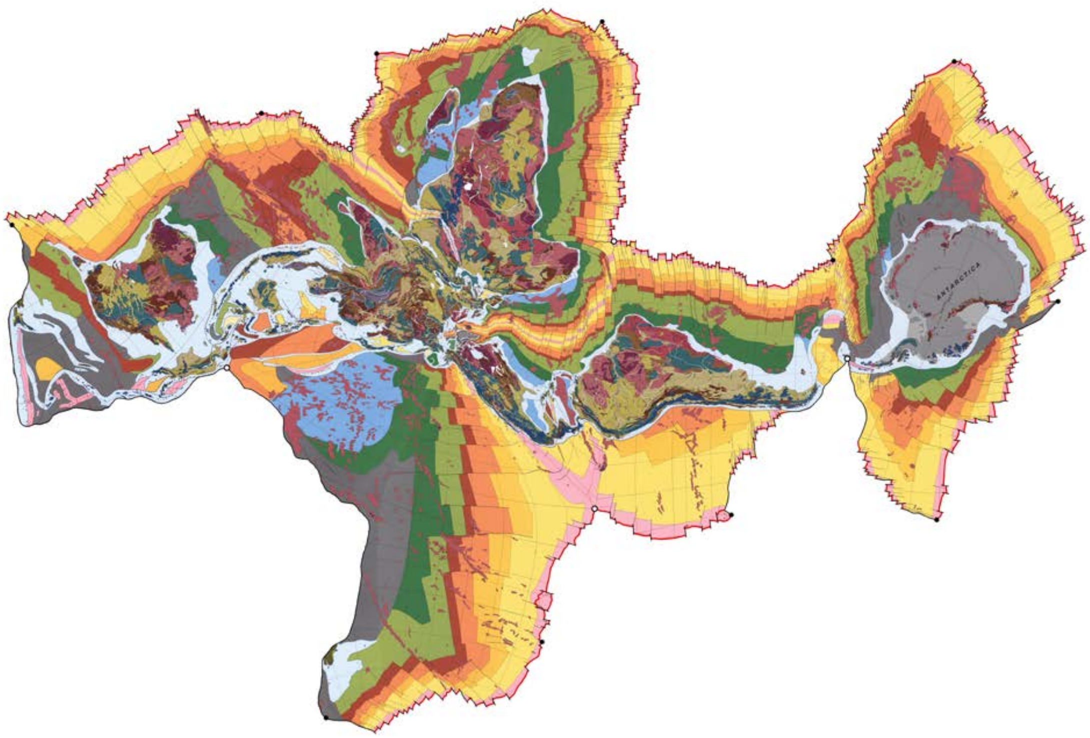

Figure 5: Map of Earth bounded by midocean ridges and major southern hemisphere trenches [2,3]

To paraphrase Beloussov in his 1977 Letter,[4] there is yet a lot of uncertainties about the deep interior of our planet, and the processes occurring there. Much seems to be contradictory and mysterious. But the surface is clearly evident, and the means are now available to compose this within critical, governing boundaries, and explore both the immediate past and the near future with comprehensive accuracy, limited only by our imagination and our insight.

For example, the Wallace Line is a 1,500 mile demarcation in Indonesia either side of which are wildly divergent flora and fauna, noted by the 19th-century naturalist Alfred Russel Wallace, founder with Charles Darwin of the theory of natural selection. They postulated separate evolutionary paths and inferred relative motion of Earth's crust. Tectonics, an intricate worldwide system, is mum in its formal vocabulary about evolution, offering only a movement mechanism. To connect Wallace's line and tectonics is to ask a global question. The line's significance is its boundary condition, an anomalous fence in worldwide species distribution. The problem is how to picture its global import. Putting the Wallace line in the middle, usual cartography, foregoes a decent appraisal of the globe's other side. A map that puts at its edge the boundary of immediate significance puts that boundary into a critical state. The Wallace line's most extreme expression is embedded into the figure a CSNB-map makes of it. See **Fig. 6**.

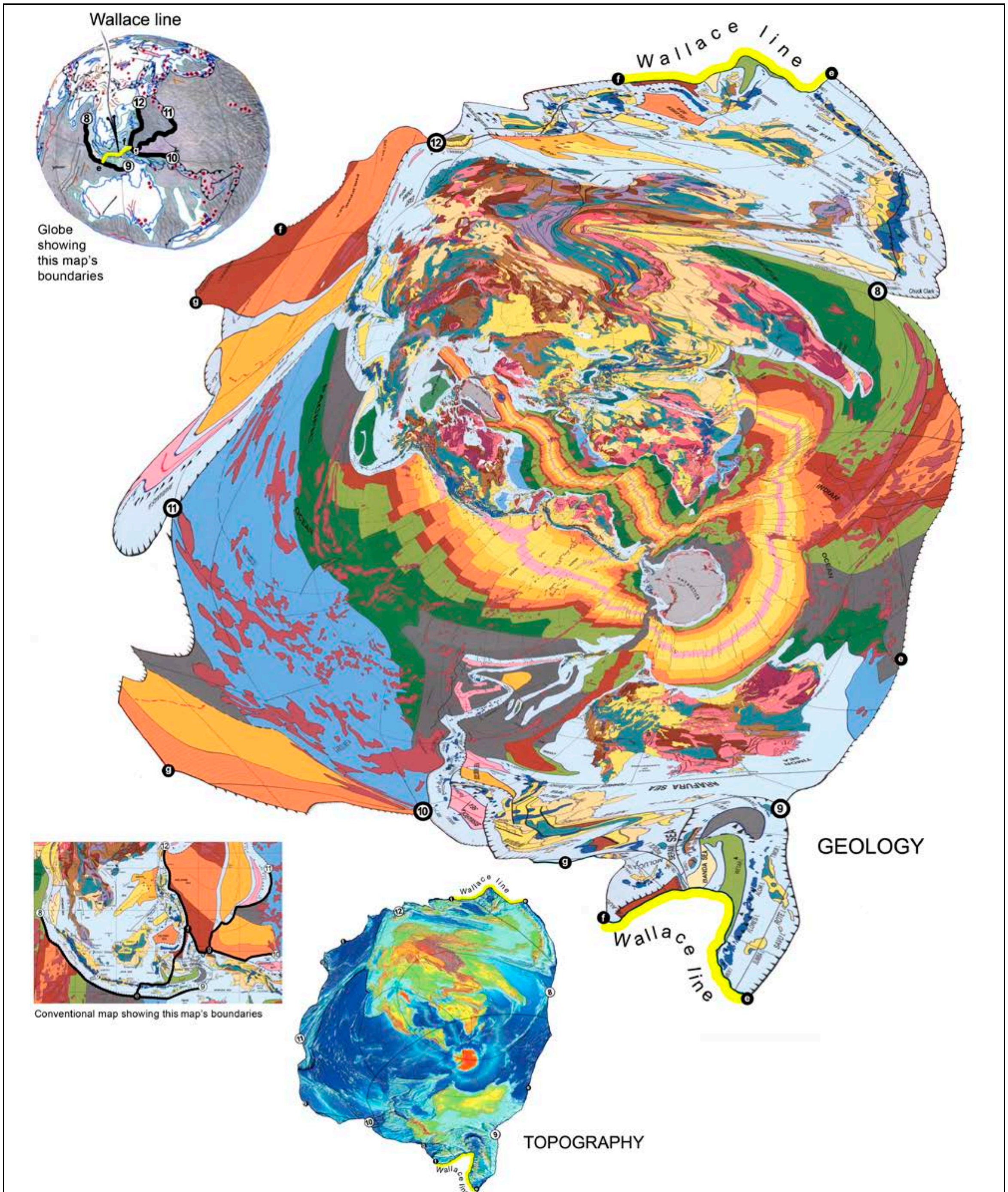

Figure 6: Map of Earth bound by the Wallace line and nearby trenches [2,3]

Paul Daniel Lowman Jr. passed away on September 29, 2011, at age 80. Paul Lowman worked for over five decades at NASA's Goddard Space Flight Center, where he was the first geologist hired by the space agency. He helped manage the Earth observation satellite called *Earth Resources Technology Satellite* (ERTS-1), later renamed *Landsat 1*, and coauthored *Mission to Earth: Landsat Views of the World*, contributing to it a Glossary of Technical Terms that fascinated this cartographer long before I ever became acquainted with Lowman himself.

Lowman was involved with pre-*Apollo* and *Apollo* lunar geology and was on a first-name basis with many *Apollo* and *Skylab* astronauts, including John Young, Jack Schmidt, Owen Garriott, and Neil Armstrong, who wrote the forward for Paul's last book, *Exploring Space, Exploring Earth* (Cambridge University Press, 2002).[5]

The tracts Paul sent me in 1999: "Plate Tectonics and Continental Drift: A Sceptic's View," published in *The Blue Planet*,[6] and "Mechanical Obstacles to the Movement of Continent-Bearing Plates," published in *Geophysical Research Letters*.[7]

Paul Daniel Lowman, 1931-2011

His Tectonic Activity Maps will be familiar to readers of NCGT by his contributions in Issue 8, September 1998, and Issue 54, March 2010.

Notes & Sources:

1) P. E. Clark and C. S. Clark, "Constant-Scale Natural Boundary Mapping to Reveal Global and Cosmic Processes," SpringerBrief in Astronomy, 2013
2) Global geology sourced from *Geological Map of the World* at 1:250000000, 2nd Edition. Phillippe Bouysse et al. © CCGM/CGMW 2000.
3) Global topography sourced from MGG Images, NOAA.
4) *NCGT Journal,* v. 2, no. 3, September 2014
5) Biographical information adapted from John Putnam, writing in *Goddardview*, a bi-weekly publication of the Goddard Space Flight Center, vol. 7, Issue 8, p. 11.
6) B. J. Skinner and B. W. Murck, John Wiley & Sons. 1995.
7) Vol. 12, No. 5, pages 223–225, May 1985

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Earth's altitudinal bimodality

Dear Editor,

As a retired school teacher in Japan, I am enjoying reading articles published in NCGT Journal. In each issue of the Journal, theories of global tectonics such as plate tectonics, oceanization, wrench tectonics, surge tectonics and expansion are lively discussed. It seems to me, however, that history of surface topography of the Earth has been given insufficient attention in any theories. So here I would like to present my personal view on the altitudinal biomodality of the Earth and to invite your comment.

The Earth was born as one of the terrestrial planets. Since only the Earth is not considered to have been born through a special mechanism, it is thought that the early Earth has had the features common to other terrestrial planets.

Terrestrial planets, including the Earth, have geomorphic dichotomy consisting of highland and lowland. In view of altitudal distribution, the Venus, Mars and Moon are unimodal, but the Earth alone is bimodal (**Fig. 1**).

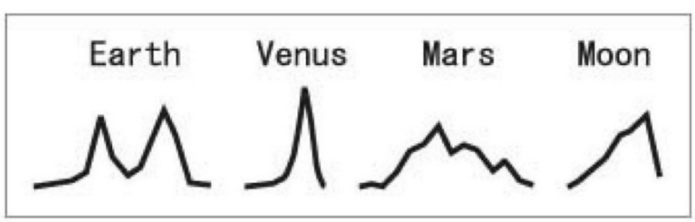

Fig. 1 Hypsometric diagrams of terrestrial planets (complied after Masursky, H. et al., 1980. Pioneer Venus radar results: Geology from images and altimetry. *Jour. Geophys. Res.*, v. 85, no. A13, p. 8232-8260.

I consider that the surface topography of terrestrial planets commonly has a geomorphic dichotomy consisting of highland and lowland, as well as the unimodal distribution in altitude. It does mean that the bimodal distribution in altitude of the Earth may have formed during its later stage of its history. Hence, theories of global tectonics should explain not only the origin of the geomorphic dichotomy, but also the process through which the Earth has obtained its altitudinal bimodality.