Geological Society of America

Structural Geology & Tectonics Division

2007
Career Contribution Award
Presented to Warren Bell Hamilton

Citation by Keith Howard

Warren Hamilton's powerful and innovative contributions to the development of tectonic concepts have had major influence on the directions of our science, consistently breaking new ground and undermining entrenched old dogmas.

Warren's prolific career has time after time presented us lucid and perceptive syntheses setting forth new and long-lasting concepts in global and crustal-scale views of tectonic and magmatic processes. Warren's current debunking of deep-seated plumes ("they don't exist"), his proposals for a weak, plateless Archean crust, and his drastic reinterpretation of Venus as a low-heat-flow planet that preserves its early crust and impact basins pose only the latest of many bold challenges he has offered the structure and tectonics community. And he doesn't go into these topics lightly, but carefully critiques, questions old paradigms, and integrates cosmic and mantle geochemistry, seismic tomography, and reams of geologic observation into his syntheses.

In 1966, the 100 percent Cenozoic extension that he and Brad Myers proposed for the Basin and Range faced a skeptical reception from stabilists, but it spurred the community to test it, and find it near the mark. On a similar note, I watched many California experts initially deride his late- 1960s integration of Mesozoic California geology into subduction models. Yet it paved new paths for the structure and tectonics community to integrate plate-tectonic concepts and on-land geology.

His 1979 synthesis of Indonesian tectonics remains a standard of comparison for countless newer studies of subduction belts worldwide. His Indonesian knowledge led to his elegant analysis that subduction drives plate tectonics, and that top-down cooling of oceanic lithosphere produces the density inversions that drive subduction. Other contributions provided tectonic syntheses of regions as diverse as Antarctica, the Gulf of California, Laramide uplifts and the Colorado Plateau, Cordilleran metamorphic core complexes, and the Urals and a broad range of topical studies. Insights into magmatic processes in relation to tectonics arose from field relations in island arcs, western American batholiths, exposures of the deep crust, and much more. He comprehensively integrated crust-building magmatic processes and their variations with depth into tectonic models. His global view has brought us concepts of sill-like batholiths, extension in volcanic arcs as a natural consequence of subduction, and a proposed new framework for understanding tectonism and magmatic heat loss in an Archean world lacking rigid plates and subduction.

Warren's ability to synthesize sweeping new general insights rests ultimately on his appreciation of, and perceptive contributions in, detailed field geology. His long-time collaborator Brad Myers once remarked to me proudly about Warren's mapping of the Big Maria Mountains that

the maps were "full of squiggly lines—and Warren isn't a squiggly-line person!" The highly detailed mapping in the Big Maria area prompted Warren's notions of extensional faulting, ductile Cordilleran thrusting, and stunnning 100:1 tectonic attenuation of the Grand Canyon's Paleozoic formations –– concepts as usual ahead of their time.

Warren's communication skills -- on field trips, informal contacts, hundreds of lectures, and many visiting professorships and distinguished lectureships -- have stimulated and influenced large numbers of students. He has served as a visiting scientist in many countries, and he has been charismatic mentor, guide, and friend to countless colleagues and students. Colleagues come to him as a sounding board on subjects ranging from giant Precambrian impact structures to environmental policy. Though he is never one to coddle or mince words at work with which he disagrees, Warren is outgoing, generous with his time, and a helpful tutor to those with whom he comes in contact. His crisp, power-packed collegial letters enjoy their own celebrated reputation.

You would think that five decades of huge contributions, membership in the National Academy of Sciences, and a Penrose Medal would be more than enough for any career, but Warren shows no signs of slowing down. Three meaty and eloquent papers by him due to be published this month forcefully argue for top-down cooling of slabs as the driver of plate motions and of upper- mantle convection, for a lack of plate tectonics in Earth's first two billion years, and for a plume- free planet Venus. Like many of his other works, these diverse iconoclasms are directly at odds with accepted paradigms. Pay close attention. Warren's intellectual ability to grasp the simple picture from a mass of details has been stunningly perceptive.

This man has been enormously influential on tectonic concepts, and on geologists. It is a high honor to present to you Warren Hamilton as the 2007 Career Contribution Awardee of the Structure and Tectonics Division.

Response by Warren Hamilton

Thank you, Keith, for that generous account. For 60 years, I have been having a marvelous time seeing as much as possible of our planet and trying to figure out how it works. Being honored for the products of that exciting activity, and being placed with the eminent prior awardees, is a huge bonus.

I have always learned from people who knew more than I did about many things. From Keith, for example, I learned much about the nature of large-offset extensional faulting, and about the behavior of sedimentary rocks depressed into anatectic regimes. My longtime colleague Brad Myers was the best reader of geologic maps I have known. I have swapped and developed ideas with hundreds of colleagues, often in the field, and could not have worked without the reports generated by thousands of other scientists.

I was repeatedly fortunate to be in the right place at the right time. My first Antarctic season, 1958, changed me from a silent to an active continental drifter, at a time when the overwhelming American view was that no lateral motion of part of Earth's outer shell was possible. I was a

visiting prof at Scripps when plate tectonics was brand new, and students including Tanya Atwater and Dan Karig brought me up to speed before most landlocked geologists knew anything was up. My early plate syntheses of continental geology led to the opportunity to integrate and learn from the onshore geology and offshore geophysics of spectacularly complex Indonesia and surrounding regions. This and much more was made possible by my USGS position (although some of my synthesis was unfunded, and even time for it was bootlegged). Fast forward, and I have been for seven years in a mind-opening multidisciplinary e-mail round table with Don Anderson, Gill Foulger, Jerry Winterer, Jim Natland, and others.

We now know that Earth accreted rapidly, violently, and hot. Nevertheless, popular geodynamic theories are descended from 1950s conjecture that Earth has fractionated only very slowly and incompletely. 1960s geochemists hardened this speculation into dogma that was accepted by newborn geodynamicists, who built whole-mantle convection, bottom-up drives, plumes, and deep subduction from it. Powerful evidence contradicts all components of these chemical and dynamic conjectures, yet they are now parts of the belief systems of most geoscientists. Alternatives are little considered. The balance worsens as specialties become more myopic, expensive, and inbred, and as broad approaches wither for lack of financial support.

Enter peer review. Recycled popular dogma breezes through, but new concepts displease challenged experts. It is difficult to publish, or get a grant for, work contrary to conventional wisdom because many reviewers, editors, and managers obstruct anything that conflicts with their beliefs. My own descriptive work sailed through, but the innovation for which you honor me often did not, and some of my best work was wholly blocked. Keith mentioned my three current major contrarian papers. These are appearing in books with supportive editors because I am now unwilling to probe successive journals for possible chinks in their conventional-wisdom armor. Two of these three multidisciplinary manuscripts were attacked viciously, on personal as well as contextual grounds, by turf-defending specialist reviewers. Other geoscientists whose work I most admire report similar personal and topical obstruction of contrarian papers which ultimately proved to be broadly correct.

So I appeal to all of you, as judges at all levels, from what you and others write to whom you support or hire or promote, to recognize that consensus may not define truth. Changes as profound as plate tectonics, and as unanticipated by the majority, likely lie ahead. This awareness should generate both positive and negative attitudes. On the one hand, innovative work should be evaluated on its own terms. Do the new concepts provide a viable explanation for the relevant evidence? What sorts of evidence are cited in support of each, and what does each misfit or overlook? What is required, and what is merely permitted, by independent data from different disciplines? What are the explicit and implicit assumptions behind new and old interpretations? On the other hand, any work that reaches a traditional conclusion should be viewed with skepticism. Are there flaws or gaps in the logic claimed to support the conclusion that was determined before the work was done, and could that conclusion be merely a popular assumption? A red flag for failed conjecture is special pleading to excuse each misfit of data to predictions, such as now characterizes advocacy of deep mantle plumes.

Science functions best when we can override our hard-wired inclination to blindly defend our clan. The mythology of science says that multiple working hypotheses lead to efficient

incorporation of improved concepts. The reality is that ruling conjectures have great inertia, and that much that is patently false is widely accepted as true. Many current dynamic and petrologic invocations of plate interactions, 40 years on, are of misconceived cartoon systems that resemble nothing on Earth. Chemical and isotopic numerology has largely displaced igneous petrology, and impossible magmagenesis is widely postulated. Dick Armstrong showed decades ago that isotopic data do not require the common assumption that the upper mantle has fractionated unidirectionally, but only recently have a few geochemists begun to recognize that he was correct. And so on.

The schedule of a roving geologist produces hardships for young families. Alicita, my wife for those 60 years, nevertheless raised three wonderful children, and not until they were all in or beyond college was she able to widely share in the perks.

Thank you much. It has been a great trip.