

Letter to the Editor

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I slid into the study of map projections late in the 1980s, naïvely supposing the field must be safely obscure and staid. For the most part it is, and yet I was quickly confronted with the spectacle of Arno Peters. A little reading on the history of map projections revealed it to be speckled with crusaders storming in to offer The Solution to all that ails the enterprise. These days, the Internet being what it is, new crusaders contact me with some regularity. Verbiage attending such campaigns is largely predictable, since the same basic motives and methods fuel all quacks. To the roster of mountebanks we can add Mr. Abbas Bazeghi, who wrote *Cartographic Perspectives'* Winter 2008 **Mapping: Methods & Tips** article, "Matrix Projection—A True Equal-Area Map of the World."

He leads out with a synopsis of the history of map projections. Given that his audience was to be cartographers, one might suppose he would research his material with some care. Remarkably, however, it turns out you must read carefully to find the few clearly correct facts, since it is errors, unsubstantiated musings, and grade school fallacies that comprise the bulk of the narrative. There would be little point in noting every error; this isn't really the forum for that, and in any case surely some thrill of the chase should be left to the reader. Just the doozies will suffice.

Bazeghi asserts, "*Before Ferdinand Magellan's explorations . . . the earth was assumed by most people to be flat.*" Surely most people of the time did not assume anything at all about the shape of the earth and never gave it a thought. The very notion of "the earth" wasn't likely part of the psyche of most people. In any case, what we can say with great certainty is that few educated Christians and Muslims ever believed the earth was flat (Russell 1991). Eratosthenes had settled the matter conclusively with great precision and elegance two hundred years before the advent of the Christian era. Hellenistic culture digested and accepted Eratosthenes's results over the ensuing century. The gross shape of the earth has never since been under any serious dispute in Western or Middle-Eastern culture. The few dissenters, such as Lactantius, were viewed as kooks even in their own time.

Continuing, ". . . Columbus assumed that he had reached the shores of India . . . Consequently, he grossly miscalculated the size of the earth." This inverts cause and effect. Columbus grasped at a lot of straws in order to conclude that the earth was much smaller than Eratosthenes calculated. That's how he convinced himself India was only a short voyage west in the first place. He was wrong, and the scholars knew it.

"[Galileo] was forced by . . . the church to stop teaching Copernicus' theory on roundness of the earth." Actually, the Church never objected to teaching earth's sphericity, since that had long been presumed and was regarded as scripturally compatible. I can't find a single citation supporting the claim of any Church censure on the matter of earth's sphericity.

"Nevertheless, by 1570 AD new world maps based on the spherical shape of the earth began to appear in Europe." Somehow Mr. Bazeghi has managed to miss a century of maps, including those that existed before Columbus ever set sail, such as the profusion of Ptolemaic maps appearing in the 1480s and 1490s. Those maps cannot be credibly argued to represent anything but a spherical earth. And, of course, Roger Bacon invented a map projection (for a spherical earth) in the 1200s. Yet Bazeghi presents Mercator's 1569 map as a landmark in this context, claiming it ". . . provided a grid to expand on and refine as more accurate surveys . . . were prepared in the following

years." How? Even if we dismiss the Ptolemaic projections and derivatives as being only "partial-earth," we have maps conveying the entire sphere starting with Contarini's and Rosselli's 1506 map on a conic projection. Dozens of whole-world maps antedate 1569 in a wonderful florescence of map projection experimentation. Many globes from the period are also extant. Mercator's projection established a meridian in scientific map projections, but it contributed nothing to anyone's ability to put what they had surveyed onto a map.

Then we are told that Cellarius introduced, around 1660, "*the most well known example*" of a projection to present the world more realistically than Mercator. The citation mystifies me. True, Andreas Cellarius produced a star atlas in 1660, but the only terrestrial world map attributed to any Cellarius is that of Christophorus from 1692. This map does, in fact, present the world in two circular hemispheres as Bazeghi describes, but he follows with "*The map is an artistic presentation and is not based on scientific or mathematical rules. The earth map in this design is grossly distorted with a great deal of guess work and many missing or obscure parts of land and seas.*" This is claptrap from start to finish. The projection is the stereographic, introduced in the Hellenistic era, and has a strict mathematical formulation, sports the conformal property, and accrues reasonably low distortion in the double hemispheric format. The cartography is representative of the period and even exemplary in its unwillingness to speculate on such unsupported hypotheses as an Antarctic continent. The projection was used extensively in that format in the seventeenth and eighteenth centuries, but showed up in modern times a century earlier than the Cellarius map, Rumold Mercator's 1587 map being perhaps the first, but followed by many others. One can only speculate on how Mr. Bazeghi pulled the whimsical name of Cellarius out of his bag of imaginary history.

Mr. Bazeghi notes the Robinson as being the National Geographic's standard projection since 1988 but apparently hasn't noticed that they changed over to the Winkel Tripel a decade ago. He compares the Robinson to the Mercator (he seems to compare everything to the Mercator, quite in harmony with every projection quack) by noting that the Robinson preserves the central meridian's length compared to the equator, whereas the Mercator doubles it. In point of fact, the Mercator renders all complete meridians as infinite in length, and no convention cuts them off at double the equator's length. "Double" is therefore yet another spurious assertion.

On page 57, Mr. Bazeghi presents a bewilderingly fictitious display of map projection history. While the dates for the Mercator and Robinson projection are correct, he lists the sinusoidal as "1950s," the Mollweide as "1960s," and Goode's as "1970s." Meanwhile, the sinusoidal was invented by 1570 at latest and has seen sporadic use ever since—and heavy use by Sanson in the 1600s, for example. The Mollweide was described in 1805 and has appeared commonly since then, and Goode's homolosine has featured in that eponymous atlas ceaselessly since the 1930s. These facts are remarkably easy to come by. We can only hope the dates he attaches to his own inventions are correct.

That page and the following pages treat the reader to several fantastic claims amongst the illustrations, including one that is patently false. Take, for instance, this hyperbole: "*Truest map of the world ever created.*" variations of which have attended every crusade from the beginning. Further: "*The grid is the most precise ever designed,*" which in point of fact means nothing—any "grid" is completely "precise." "*This map is the perfect map to use when presenting statistical graphic information to scale regarding global warming issues,*" a statement unsupported in any particular way. It's probably

a reasonable map to use, but it is not “the” perfect map to use or the only reasonable map to use by any means.

And the false claim? “A true equal area map of the world.” An analysis of Mr. Bazeghi’s description of his method makes clear the method cannot result in a “true equal-area map” by the only recognized definition of “equal-area.” “Equal-area” has a precise meaning based in differential geometry. Just ensuring that a large number of finite regions have the correct area is insufficient to produce an equal-area map. The same objection holds for “A mathematically precise Direct Equal Area Projection” whatever that means. Whatever the method is, it is not “mathematically precise” with regard to areal equivalence. It is an approximation.

What are we to make of all this? Given the article’s pervasive disregard for facts in a forum where fabrications about maps hardly could go unnoticed, one is tempted to imagine it’s all a big joke. This interpretation could even be reinforced by pondering the question of why the map projections history was included in the first place. Since the synopsis does not further the “how to” purview of the *Cartographic Perspectives* forum, and does not shine flattering light on Mr. Bazeghi’s work in any apparent way, the answer to the question of “Why?” remains mysterious indeed. Why would Mr. Bazeghi make up a bunch of stuff to print just to risk being discredited? Yet the methodology section is no mere joke. Mr. Bazeghi has contrived a useful method for realizing maps that are “sufficiently” equal-area, even if they are not rigorously equal-area. His interruption schemes are novel, attractive, and “reasonable.” If he had presented *just* his method and its results, without promotional hyperbole and fanciful narrations of history, the work would be unimpeachable and even worthy of peer-reviewed publication.

That is, in fact, what I recommended. You see, Mr. Bazeghi approached me in March of 2007, having mailed me printed copies of his designs. I responded, in part:

I received your materials describing your Matrix Projection. It was a delight to see such dedicated efforts from someone outside the field.

You’ve constructed a unique and useful interruption pattern. It’s rather more complex than Cahill’s Butterfly or Waterman’s projection, both of which share some characteristics. I could imagine it being deployed on other projections as well, although its complexity might come with some difficulties, depending on the projection.

Noting a couple of claims: “Truest map of the world ever created” would be very hard to defend. There is no clear metric by which a map could make such a claim, and it becomes even more problematic when the local geometry of the projection has not been described in a way that others could reproduce the projection. I suspect most mathematical cartographers subjected to such a claim would conclude it is hyperbole.

I also note that, if I read your description of the construction method correctly, the map is not strictly equal-area. In map projection study, “equal-area” has a specific meaning at a completely local scale. Not only must the area across a broad section be correct, but any division of that section whatsoever must also be strictly equal-area. What you have created is likely equal-area “enough” for most practical purposes, but because the construction method does not report what happens at the scale of infinitesimals, it is impossible to assess how close the projection comes to being truly equal-area and also impossible to compare it usefully against real equal-area projections.

We exchanged several e-mails in which I advised over and over that he remove the hyperbole and false claim and instead prepare a technical paper for publication. Sadly, the path of integrity did not suit his ambitions. Once *Cartographic Perspectives* accepted his article for publication (the text of which I was not privy to before receiving the issue), he approached me with that ace in hand to ask if he could use me as a "reference" in his efforts to persuade Al Gore to adopt his projections in Gore's presentations about global warming. I declined on the basis of his spurious claims. Now he has gained "publication," willful deception intact, and *Cartographic Perspectives* has gained... what, exactly?

References

Russell, Jeffrey Burton. 1991. *Inventing the Flat Earth*. New York: Praeger.