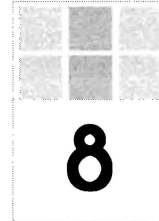


HENRY WILLIAM (BILL) MENARD

1920 - 1986

BY CLEMENT CHASE



How I got here

When Ed Goldberg and Bob Fisher first asked me to provide this piece about Bill Menard, I had in mind to do something in the way of institutional history. What was the effect of Bill on Scripps Institution of Oceanography? How would Scripps be different if Bill had never worked there? How would marine geology have developed without Bill's contributions? I soon found that this task was well beyond my reach, requiring skills at human history that scientific experience with Earth history do not provide. These skills are one of the things that Bill didn't teach me when I was a graduate student working with him at Scripps from 1966-1970.



Portrait of Henry William Menard, 1976.

The next step in thinking about what I might do was a biography. This too fell by the wayside, when I realized that others had provided superb descriptions of Bill's style and impact as a scientist and a mentor for students, especially his encouragement of women in oceanography. A list of these descriptions is compiled under "Encomia" at the end of this article. Any future biographer or historian of science interested in Bill's impact on his students and colleagues (overlapping groups) would do well to start with these brief histories. All 42 linear feet of Menard's personal papers and research materials, which he meticulously maintained, are held in the Archives of the Scripps Institution of Oceanography (complete with a remarkably useful website).

Finally, I settled on what you will find below if you read on: a loose account of some aspects of Bill's career annotated with my personal observations of and anecdotes about the person who most shaped my own life as a scientist.

■ ■ ■ First contact (almost)

The summer of 1965 after my junior year at Caltech I went to geology field camp. It is very difficult for geology students to get summer jobs after field camp takes the first six weeks. Jerry Wasserburg kindly arranged work for me as a student employee at Scripps. I was assigned to the marine topography group associated with Bill Menard.

Bill himself was in Washington serving as technical advisor in the Office of Science and Technology for a year. His presence, though unseen, was definitely felt in the lab in Ritter Hall. Isabel Taylor and Tom Chase were my supervisors for the remaining weeks of summer. Jackie Mammerickx and Stu Smith were the other members of the group with which I interacted. My task was "smooth plotting" navigational plots from old expeditions, not one of the most enthralling tasks ever. For anyone who doesn't know what that was, you can find a brief description in *Anatomy of an Expedition*, p.128 (there is also a list of all the books Menard wrote or edited at the end of this article). The basic process is adjusting ship track plots, moving and scaling dead reckoning estimates of position to agree with navigational fixes taken later, and minimizing disagreements in depths at track crossings. Satellite navigation has since obviated the need for this task. I feel no nostalgia.

From Isabel and Tom I learned that cartography is both art and science. The art comes from filling in the gaps in very incomplete data, and the science consists not of asking where a particular contour should run, but what it would mean if it were given a particular placing, and which of those meanings fit best with what they knew already. Later I discovered that this was very much Bill's style. I don't know, however, whether he inculcated the group with his attitude, or just hired people that already shared it.

■ ■ ■ Shaping an academic career

Despite the smooth plotting, I decided that marine geology was what I wanted to do. We had heard about seafloor spreading (not quite plate tectonics yet) at Caltech, and to undergraduates, transform faults and all the kinematics sounded natural. What did we know to the contrary? Marine geology just seemed the most exciting thing I could do. I applied to Scripps, was accepted, and moved to La Jolla with my wife in the fall of 1966. On the advice of Wasserburg, Menard was to be my advisor. By some extraordinary luck, I was given a desk in Bill's outer office, on the second floor of Ritter Hall overlooking Scripps Pier. The 'extraordinary' came from three things: a view of the sea, access to Bill's remarkable collection of maps and reprints, and access to Bill himself, if I could catch him coming in or going out.

One of the first conversations I had with him was standing before the map tables in that room, Bill pointing to maps of the Pacific with the bows of his half-glasses. I seldom sat down to talk to Bill, he didn't seem that comfortable in a chair. Perhaps this was the result of his injuries in World War II, or the serious injury he had suffered on an expedition in 1964, in which his back was shortened by a heavy marine camera loose on the fantail. In the four years I was in that room, I only entered his inner office maybe five times. He was always cordial and concerned about my progress in class work and research, but still had an inner reserve that discouraged too much familiarity. His wife Gifford Menard provided most of the easing of our transition to life in La Jolla. Bill smiled often, but laughed seldom.

Almost all the photographs of him that I have seen show that boyish smile, almost a grin, sincere but not outgoing.

This first extended conversation was about the only formal advice I received from Bill, beyond choosing courses. I learned a little about his history, and quite a bit about his approach to science. He particularly emphasized going where your instincts took you and choosing the important problems to work on. Bill seemed to be both bemused and rather proud that his first publication, appearing in 1948, was in vertebrate paleontology. It dealt with footbones in *Smilodon*, a fossil saber-toothed cat from the La Brea tar pits. What follows is partly from that conversation, partly from other sources.

Bill Menard was graduated from Caltech in 1942, with a geology degree. He enlisted in the Navy, and served in both the Pacific and Atlantic theaters. His geologic training must have contributed to his work as a photointerpreter on Admiral McCain's aircraft carrier in the Pacific, and helped in his role in planning for the Normandy invasion. After the war he returned to Caltech as a decorated veteran for his Master of Science degree, mapping an area in southern California. That degree came in 1947. Losing no time, he entered the geology Ph.D. program at Harvard.

Menard's tendency toward thinking broadly must have been encouraged by the example of his advisor at Harvard. Henry Crosby Stetson started out his career as a vertebrate paleontologist, but by the early 1930s was spending most of his efforts working with marine sedimentology, continental shelves, and submarine canyons. Stetson, whose career as a gentleman oceanographer was closely paralleled by Scripps's Francis Shepard, carried out his marine researches through the emerging Woods Hole Oceanographic Institution. Bill still retained his acquired taste for submarine canyons at the time I worked with him, but of course had evolved to thinking about the bottom of the ocean at much larger scales.

The experimental work for Menard's dissertation in flumes at Woods Hole was done, and led to a series of five papers published between 1948 and 1950. His doctorate was completed in 1949. No wonder that he became one of the faculty in support of making the doctorate at Scripps a four-year degree, in contrast to the approximately seven years that had prevailed before. As far as I know, my incoming class was the first and last to actually graduate en masse in four years.

Bill's interest in bathymetry and mastery of the existing data for the Pacific Ocean was shaped by his duties from 1949 to 1955 in the Naval Electronics Laboratory in San



Bill Menard (left) and Harris B. Stewart dredging in the Gulf of Alaska after surveying the Mendocino escarpment in 1951.

Diego, working with Robert Dietz, Edwin Hamilton, and Shirley Fisher. The Midpac Expedition of 1950, NEL's *PCE(R)-857* in collaboration with Scripps R/V *Horizon*, seems to have marked the moment of his evolution from a marine geologist to a deep-sea oceanographer, and the beginning of his realization of the scientific potential of topography. By 1956, Bill had talked Roger Revelle into hiring him as an associate research professor at Scripps.

■ ● The Bottom of the Sea and How It Moves

By 1966 the greatest discoveries regarding the shape of the sea's bottom were nearing an end. Arguably, the two foremost deep sea geomorphologists of the era were Bruce Heezen and Bill Menard, and Bill owned the largest ocean. He realized clearly that geomorphology at that scale was a form of geophysics. Bob Fisher tells me that Bill used to say "topography holds the answers." The oceanic ridge elevations and fracture zone morphology that he had mapped posed outstanding tectonic puzzles. In addition, Bill knew Ron Mason of Scripps and Art Raff of the Marine Physical Lab well after they all served together on Expedition Capricorn, in 1952-1953. Those two, together with Victor Vacquier, were the discoverers of lineated seafloor magnetic anomalies. This experience made it natural for Menard to become one of Scripps's earliest adopters of plate tectonics, along with trench explorer Bob Fisher. I remember Bill saying that before magnetic anomalies, marine geology was just geomorphology with a bit of sedimentology and igneous petrology. The close connection between Bill at Scripps and several of the Cambridge University geophysicists also helped. Menard's personal conversion to plate tectonic thinking, as well as some of the side tracks he followed along the way, are detailed in his book *The Ocean of Truth*, published posthumously in 1986.

Bill's concern with topography proved to be prescient. Plate tectonics was only a few years late coming to the center of continental tectonics, but full appreciation of the importance of continental topography as a geophysical phenomenon took another 25 years.

■ ● Learning from Bill

Bill didn't have a great number of graduate students, but as far as I know we all went on to good careers in Earth sciences. Dale Krause, Dan Karig, Roger Larson, Tanya Atwater, George Sharman, Jean Francheteau, Marcia McNutt, Deborah Smith, and I were either advised by Menard or worked closely with him no matter who our primary advisors were. It seems odd at this remove, but I never had a formal class from Menard. The closest I got was when George Sharman and I prepared computer-based marine exploration exercises for Bill's marine geology class. That was very early for computers in education, (and also very awkward, with punch card input and long turn-around times). My initial training in marine geology was simple: Bill gave me a proof copy of his first book, *Marine Geology of the Pacific*, and told me to read it, and ask questions about anything that puzzled me. The technique seemed to have worked well enough. Bill's supple and deceptively simple writing style conveyed a great deal of information.

Another example of unorthodox teaching is given in Bill's second book, *Anatomy of an Expedition*, describing Expedition Nova, the cruise from which my dissertation on the Fiji Plateau was a small part. Bill let several graduate students on R/V *Horizon*, including

me, each act as chief scientist for a day, while he caught up on sleep and notes for *Anatomy of an Expedition*. He wrote:

Everything went very well. Each of the students made mistakes but they were of such a nature as to reveal that no other method of teaching would work. I woke up one morning and went to the laboratory to see how Clem Chase was doing in surveying a seamount. We looked at his plot of soundings along the dead reckoning track and he explained what he was trying to do. I asked him what had caused him to make a certain course change, and he said that at that time he had known that he should do something, had tried the course change, and then had known that he should have done something else. When I arrived he had just started to do the something else, which was rapid enough self-teaching to justify the method.

Having apprentice chief scientists had another major benefit as far as I was concerned. I did my best to give the students freedom of action. Consequently when the incident above occurred, Clem had not been to sleep for thirty hours and I was rested and ready to work at something other than hour-to-hour operations.

One thing I learned about Bill on Nova was quite incidental. In the mess hall one morning I saw him sitting at the table with a deck of cards. One of the ship's crew drew me aside to the galley and warned me to never, ever, play poker with Bill. The seaman said that Bill was unbeatable and merciless at the "game," and had supported his college education playing poker.

The one thing that was hardest to learn from Bill was how to emulate his amazing physical intuition. I can remember Stu Smith recounting that Bill would say 'go here and you will see this'; and they went there; and that was what they saw. (Stu put this in more colorful language, though. We were much in the company of sailors.)

It became clear through exposure that this level of physical intuition was built on hard work: assembly of an enormous range of observations and assimilation of them into some sort of framework that made it possible to recall what he needed, plus careful thought and

probing, testing new ideas against his encyclopedic knowledge. Even though his thinking was not mathematically sophisticated, pretty much limited to counting and measuring, his insight was keen and his conclusions almost always justifiable on what was known at the time. He did make some fun, though, of the outlandish mental and geometric modeling contortions he and others had gone through in trying to explain Raff and Mason's magnetic



Nova Expedition, aboard R/V Argo. From left Sean Solomon, Colin Summerhayes, Jean Francheteau, Dan Karig, and Bill Menard in Auckland, New Zealand, 1967.

lineation patterns in the Northeast Pacific. He was quite ready to accept the seafloor spreading hypothesis once new evidence began to make it compelling.

■ ■ ■ After Scripps

When I left Scripps in 1970 to take up a postdoctoral fellowship at Cambridge University, I had to depart too early to attend graduation. Not long after we reached Cambridge, Bill and Gifford arrived to stay at Churchill College. Bill and I frequently saw each other at Madingley Rise, the headquarters of Teddy Bullard's Department of Geodesy and Geophysics. Bill's presence was quite useful, as I was compiling fracture zone trends, magnetic anomaly spreading rates, and earthquake slip vectors for a global plate tectonics motions set. After that year, I only saw Bill at the occasional scientific conference, as my interests first went into the mantle then onto the continents.

Bill himself left Scripps in 1978 to become head of the U.S. Geological Survey he had long admired. I heard from friends in Menlo Park that it was a rough job for Bill, as the USGS didn't take kindly to outsiders, especially outsiders with a portfolio to return the Alaska Branch to Alaska. His tenure there was three years, and ended at the start of the Reagan administration. Bill's environmental views were no longer welcome in Washington. After all, he was the first writer of a geological textbook that started with Thomas Malthus. Menard then returned to Scripps, and restarted his career with his customary energy.

The last time I saw Bill was at the San Francisco American Geophysical Union in 1985, when he was awarded the AGU's Bowie Medal. Bill was very frail with the cancer that would kill him the next February, but still had the straight back, and the smile. He was immensely pleased by the award; Bill was always very conscious of honors. He didn't live to make it to the Menard symposium organized to recognize his contributions, but co-authored three papers in the subsequent special issue of *Journal of Geophysical Research*. That so many of his works were finished while he was fatally ill, and saw publication after his death, is a tribute to his iron will and his unquenchable love of science.

The best scientist is open to experience and begins with romance—the idea that anything is possible.

—Ray Bradbury

(A high school friend of Bill Menard)

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