FOREWORD

Paul F. Hoffman: Career and Contributions

This volume honours Paul F. Hoffman for his groundbreaking field studies and syntheses of Paleoproterozoic tectonics and Neoproterozoic climate states, and his influence on generations of student-colleagues. Paul's stratigraphic approach to regional tectonics and his early embrace of Precambrian plate tectonics allowed him to make a great leap forward in our understanding of the tectonics of the Canadian Shield. The second phase of Paul's career required a mastery of carbonate sequence stratigraphy, low-temperature and stable-isotope geochemistry, and geophysical climate dynamics. Based on years of field work in newly-independent Namibia, he became the leading advocate for ice-covered oceans (Snowball Earth hypothesis) in the Cryogenian period, at a time when the hypothesis was dormant. The hypothesis, and Paul's field work, continues to unfold.

Paul F. Hoffman, born in Toronto, Ontario on March 21, 1941, was the oldest of four children of an industrial paint chemist and a primary school art teacher. Although raised in the city, they spent summers and weekends in the country, where Paul undoubtedly gained his love for the natural world. During his teenage years Hoffman was fascinated with rocks and minerals so spent hours viewing the collections at the Royal Ontario Museum. He became an avid mineral collector.

Paul attended McMaster University in Hamilton, Ontario, which had a strong faculty in geology and geochemistry. He received his B.Sc. in 1964, graduating first in his class. He worked every summer as a field assistant doing regional mapping in the Canadian Shield, first with the Ontario Department of Mines (now the Ontario Geological Survey) and then with Geological Survey of Canada (GSC) in the Northwest Territories. As a result, he believed that the tectonics of the Canadian Shield was an important research area. At a time when few Precambrian geologists were trained in 'soft-rock' geology, sedimentologist-structural geologist Vint Gwynn at McMaster had a decisive influence on Paul by arguing that mountain belts of any age are best understood from the outside-inward, starting with the stratigraphy and sedimentology of the adjacent sedimentary basins.

Paul applied to Johns Hopkins University in Baltimore, following the tradition started by Canadian geologist, Andrew C. Lawson, who also did his GSC-supported dissertation there. Paul was most interested in working with both Francis Pettijohn and Cliff Hopson, but as Hopson left for UC Santa Barbara the same year Paul arrived it wouldn't be until 1972 that he would get to spend time with him.

Paul's dissertation topic, unorthodox for GSC because it wouldn't produce a map, was to compare the 2-billion-year-old, 12-km-thick sedimentary succession in the Great Slave Lake area with those in the Appalachians and other Phanerozoic 'geosynclines', where pre-orogenic sediment was shed toward the geosynclinal axis, post-orogenic transport directed in the opposite direction, and syn-orogenic (mainly deepwater) sediment flow typically paralleled the orogenic axis.

After his first year of graduate school, during the 1965 field season

A young Paul enjoying life by the Credit River.

with John McGlynn, Paul's mentor at the GSC and later Director of the Precambrian Division there, the GSC gave Paul a few days of helicopter time to check the feasibility of his proposed thesis project, and as he flew over outcrops on islands in the northern part of the lake he was floored by the extensive outcrops of beautifully exposed and perfectly preserved stromatolites.

Following the 'stromatolite extravaganza' as Paul put it, he headed south to the Tetons to hook up with his roommate Peter Geiser, but as he

This house was built by Paul's parents, Sam and Dorothy (in photo), on a 20-acre lot in 1939/40. The Hoffman kids spent every summer there and weekends throughout the year. In 1945, an addition was added to the near end, nearly tripling the inside area, but only the "old house" was used in winter. The house looks across the valley to the Niagara escarpment, which was good for fossil and mineral collecting. After Dorothy retired around 1989, age 75, she lived there year round until age 92, when she moved back to the city house in winter. The house had no vehicle access, and therefore few visitors. Dorothy preferred the winter because she could haul in water and supplies on a toboggan.

couldn't find him, he went to Green River, Wyoming where he bought an International Scout, in which he rambled for several weeks looking at geology in Wyoming and Utah. That winter he became Conrad Gebelein's field assistant at Florida's Cape Sable, where stromatolites were actively growing and eroded.

In what can only be called a serendipitous stroke of luck for Paul, carbonate sedimentologist Bob Ginsburg joined the Hopkins faculty in 1965 and together with Francis Pettijohn – who had first become interested in Precambrian rocks from Lawson's historical geology lectures – formed just the support Paul needed. For his Ph.D. dissertation, Paul spent two summers, with logistics supported by the GSC, measuring stratigraphic sections, inferring sedimentary paleoenvironments, and measuring nearly 8000 paleocurrent directions, in magnificently exposed outcrops of Paleoproterozoic rocks in the East Arm of Great Slave Lake. The name the northern natives used for Andrew Lawson, "Kow-atoos-winuek-mock", or "The man who goes around the shore", would have applied equally well to Paul working in the countless bays, channels, and islands of the East Arm, where glaciated lakeshore outcrops, brushed clean of lichen by ice during annual break-up, are unparalleled for their clarity of detail.

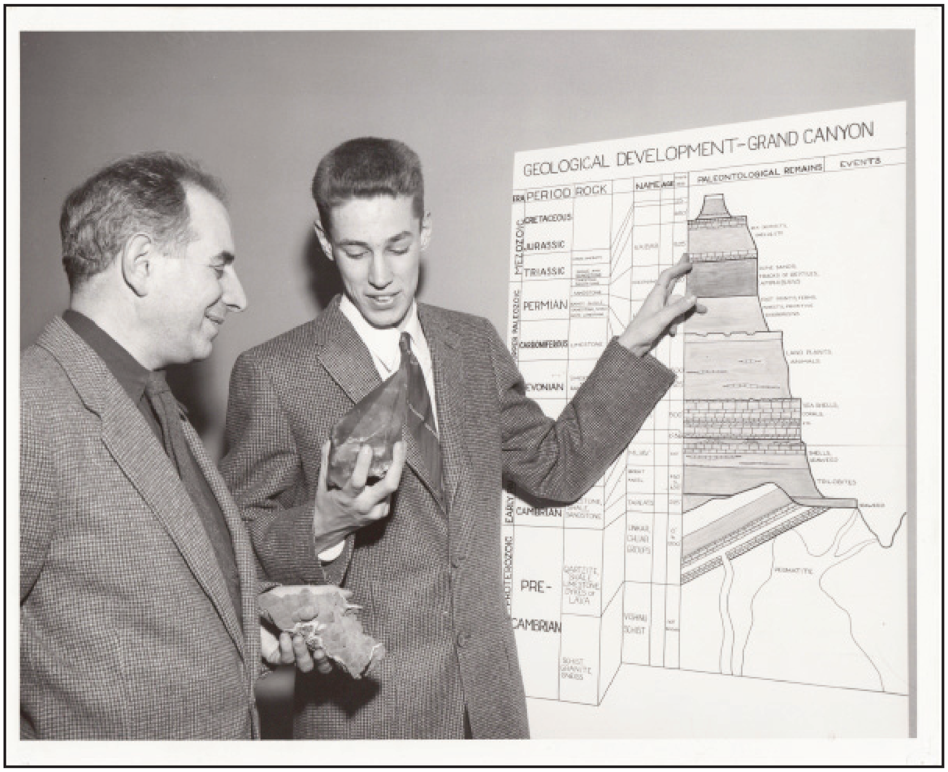
Although the primary focus of his dissertation research was a paleocurrent comparison of the rocks in the East Arm of Great Slave Lake with those of geosynclines like the Appalachians, the particularly well-exposed, stromatolite-rich carbonate units provided a secondary bonanza and so, in February 1967, after his first field season on Great Slave Lake, Paul presented the results at a conference on algal stromatolites organized by Ginsburg. At the conference he made connections with sedimentologists working on Holocene carbonate in the Bahamas, the United Arab Emirates, and Shark Bay, Western Australia, where stromatolites exist today.

Emboldened by the conference, he submitted a paper to *Science*, where he documented the continuity of single stromatolite beds for 160 km along strike and that stromatolite geometry can be used to determine paleocurrents and the orientation of ancient shorelines. By the spring after his second field season Hoffman had submitted a major GSC paper detailing the revised stratigraphy of what he termed the Great Slave Supergroup.

The following summer he wasn't scheduled for any fieldwork so he cashed in his visitation chips with scientists he met the previous year and examined Holocene carbonates in the Bahamas, Western Australia, and the Persian Gulf. Paul presented a wonderful summary of that tour in his *Tooth of Time* article on Conrad Gebelein. Over the next decade Paul published papers still cited on modern and ancient stromatolites as a result of these visits.

In 1968–69, Paul accepted a one-year lectureship at Franklin and Marshall College in Lancaster, Pennsylvania, in a research-oriented department dedicated to undergraduate teaching. While there, he developed courses in tectonic stratigraphy and modern-ancient comparative sedimentology, which he repeated in Ottawa and Calgary after he joined the GSC. He also wrote the last of his dissertation papers, *Proterozoic paleocurrents and depositional history of the East Arm fold belt, Great Slave Lake, Northwest Territories*. In it, he contrasted the parallel development of the Great Slave and southern Appalachian geosynclines with their paleocurrent directions, axial in the East Arm but transverse in the Appalachians. He related the Great Slave Supergroup to a covered orogenic belt in the basement west of Great Slave Lake, rather than in the Churchill province as he had anticipated. He identified the Wopmay subprovince as the exposed extension of his inferred orogenic belt.

In 1969, he accepted a position (as Precambrian paleontologist, filling a vacancy created by the departure of the late Hans J. Hofmann) with the GSC in Ottawa and immediately began a three-year reconnaissance profile of the northern Wopmay subprovince and the adjacent sedimentary



Paul shows his father, Sam, minerals and a geological section through the Grand Canyon, 1959.

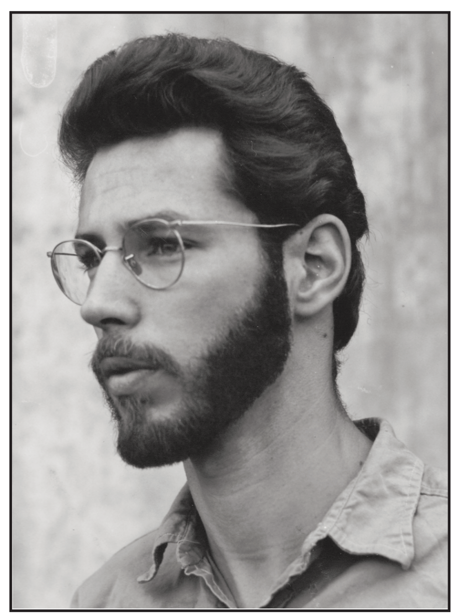
belt, which he named the Coronation geosyncline, bordering the Slave craton. These years were all-important because it was at this time that Paul wholeheartedly accepted the new paradigm that geosynclines mark the sites where former ocean basins opened and closed.

John Rodgers, a Yale University tectonics professor with strong European connections, suggested to Paul that the East Arm basin might represent an aulacogen, or a failed rift arm, based on similarities with long, linear sediment-filled troughs recognized by the Russian petroleum geologist, Nikolay Shatsky (of Shatsky Rise). This work was summarized in a landmark paper written during a nine-month stay at the University of California at Santa Barbara and entitled *Evolution of an early Proterozoic continental margin: The Coronation geosyncline and associated aulacogens, northwest Canadian shield* presented to the Royal Society of London. It was one of the first papers to document a Precambrian rifted margin, compared in considerable detail the similarities of the Coronation Geosyncline to Phanerozoic geosynclines, and suggested the existence of plate tectonics in the Paleoproterozoic, an idea that was at the time, and for some researchers, still is, far from demonstrated. Simultaneous work by Kevin Burke and A. J. Whiteman on African rift basins led Paul to include Kevin and his Albany cohort, John Dewey, in another classic paper, *Aulacogens and their genetic relation to geosynclines with a Proterozoic example from Great Slave Lake, Canada*. Thanks to Paul and Kevin, aulacogens and tripartite rifts were hot topics!

By now Paul knew that if he were to understand the tectonic regime of Wopmay orogen, which due to its shallow level of erosion, he recognized as perhaps the best exposed proxy for Paleoproterozoic orogenic style, he would need to map a cross section of the orogen. In this endeavor Paul was forced to confront problems in nearly all aspects of geology and solid-earth geophysics, which would set him up perfectly for future endeavors.

During the summer of 1972 he led a field trip for the IGC in the East Arm and spent a month mapping several islands, where he carefully studied the transition from platform to basin and recognized stromatolites in both platform and basinal facies. This led to yet another important paper entitled *Shallow and deepwater stromatolites in an Early Proterozoic platform-to-basin facies change, Great Slave Lake, Northwest Territories*.

Following his winter in Santa Barbara, where he was strongly influenced by C.A. Hopson, R.V. Fisher, and W.S. Wise, all experts in various aspects of igneous rocks, as well as by structural and sedimentary geologist John Crowell, he started a three-year project within Wopmay orogen to map a 1º cross section of the western post-collisional volcano-plutonic belt, known today as the Great Bear magmatic zone. Paul wanted to document ash-flow tuffs, because they had not been widely recognized in Precambrian rocks, but which he knew existed in the Great Bear from the final summer of his Wopmay transect ('71) and his subsequent winter at UCSB ('71–72). He also knew that the internal zone of the orogen would be the most difficult one and, as he already was familiar with the eastern side, wanted to understand the western side as well before tackling the metamorphic core. Although working on igneous rocks was new to Paul he produced a wonderful map and paper co-authored with J.C. McGlynn that documented the volcano-plutonic geology cut by an extensive system of northeast-trending transcurrent faults.



Paul Hoffman as he looked when he joined the GSC, 1970.

Field crew from Great Bear field season of 1975 on post-season field trip to Glacier National Park, Montana. Standing L to R: Rein Tirrul, forgotten one, Ian Bell, Paul Hoffman. Kneeling: Mike Cecile, Mike Easton.

Crew from 1976 project in the East Arm of Great Slave Lake. L to R: Ian Bell, Mike Flanagan, Linda Thorstad, Scott Dallimore, Robert Hildebrand, Ian deBie, Paul Hoffman.

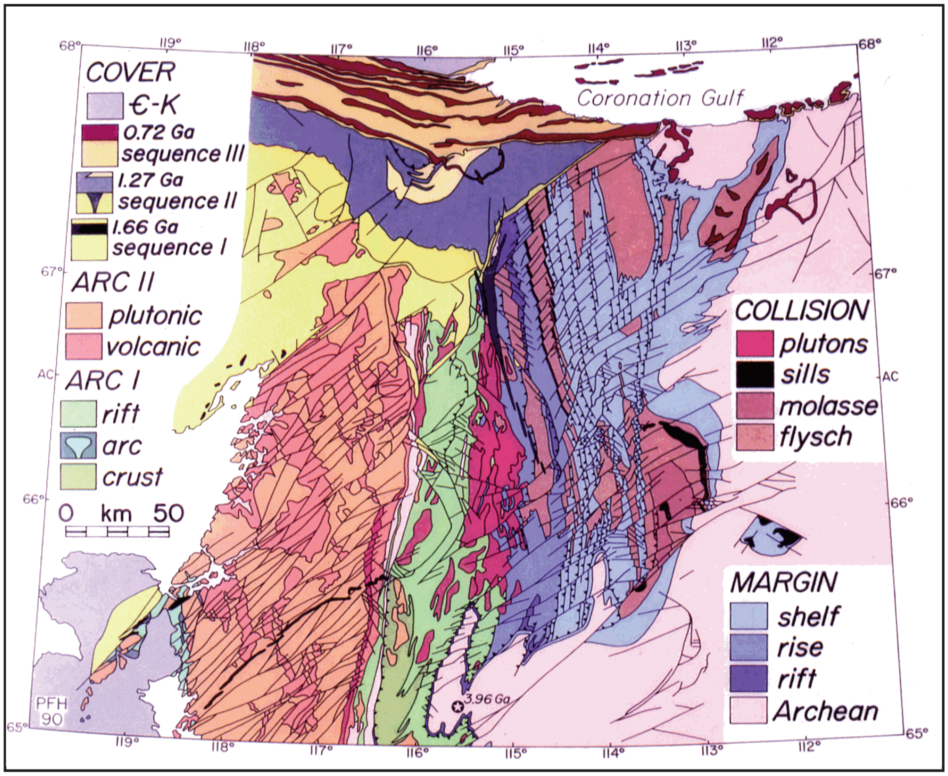
In 1976, between major field projects, he obtained permission to map the entire East Arm of Great Slave Lake in a single field season, a daunting undertaking as the area comprised some 42, 1:50,000 sheets. As one of his senior assistants, Hildebrand can attest not only to its madness, for they only took four days off over the four and a half month season, but also to its brilliance, because it was completed with spectacular results: instead of an aulacogen, the belt turned out to be part of a major collisional orogen between the Slave and Rae cratons. It contained foredeep deposits from two different orogenic belts, the younger Wopmay orogen on the western side of Slave craton and the older Thelon on the east.

Back in Wopmay orogen the following field season, Paul moved eastward into the internal metamorphic-plutonic core of the orogen, where once again he confronted new facets of geology. During this, and the following project, in which he mapped the entire foreland fold-thrust belt of the orogen, he adopted a new strategy of incorporating graduate student projects to study specific topics that would benefit from more detailed work. This led to Ph.D. projects by Mike Easton and Marc St-Onge, who worked on the volcanic and metamorphic geology of the internal zone respectively; John Grotzinger, who studied the carbonate sedimentology and stratigraphy of the passive-margin sequence; Rein Tirrul, who studied the foreland fold-thrust belt and the system of late conjugate transcurrent faults; Sam Bowring, who provided critical U–Pb geochronology and isotopic tracer studies throughout the orogen as well as mapped the eastern Great Bear magmatic zone; Robert Hildebrand, who studied folded stratovolcano and caldera complexes and their exotic basement in the most heavily mineralized areas of the Great Bear magmatic zone; and Stephen B. Lucas, who studied low-grade metamorphic variability controlling basement deformation in the cratonic foreland. These projects were made possible by cooperation, at the level of middle management, between different federal government departments. Paul's deep interest in plate tectonics and global geology rubbed off on his student colleagues, as did his rapid-fire style of oral presentation.

By 1979, with the mapping of the northern Great Bear and internal zones behind him, Paul synthesized the tectonic development of Wopmay orogen as a complete Wilson cycle terminated by continent-microcontinent-continent collision. Appropriately, the paper was presented at a symposium honouring J. Tuzo Wilson, and published by the Geological Association of Canada in 1980 as their Special Paper 20. In his paper, Paul proposed that rifting of the western Slave craton led to the development of a subsiding passive margin that was abruptly drowned and then deformed by westward subduction beneath an east-facing microcontinental magmatic arc. The arc-continent collision was immediately followed by subduction polarity flip and growth of a west-facing magmatic arc, the Great Bear magmatic zone, on the newly accreted terrane. Arc magmatism ended with terminal collision, manifested throughout the orogen by an unusually well-developed system of conjugate transcurrent faults, including the McDonald and Bathurst faults 500 km to the east of the orogen. At the time, no orogen of deep Precambrian age had been so comprehensively interpreted in terms of actualistic plate tectonics. This was all the more remarkable because the many age relationships were based entirely on field mapping—there was as yet not a single U–Pb zircon date in the orogen.

The lessons learned by mapping and studying a transect across Wopmay orogen served Paul well, for few, if any, areas of commensurate size display better-exposed and more diverse rock types and structures than Wopmay orogen. Thus, when offered the task of compiling the Precambrian geology of North America as part of the GSA's Decade of North America (DNAG), he was able to easily expand his already tried and true approach to encompass the entire Canadian Shield, Laurentia, and the history of supercontinents. DNAG was well-timed as it coincided with a great expansion of precise and reliable U–Pb geochronology throughout Laurentia. Paul often remarked that U–Pb dating changed tectonic geology from competitive drafting to real science.

During the years he was researching and compiling the Precambrian geology of North America, three contributions stand out for their insight and originality. In the first, Paul utilized geology, aeromagnetics and gravity to suggest that the Cape Smith belt, located in northernmost Quebec, was a huge klippe of mafic and ultramafic rocks. For the second, he used aeromagnetic anomalies, U–Pb geochronology, structural kinematics and Cenozoic analogues to argue that the Great Slave Lake shear zone of the Northwest Territories was a continental transform fault related to the indentation of the Churchill Province by the Slave Province. And the third presaged the modern notion of slab failure magmatism by pointing out that several



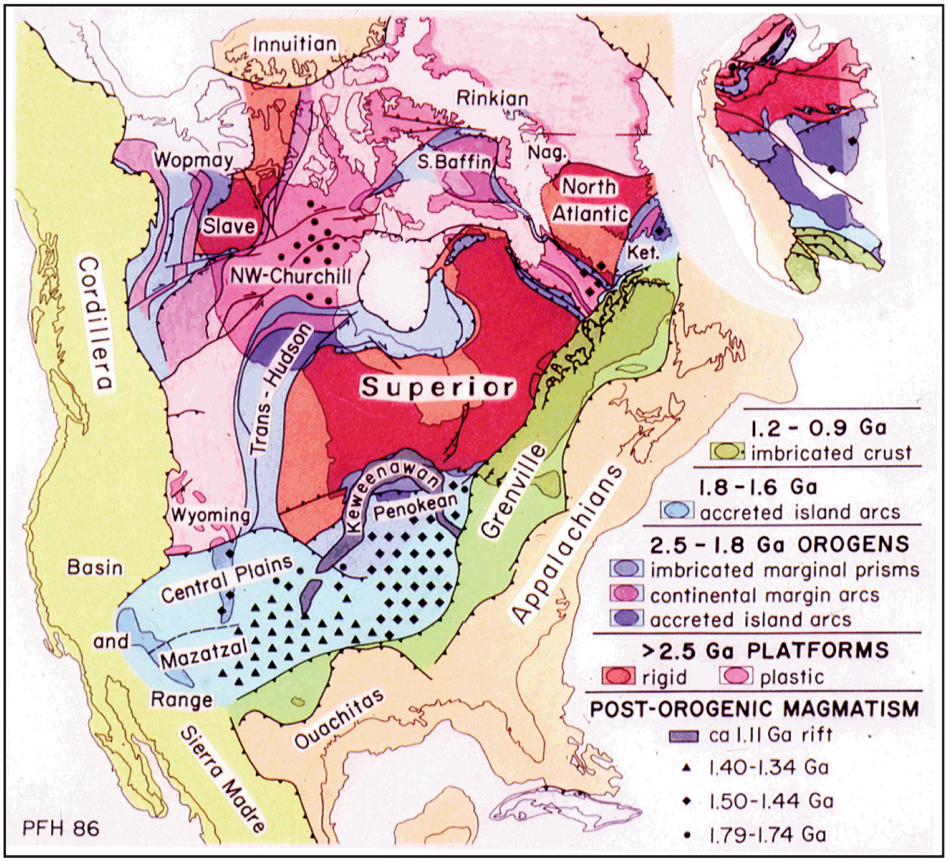
Paul's geological compilation of Wopmay orogen, 1990.

Paleoproterozoic collisional foredeeps contained mafic magmatism.

In 1988, Paul published what is now a classic of North American geology as the *United Plates of America, The birth of a craton: Early Proterozoic assembly and growth of Laurentia*. In the paper, now cited nearly a thousand times, he argued that Laurentia owed its existence to a complex, but understandable, network of Early Proterozoic orogenic belts that stitched the various cratonic blocks together.

The United Plates paper was immediately followed by a more complete treatment of the Precambrian of North America published as *Precambrian geology and tectonic history of North America* in the overview volume of the GSA Decade of North America. This was a mammoth undertaking: drafting the figures took Paul ten consecutive 100-hour weeks. In that paper he demonstrated that the lithology, structure and evolutionary development of crust during the Archean were similar to those of the Proterozoic. He also suggested that the widespread Neoarchean pulse of deformation and magmatism might have created a single Late Archean supercontinent, break up of which was followed by the Paleoproterozoic parade of collisions that resulted in the formation of Laurentia. This naturally led him to suggest that the widespread 1.5–1.3 Ga anorogenic magmatism of eastern Laurentia arose when the supercontinent grew sufficiently large that its central portions were far from the cooling effects of subduction around the periphery of the supercontinent. This insulated the mantle, which induced asthenospheric upwelling, melting and uplift in the absence of lithospheric stretching.

With Paul's curiosity and creativity, these regional studies led naturally to bellwether papers on the nature of the mantle beneath the Canadian shield, Archean flake tectonics and the accretionary nature of granite-greenstone terranes, and the supercontinent cycle. In 1991, Paul left Ottawa and moved to the Pat Bay (Vancouver Island) office. Within a year his time at the Survey was done and his final publications — a major contribution to the new Geological Map of Canada by J.O. Wheeler, as well as geological maps of the fold-thrust belt (externides) in Wopmay and a compilation of the Slave craton and environs — slowly worked their way through the publication queue.



The United Plates of America, 1986.

In 1992 Paul accepted Chris Barnes invitation to relocate from the GSC to the University of Victoria. This move, along with a fateful suggestion by John Grotzinger, who was by then working on latest Neoproterozoic strata in southern Namibia, and a field trip led by Roy Miller of the Geological Survey of Namibia, marked a major shift in Paul's attention from earlier Proterozoic tectonics and supercontinents to Neoproterozoic paleoceanography and glaciation. Just as his earlier inspiration had been Cenozoic plate tectonics, his inspiration now came from Cenozoic deep-sea sediment and glacial ice cores. His first trip to Namibia, in the summer of 1992, began a 22-year and counting field campaign in the Kaoko and Damara fold belts in the rugged and wild northwest of the country. This field project gained a boost in 1994 with Paul's move to Harvard University and the acquisition the following year of his trustworthy Toyota Hilux (the bakkie), which continues to ferry Paul and a troupe of students annually from Windhoek to Damaraland and beyond.

Paul's interest in the Neoproterozoic lay in the climatic paradox of glacial deposits sandwiched between tropical platform carbonates. Although a variety of weakly developed hypotheses for this enigma had been proposed, none had been rigorously tested. Nowhere was better suited to address this provocative problem than Namibia, with a pair of Cryogenian glacial units (Chuos and Ghaub formations) intercalated with the superbly exposed warm-water carbonates of the Otavi Group. At the same time, the Neoproterozoic fold and thrust belts on the southwestern promontory of the Congo craton were ripe for a systematic mapping effort. Working with isotope geochemist A. Jay Kaufman, Paul coupled this mapping with sequence stratigraphy and carbon isotope chemostratigraphy of the Otavi Group. An early and important result of this work was the demonstration that the hallmark negative carbon isotope anomalies that had been previously attributed to the post-glacial cap carbonates also preceded at least one of the glaciations. Furthermore, the cap carbonates stood out as unusually thick depositional sequences within the context of a carbonate platform otherwise dominated by metre-scale parasequences, implying a long duration for the glacial periods.

After the 1997 field season, Paul had accumulated sufficient data to document that the Otavi basin extended from an intra-shelf platform in the north across a spectacularly exposed foreslope and into a deep basin to the south, with the basin geometry controlled by episodic extension that remained active until the interglacial interval. After four full field seasons, he was ready to address the climatic dichotomy from the perspective of northwest Namibia. As he was completing his first full paper on the Otavi Group for *GSA Today*, in which he carefully articulated the competing hypotheses to explain Neoproterozoic glaciation, Paul concluded that the Snowball Earth hypothesis, proposed quietly by Joe Kirschvink in a two-page paper in the 1992 Proterozoic Biosphere volume, was not only most consistent with the data emerging from Namibia and elsewhere, but that it correctly predicted many of the features of Neoproterozoic glaciations, specifically that they were long-lived and followed by negative carbon isotope anomalies preserved in unusually thick accumulations of post-glacial carbonate. The *GSA Today* paper was published in May of 1998 and with the creative guidance of new Harvard colleague and geochemist Dan Schrag, *A Neoproterozoic Snowball Earth* was published in *Science* in September.

Paul knew that this paper was going to make waves, but even he must have been amazed at just how big they were. Seemingly overnight, the Snowball Earth hypothesis, which he has always diligently attributed to Joe, changed the focus and breadth of research on the Neoproterozoic. With its extraordinary claim of oceans completely frozen over for some 10 million years and atmospheric CO_2 levels in 100s of millibars at its close, the Snowball Earth hypothesis captivated the public through many documentaries and one popular science book, inspired researchers from diverse disciplines, and galvanized skeptics. In the years immediately following the *Science* paper,

Paul, Sam Bowring, Joe Kirschvink, Doug Irwin, Dan Schrag, and John Grotzinger at 'Pip's Rock', Kunene Region, Namibia where the abrupt conformable transition from carbonate debrite and ice-rafted debris of glacial marine origin (Ghaub Formation) to peloidal dolarenite, aka cap dolostone, characteristic of the Marinoan syndeglacial transgression globally, is visible just above the heads of those standing.

Paul and Dan both trumpeted and refined the hypothesis, first with a beautifully crafted *Scientific American* article, then with a paper in *Terra Nova* in 2002, in which they elaborated on the many subtleties of the hypothesis and addressed some of the early criticisms. This paper remains the handbook to the Snowball Earth hypothesis.

Through colleagues and graduate students, Paul has gnawed away at many problems related to the Snowball Earth and the Neoproterozoic in general, from the question of the timescale, geochemical, and isostatic-eustatic implications of the post-glacial cap carbonates to the compilation and interpretation of the Neoproterozoic carbon isotope record. In 2005 he joined with subsequent snowball critic Philip Allen in a paper in *Nature* where they argued that the giant wave ripples unique to basal Ediacaran cap carbonates were the product of extreme and sustained winds in the aftermath of Snowball Earth. The following year, Philip hosted the Snowball Earth conference in Ascona, Switzerland, a culmination of 7 years of subsequent research on the snowball Earth hypothesis and countless conference symposia. This conference brought together geologists, climate modelers, geochemists, glacial sedimentologists, biologists—snowball proponents and antagonists alike—under one roof for what, in hindsight, was interpreted by some as Snowball Earth on trial. Despite one view that the conference was the death knell of the Snowball Earth hypothesis, the snowball remains alive and well, increasingly supported by geochemical, modelling, and geochronological results.

Lost in the turbulence of the Snowball Earth hypothesis was a paper Paul published with post-doc Ebbe Hartz in *Geology* in 1999 on the Ombonde detachment, a very low-angle normal fault that cut the Otavi Group in the southern Kaoko belt and not easily attributed to lithospheric extension. In this remarkably unheralded paper and one of Paul's favourites from his bibliography, he argued instead that the detachment was the result of a submarine landslide related to early Pan-African foreland flexure. More recent mapping has revealed a second detachment to the north.

Another important milestone in Paul's Namibia research was the publication in 2008 of a chapter on the Otavi Group for Roy Miller's *The Geology of Namibia*. This chapter, buried deep within this beautiful and massive three-volume tome, was Paul's first synthesis of the extensive mapping, stratigraphy, and isotope geochemistry he and his network of former students and collaborators had accomplished in northwestern Namibia.

Following a pledge to his wife Erica not to stay on the East Coast indefinitely, Paul retired from his teaching and administrative duties at Harvard University in 2008. During his 14 years there, four PhD students completed their dissertations: Galen Pippa Halverson, Adam Maloof, Francis Macdonald, and David Jones. His first post-retirement adventure was to Australia, where with the support of a fellowship from the Harvard Club of Australia, he spent three months based in Adelaide with Erica. Paul and Erica then returned to Victoria.

Over their careers most scientists are content to stay within their

Clockwise from left: Paul, his daughter-in-law, Claire Stephenson, his mother Dorothy Medhurst, wife Erica, and son Guy.

cocoon of knowledge but not so Paul, for he has consistently challenged himself and moved into new fields of geology, mastered them, and made significant contributions. From his early insights into stromatolites, geosynclines, and the origin of aulacogens, through his studies of igneous, metamorphic, and structural geology in Wopmay orogen, to his compilations of the Precambrian of North America and his leadership in the maturation of the Snowball Earth hypothesis, Paul has developed an encyclopedic command of the geological literature and its history, a masterful understanding of a broad cross section of geology, and has augmented this knowledge with fresh, insightful, and innovative ideas. Few scientists in any field work harder than Paul and perhaps the lessons to be learned from his career are to read the literature assiduously, to spend as much time as possible looking at the rocks, never stop learning and growing, to always challenge yourself and others with new and testable ideas, and that to truly understand the strengths and weaknesses of a model, you must make it your own.

In honour of his accomplishments Paul was awarded the Past President's Medal of the Geological Society of Canada in 1974, the R.J.W. Douglas Medal of the Canadian Society of Petroleum Geologists in 1991, and in 1992, the Logan Medal, the highest honour of the Geological Association of Canada. He is a recipient of the Alfred Wegener Medal of the European Union of Geosciences, the Henno Martin Medal of the Geological Society of Namibia, the Du Toit medal from the South African Geological Society, and the Willet G. Miller Medal of the Royal Society of Canada. In 2009, he was the Wollaston Medal Laureate of the Geological Society of London, in 2010 the Bucher Medallist of the American Geophysical Union, and in 2011 was awarded the Penrose Medal from the Geological Society of America.

Hoffman is a Fellow of the Royal Society of Canada, the Geological Society of America, the American Geophysical Union and the American Association for the Advancement of Science, and a Foreign Associate of the U.S. National Academy of Sciences and the American Academy of Arts and Sciences. In 2012 he was appointed an Officer of the Order of Canada.

Robert S. Hildebrand
Galen P. Halverson

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