Sheldon Breiner

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Merlin of magnetics

By DOLORES PROUBASTA
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It probably was an American oil industry scribe who coined the word *explorationist.* Although it has not been dignified by English dictionaries, it is, as intended, often used to set geologists, geophysicists, and wildcatters apart from *explorers* - *a* term associated with Magellanic voyages, Amazonian expeditions, and other geographical exploits. But the distinction intended by the neologism is increasingly tenuous.

It is doubtful that today's argonauts will find much new on the face of the earth. Beneath it, however, in the *explorationists'* domain, the discoveries to come could be just as startling - albeit less picturesque - as Jules Verne's panoramas in *Journey to the Center of the Earth.* Even The Explorers Club of New York - the *ne plus ultra,* by-invitation-only of those its name sets apart - recognizes that today's search and discovery needn't be confined to things geographical. Thus, its roster includes ornithological, chemical, or even geophysical *explorers.*

One of them, Sheldon Breiner, day-dreamed of exploratory feats while decorating wedding or bar mitzvah cakes, delivering pastries on his way to school, or repairing the compressor in his parents' bakery in St. Louis. The object of the imaginary quest was simply "anything and everything."

Growing up didn't taper this liberal scope. Breiner has discovered ore and oil deposits, remnants of ancient civilizations, sunken anchors and nuclear submarines, avalanche victims, and much, much more. Even over pedestrian objects such as a key or a secretary's contact lens, Breiner takes off in hot pursuit. (ironically, the only participation he declines is treasure hunting, though predictably he receives hundreds of requests.)

Breiner's childhood expectations have been surpassed. He is considered the world's foremost finder of lost, hidden, or buried things by means of magnetics, a method he has considerably honed and put to imaginative use. It all began with a Stanford University honors scholarship in geophysics - though Breiner claims he had to reach for a dictionary to know what he was getting into.

Breiner at the National Gallery of Art next to the colossal Olmec monument, buried for 3,000 years in the jungles of Mexico, discovered using a magnetometer.

"Where I came from it wasn't a word to pop up often. My parents were immigrants - mother from Russia, father from Yugoslavia - and most of our efforts and conversations had to do with the family business. My two brothers, my sister and I helped out ever since we can remember. So, although geophysics had never entered my mind, the description of it seemed interesting enough. And there was an added incentive: of the various scholarships I was offered, Stanford in California was farthest from Missouri, and I wanted to put some distance between me and the bakery - or my dad might still have me working there."

After receiving his Bachelor's in geophysics in 1959, Breiner went to Europe on a three-month travel scholarship award, followed by six months in the Army reserve. Then he returned to Stanford to pursue a Master's. In the interim he married Mimi, a history student whose serene approach to life is the complementary yin to Breiner's hyperactive yang.

"It's pointless to try to keep up with Sheldon," says Mimi. "In fact, part of my job as a support system at home is to slow him down a bit. His idea of a hike, for instance, is going with our son David to the Himalayas and climbing up to 16,000 feet. 'Jogging,' of course, involves running the Boston Marathon" (a feat accomplished by fewer than I out of every 1,000 runners).

Perhaps this moxie, paired with an explorer's innate curiosity, were essential to the events which followed Breiner's choice of his Master's research topic. It involved using two, possibly three, magnetometers suspended from an aircraft as a technique to map subsurface geology for determination of sediment thickness. In 1960 he contacted one of the leading manufacturers of magnetometers, Varian Associates in Palo Alto, to see if they would lend him some instruments. Instead, he received a counteroffer.

"Varian had a brand new tool - an optically pumped magnetometer - they wanted to test. Among other elements it used the vapor of rubidium to accomplish the pumping of electrons. The electrons undergo selective energy-level transitions and become concentrated in a particular energy sublevel of the atom. This alkali vapor magnetometer (with rubidium or cesium sensors) had much greater sensitivity than its forerunner, the proton magnetometer. In fact, the rubidium magnetometer measured a change of I part in 100 million of the earth's magnetic field. But in order to use such precision, this instrument needed to be manipulated creatively.

"It would be my job, they offered, to set the parameters for its top performance and to determine the range of applications. Varian would get a patent and a marketing strategy, and I'd get a research project out of it. I couldn't wait to get started. I immediately improvised a test facility by the Stanford campus.

"I soon realized that in order to make positive measurements I had to remove sundry magnetic things I carried. The clip in the waist of men's trousers, for example, is magnetic, but not the zipper (which led to a couple of surveys in my underwear). Shoes are always magnetic. Keys are seldom magnetic, but key chains are. The screw in rim glasses is, but the stainless steel screws used in bone reconstruction aren't. There were hundreds of such observations to be made. I also dug up the oddest iron or steel items picked up by the instruments. Other finds were incidental because the magnetometer doesn't detect non-ferromagnetic metals such as aluminum, brass, bronze, copper, gold, silver - nor the rattlesnakes I sometimes found coiled by the sensors.

"Soon it was time to put the magnetometer to new uses. I measured the electric currents of the human heart and brain, mounted it on a gun-sniffing dog to verify his findings, tracked migratory animals such as sea turtles, measured the effect of a nuclear detonation thousands of miles away, and studied its possible applications on satellites. I guess that imagination was the only limiting factor to what could be done with that instrument."

The first airborne test of the rubidium magnetometer-gradiometer in Monument Valley, Arizona - part of Breiner's Master's research project at Stanford.

His Master's completed in 1962, Breiner remained at Varian where total immersion in magnetics would eventually earn him world-renown as the guru for novel applications. For example, to resort managers and rescue personnel, Breiner - a slalom skier - demonstrated the advantages of attaching a magnet to ski boots to facilitate rescue operations. Although the idea never got off the ground because resort officials usually avoid avalanchc-talk with their patrons, in 1962 he did outfit with magnetometers the first American team to ascend Mt. Everest.

Another departure from standard survey applications resulted from Robert Kennedy's assassination in 1968. Breiner was summoned to Washington to help find a solution for improving security at political rallies and airports.

"A member of the Science Advisory Committee knew that as part of my work I had measured the magnetism of most objects, including guns. What I suggested was using several pairs of magnetometers relative to strategic

locations on the body as a frisking method. Since no guns were allowed in the Executive Office Building, I used for demonstration common tools with the magnetic equivalent of various types of guns. Unfortunately the method has limitations which can't be divulged, but is superior to any alternative, and it was adopted." (And is now used for airport security around the world.)

in other areas, continued testing often gave startling results. For example, in connection with the use of magnetometers and gradiometers to detect buried objects, Breiner had a 10-foot deep hole dug with a backhoe. He then buried several iron pipes in it. As expected, walking over the site yielded a clear magnetic anomaly. Later, the pipes were removed and the hole refilled with the same soil. Although it may seem that the experiment was thus concluded, Breiner's scientific curiosity required another measurement of the reclaimed site.

“I found a magnetic anomaly almost as marked as when the pipes were there. It turns out that the soil, undisturbed, obtains a certain level of magnetism. Plowing or digging realigns it and creates an anomaly. We therefore know now that we can find disturbed ground, which is an excellent clue in archaeology. Perhaps we'll even learn to date cultural sites, Plus or minus a couple of centuries, by the level of disturbance if we only knew how long it took to obtain the previous undisturbed level of magnetism."

It is precisely in archaeology that Breiner has derived most satisfaction from magnetometer performance. Fortunately, fired clay - pottery, tiles, bricks, fire pits, etc. - are not only remarkably enduring but also strongly magnetic due to the alignment of their magnetically susceptible elements with the earth's magnetic field during the cooling process.

Breiner's introduction to archaeology was in 1964. The Applied Science Center for Archaeology at the University of Pennsylvania approached Varian Associates and suggested they test the rubidium magnetometer at 200-year-old Fort Lennox, on the Richelieu River, south of Montreal. That was in line with the company's research plans and Breiner was naturally put in charge.

"I used a dual or differential magnetometer scheme which instantly cancels extraneous magnetic variations, such as the effects of magnetic pulsations from the sun. The system worked well in Canada. So, Froelich Rainey, the director of the Applied Science Center, invited us to join him at a much more challenging site.

"Our target was the ancient Greek city of Sybaris, buried for over 2,000 years under 10-20 feet of silt and clay deposited by two rivers, in the province of Calabria, in southern Italy. The proton magnetometer had already been used there, successfully outlining a massive 3,600foot long wall buried at depths of 3-10 feet with its base at 16 feet or more.

"We proved, however, that cesium or rubidium magnetometers allowed more meaningful resolution due to their continuous output and higher sensitivity. Still, some areas with extremely subtle anomalies required the use of a gradiometer or differential magnetometer." (In 1965 Breiner published his observations in *Science.)*

Whether it was Sybaris they found or later superposed Greek and Roman structures is debatable. Nonetheless, Breiner's own valuable discovery was a new avocation: "To reconstruct what once existed in a given place, the remnants of a vanished culture, with minimal evidence and to do so without having to excavate, is a challenge hard to pass up."

Breiner would henceforth participate in or be a consultant to numerous expeditions - whether searching for Etruscan tombs in central Italy, the second lost city of the Incas in Peru, a 6,000-year old city in Iran, a ship sunk 400 years ago off the coast of California, or Atlantis, off the island of Santorini in Greece. But Breiner's name is mostly linked to the discovery of an ancient Mesoamerican civilization - some speculate it may be the parent of all the others in the New World - the Olmec, who flourished in 1200-900 BC.

It was March 1968 when he arrived at a site near San Lorenzo Tenochtitlan. This is in the Veracruz region of Mexico, where 20 years before Matthew Stirling of the Smithsonian Institution accidentally discovered some sculptures which had come to light through the erosion of the fill they were buried in. Presumably, others might still lie hidden. But in jungle terrain where even an exceptional worker can dig only one cubic meter of dirt per day, random digging was folly.

Anthropology professor Michael Coe, an authority on the Maya and Olmec cultures, had been eyeing a long-term investigation of the Olmec sites under the auspices of Yale University and Mexico's Instituto Nacional de

Antropologia e Historia, financed by America's Na tional Science Foundation. It was suggested that Coe send Breiner chips of the monuments and soil samples to determine whether the method would be suitable for the site.

"I studied them and decided it would be extremely easy to locate other statues. Those already found had an induced and remanent magnetization of 2 x 10-4 and 4 x 10-4 emu while the soil in the fill was of less than 3 x 10-5 emu - sufficient contrast for a magnetometer to spot them. "

Detected, initially from horseback, at a depth of 7 1/2 feet by Breiner's magnetometer, the Olmec rain god Is one of the most Important archaeological pieces of the Americas. It now presides over the Olmec exhibit at the Museo Arqueologico de Mexico, In Mexico City.

The explorer in Breiner found that "getting there was half the fun." A boat built in defiance of Archimedes' principle took him up the Coatzacoalcos river. Six hours later, a stick visible to native eyes only amidst tropical flora marked the point of disembarkment. With his gear, he proceeded on horseback to a low mesa overlooking the surrounding terrain. Working in the jungle included amenities such as the deadly fer-de-lance snake (the nearest *medico* six hours away), and myriad species known and unknown to entomology (Mimi was still unscrewing ticks from Sheldon's back a week after his return to the US). The reward for a hard day's work was a meal of armadillo or iguana - which Breiner found palatable enough.

The Indian workers, and some archaeologists as well, listened to the newcomer with curiosity and indulgence, as he claimed his instrument noted several anomalies in the first hour of field work.

"I concentrated on one which I estimated to be 7 feet down. As we dug it up we found what is said to be the finest example of Pre-Columbian art - a 3 1/2 foot-high squatting man-jaguar - the great Olmec rain god himself. I can't describe how rewarding that was**.** Practically all anomalies represented a monument since there are no naturally occurring rocks in the area and any found were quarried iron-rich basalt from the Tuxtla mountains, 50 miles away. Without the benefit of wheels, the Olmec had transported boulders big enough to carve things up to 40 tons heavy.

"As to other details of the work, in order to make instant decisions I arranged the instrument to have an audio output. The tone varied according to the intensity of the magnetic field. To record the data, I used a simple tape recorder, which is always magnetic. So I had someone walk behind me with the recorder and I would push the magnetometer, get a measurement and yell back: *four, five, two,* or whatever reading I got. Of course, I also had the digital display for more accurate data which I would play back at night and plot them out into a magnetic map to determine where the anomalies were and how dense a set of readings was needed to portray the magnetic field of that area.

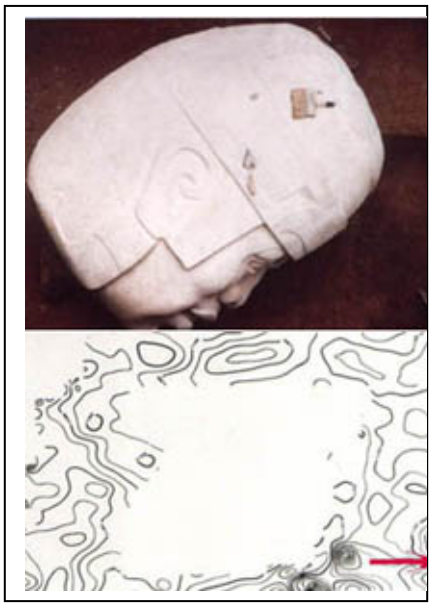
"A lot of computer work was involved. And I applied geophysical data processing approaches just as it's done when looking for minerals. For instance, there's a technique called upward continuation where you take the data from say, an airborne survey, and mathematically continue this upward, maybe 1,000-2,000 meters, to get a different form of the data. Well, in order to produce a more accurate map representative of the bigger monuments, while eliminating anomalies due to small objects, I upward continued *one meter* only. It worked very well."

In the course of three two-month seasons, Breiner and his assistants made 80,000 measurements and pinpointed some 100 significant artifacts. Although limited funding restricted excavation to only 20% of the sites, in every case the find was spectacular, often puzzling.

Geometrically perfect disks, rectangular blocks, spheres - some featuring smoothly carved holes with strange symbols - gave no answers as to their purpose. Even more intriguing, most of them, and all but one of the colossal helmeted heads found, had been subject to coeval vandalism and burial in those fills, as if to erase the memory of a religion or rule.

According to Coe, after one or several iconoclastic acts, circa 900 BC, the jaguar people disappeared - perhaps gone elsewhere or assimilated by others. It is the archaeologists' piecemeal task to deduce what happened.

Meanwhile, Breiner reached two categorical conclusions: at least 17 monuments would have eluded the shrewdest archaeologist without magnetometers (as he and Coe reported in *American Scientist*, September-October 1972), and something which defies explanation but he vows it is "the law" of search - "Whatever it is that you're looking for will be at the edge of the survey area - sometimes within, sometimes just outside. And redefining the area, of course, is self-defeating, for then your objective will still be found at the edge."



The best preserved Olmec head found weighed 10 tons and was buried 16 feet deep at the anomaly indicated on the magnetic intensity contour map. (The blank area was covered by a pond where no measurements were taken.) Graphic proof of Breiner's law of search: the find is always at the edge of the survey area.

Breiner's romance with archaeology didn't, however, distract him from his goals as Varian's manager of geophysical research. His original idea for a Master's topic - vertical gradiometers - was kindling. In fact, his experiences testing highly sensitive magnetometers had proven that for optimum results, they had to be used in some sort of differential array. This led to a number of effective magnetometer/gradiometer configurations, both mobile and fixed, used in the air, at sea, and on land.

By the mid- '60s, Breiner had developed an array of two instruments ' usually towed from a ship behind one another - the longitudinal marine gradiometer – to remove time variations from the data but still measure conventional total field intensity. As he foresaw, it allowed geomagnetic prospecting and deposit delineation of such accuracy that now over 40 vessels use it for petroleum and oceanic exploration around the world.

Yet another method introduced by Breiner was the transverse gradiometer (IEEE Ocean Electronics Symposium, Honolulu, August 1966) - originally a marine and now an airborne array consisting of a sensor in each wingtip pod, and one in the tail stringer or in the nose of the craft. A highly accurate method to map the magnetic field, it has helped Breiner discover natural resources worldwide - diamonds in Australia, oil deposits in China, uranium in Zambia, etc.

But by the time of these finds, he was already on his own. In 1969 he took his ideas to several individual investors and raised $1 million dollars to form Geometrics, Inc. In the beginning, the Sunnyvale-based firm manufactured magnetometers only. Then it added gamma-ray scintillometers and spectrometers for uranium cxploration, plus logging tools, aeromagnetic and radiomagnetic software, and refraction seismographs for weathering correction, of most of which it is the leading supplier.

With the growth in instrumentation, Geometrics began offering airborne geophysical survey services. Now conducting over 500,000 line kilometers per year, the company also provides equipment and training for aerial surveys in 100 countries.

In running the business, Breiner adheres to one precept: "Compete in only a few defined niches which the major companies aren't interested in, or can't afford to compete. This is the way to get the largest market share of specialized products or services. And, in deciding which particular niche to incorporate to your product line, a healthy market is the paramount consideration. That is, there must be at least one company ahead to lead the market share, but if there are as many as half a dozen distributing equal shares that's the sign of a sick market.

"Then, whatever market niche you've decided to break into, hire the best technical and marketing specialists or buy a company with experience in it. Just don't expect to learn about it as you go."

In 1976 Geometrics was sold to EG&G, of Wellesley, Massachusetts, a high technology company, for 1.3 million EG&G shares, worth today in excess of $40 million. Breiner remained as president of EG&G Geometrics until 1983. Now, he is chairman and still its driving force. Furthermore, whether as founder, investor, partner,

president, director, and often a combination thereof, Breiner is a board room commuter, to wit: two investment firms specializing in startup and pre-startup high-tech concerns; two companies supplying the semiconductor industry; one company developing artificial intelligence for various commercial applications. And in the petroleum industry: a firm which provides monitoring and mapping services for hydraulic fracturing, and an engineering organization which develops instrumentation for measuring total oil content in reservoirs. The inevitable query: can one give proper attention to such a diversity of concerns?

"When I started something," he says, "I knew I had to restrain much of my technical training and *not* involve myself with the technical aspects in order to look at the broader picture, that is, running the business. I don't poke into details. An executive's role relates primarily to people and finances."

Breiner's selective business involvement doesn't, however, clarify how his schedule allows for 100,000-150,000 miles a year on business trips, competitive sports, hobbies-turned-craft such as photography and carpentry, and yes -with time to spare for civic organizations ranging from the preservation of open spaces to career counseling for women.

In addition, he's an occasional lecturer in the departments of geophysics, applied earth sciences, and the graduate school of business at Stanford, where he often lends a hand in fund-raising programs. (In 1979 he and Mimi endowed the Joshua L. Soske scholarship - named after Breiner's mentor and professor of his undergraduate years - which assists gifted undergraduates and first-year graduate students in fields related to the development of natural resources, with a strong emphasis on geophysics.)

Breiner is also a prolific writer, with over 30 technical papers published, and one book, *Applications Manual for Portable Magnetometers.* Eleven years after the first printing, and 100,000 copies later, it is still *the* working guide on magnetic search of buried objects, applications of portable gradiometers, operational considerations of proton magnetometers, and the earth's magnetic field and its variations. It is also the most common college text for magnetic exploration courses in geophysics. [http://www.georentals.co.uk/ampm-opt.pdf]

Indeed, to Breiner magnetic interpretation is a "fine art" which doesn't have enough practitioners. This scarcity is a curious fact, considering that potential field geophysics (magnetics and gravity) were in the vanguard of exploration, far predating the systematic use of seismic for commercial purposes. Today, however, potential field measurements represent but 2% of the exploration effort in an industry virtually monopolized by seismic. And within this modest use, magnetic surveying is predominantly airborne.

Still, some believe magnetics is a sensible way to lead a search. Perhaps the Soviet Union bears the standard in this belief - an impressive aeromagnetic coverage of its entire territory with flight line spacings of two kilometers. Notable American earth scientists, too, have promulgated the worth of non-seismic oil and gas exploration. To mention a few: Donald Barton, who brought to the US the first two Askania magnetometers from Europe; J. D. C. Hare, the inventor of the three element magnetometer; Victor Vacquier, who developed a sensor keen enough for aerial reconnaissance; Sigmund Hammer (see *TLE,* October 1982); Lewis Nettleton *(TLE,* November 1983). And Breiner.

"You can use magnetics to find out where not to look as much as where to look. It doesn't necessarily reveal hydrocarbon deposits, but by determining the configuration of the basement rock it establishes the thickness of the overlaying sediments, which may contain oil and gas. With airborne magnetics this is done quickly, at about one tenth the cost of seismic. With tight budgets especially, it's wise to make a preliminary survey to discard those areas where an expensive seismic program isn't warranted. In fact, there is an intriguing research effort underway by several oil companies to confirm a US Geological Survey discovery showing a correlation between shallow magnetic anomalies and oil fields. It may prove to be a powerful tool for direct detection of petroleum and perhaps a rebirth of magnetics in exploration.

"So I expect that in 5-10 years the oil industry will make a wider use of magnetics, but the present state of affairs is that the average company doesn't employ anyone who understands potential field interpretation. Only the largest majors seem to have maybe one or two gravity and magnetics people. In academia, the situation isn't much better. Very few universities have adequate coverage of magnetics in their curricula. Yet, some graduates are becoming passionate advocates of the method.

"They are applying the latest computer techniques in interpretation and experimenting with new methods of acquisition. In research or industry they'll become big fishes in a small pond. Still, I wish more would realize the fascinating and many yet-unexplored uses of magnetics when choosing a field of specialization.

Magnetics - Breiner's choice - led to yet another vocation. During some measurements in the San Andreas Fault, he developed interest in earthquake prediction, which he would make the subject of his PhD dissertation in 1967. Later, his combined knowledge of earthquake prediction and marine magnetics earned him an invitation from the People's Republic of China - one of the first offered to an American businessman since the Cultural Revolution of 1%6-69. At their request he has been back many times, giving numerous lectures, and establishing commercial ties since 1972 to the tune of $5-10 million a year in equipment sold by Geometrics to China.

"The science of earthquake prediction is about equally developed in the US, China, or the Soviet Union," comments Breiner. "The problem is that our theories must be substantiated by the catastrophes themselves. In China, two have been successfully predicted. The endangered towns were evacuated and many lives saved. I doubt if the US government could do the same - the panic might have equally fatal consequences. Therefore, research for earthquake prediction receives minimal funding here. And since our government seems to operate in a crisis mode, research will only be stepped up in the event of a major disaster."

On a level pier in the crawl space of Breiner's basement, the self-made tilt-meter sends its signals to a plotter nearby, registering seismic events as far away as 8,000 miles.

If it happens, the Breiners' neighborhood in Portola Valley may not be the safest place. They make their home less than 300 yards away from the main San Andreas Fault trace, and play tennis right on top of it on a court aptly named *Double* Fault. But their house, cozily rustic and camouflaged by northern California native shrubs and trees, is ready for the worst. Following Breiner's design recommendations the foundations are big concrete, steel-rein forced piers, with triangular structures to prevent lateral movement. The main beams of the floor are attached to the concrete foundation on the edge of the house by imposing steel plates so that the main floor is an integral part of the foundation. The outer, upper corners of the house are reinforced with extra steel sheets and there are extra nails in the shear walls.

Other contingent measures include plenty of canned food, drinking water, and a bacchanalian collection of fine wines to cope with isolation. All structural features are to minimize the effects of elastic rebound, which Breiner describes:

"At some points, about 10 miles from where we live, the fault is creeping two inches a year relative to the other side. Around here it hasn't moved since 1906, but when it happens the greatest movement will take place right at the fault trace. In the first second the land will move and the house will momentarily stand still, which will cause a big jerk on the foundations.

"Then the structure will want to catch up to the moving earth. But the earth will stop and the house will keep going. So, we'll have a big single whipping action - one direction, then the other. I'm not concerned about surface waves that come from distant points of the fault or from the fault shear itself. It's the first action that worries me."

Mimi, somewhat less intrigued by the elastic rebound theory, remarks: "It's uncanny how we never have the slightest tremor around here until Sheldon goes on a trip. Then, when I tell him about one happening in his absence, he doesn't believe me until he goes to the basement and sees it registered on the seismograph."

Next to the various items found in a typical American basement, in Breiner's there is a home-made seismograph on a special concrete pier. It is actually a tiltmeter which registers earthquake magnitudes of seven or more on the Richter scale up to 8,000 miles away, and of five or six anywhere in North America.

"Every two or three days I inspect it, and it never fails - there's an earthquake registered. I enjoy making an educated guess from the time between the arrival of the primary and secondary waves as to where it happened, and then check with the newspapers to see how close I came."

[*From the Stanford Observer, Campus Report September 26, 1984, "Indeed, the spring earthquake of magnitude 6.2 near Morgan Hill provided just such an example, and something of a*

Stanford legend. The quake came in the middle of the School of Earth Science's industrial affiliates lunch on the patio behind the Mitchell Building. As soon as the ground started rolling, most people dove under the nearest table. But alumnus Sheldon Breiner, the legend goes, stood cooly in an alcove timing the various waves on his digital wristwatch. He later announced the probable location of the epicenter and made a good estimate of the power"]

Breiner unrolls yards of evidence that his unpretentious cellar gadget and his guesses are finely tuned. In the charts, next to his interrogative notations, there is usually a newspaper clipping canceling the question marks:

December 1, 1983, Guatemala, magnitude = 6.5? (on the dot) - November 30, Hokkaido, Japan, 6.1 - November 16, Hawaii, 6.7 - November 23, 1980, Italy, 6.7. The record goes back five years.

A few hours with Breiner and you can't help but look back at your own past which has culminated in one job and a couple of hobbies. How can another handle such variety of interests, and with finesse? In trying to reduce Breiner to the level of mere mortals, the average achiever asks: "But if you had to choose one, only *one* thing to do?

"I wouldn't do without either" is the answer from a man who with the relentless thrust and single-mindedness of a 5-year-old, stuck to his original plan of ecumenical exploration. An explorationist *vis-a-vis* explorer by virtue of the same curiosity and chutzpa that since time immemorial drove others to look for the end of the rainbow. ±