

In Memorium
Dr. Geoffrey Owen Seltzer



Photo Credit: Stephen C. Porter

The Quaternary science community lost one of its leaders, and most influential and enthusiastic participants with the passing of Geoffrey Owen Seltzer on January 15, 2005. Geoff, 45, was at the prime of his career, and died after a brave 18-month battle with cancer. He is survived by his wife, Katie Reed; father, George Seltzer of Minneapolis; brothers Jonathan and Matthew of Minneapolis and Ethan of Portland, Oregon, and their families. Geoff touched the lives and careers of numerous students and colleagues through his powerful intellect and insight, his genuine kindness, and his deep concern for advancing the field of Quaternary science. He was a valued member of every community he was a part of and will be missed. This special edition of *Quaternary International* is dedicated in Geoff's memory, and we offer this brief biographical review as tribute to some of his specific contributions to Quaternary science, with selective detail on his work with snowlines.

Born in Minneapolis, Minnesota in 1959, Geoff earned his B.A. at Carlton College (1982), and his M.S. (1987), and Ph.D. (1991) at the University of Minnesota. Geoff was a post-doctoral fellow and senior research associate at the Byrd Polar Research Center at Ohio State University, and has served on the faculty of the Earth Sciences Department at Syracuse University since 1994. His numerous awards include being named a fellow of the Geological Society of America in 2004. Geoff's major contributions to the field of Quaternary science include his careful analysis of the climatic significance of paleosnowlines in the Andes, his novel use of stable isotopes from Lake Junin, Peru to develop a record of regional moisture balance, his leadership in

compiling multi-proxy evidence from Lake Titicaca sediments to substantiate early warming of tropical South America at the Last Glacial–Interglacial transition, and his galvanizing efforts to apply surface exposure dating methods to date moraines in Peru and Bolivia. Results of Geoff's research are published in more than 42 papers, all in top journals including *Science*, *Nature*, *Geology*, *Quaternary Research*, and *GSA Bulletin*.

Geoff was blessed with a combination of keen intellectual insight into many of the key questions that face the Quaternary sciences and an ideal personality for fostering collaborative research efforts with scientists with diverse areas of specialization. He was also very successful at organizing and coordinating large research programs, and at obtaining consistent funding for these ventures. In the mid-1990s he spearheaded efforts to obtain the first long sediment cores from Lake Titicaca and other lakes on the Altiplano of Bolivia and Peru. Permission to drill Lake Titicaca required negotiations with officials in both the Peruvian and Bolivian governments, and Geoff's calm and unflappable nature, his patience, and his knowledge of and interest in Andean culture proved indispensable in navigating these labyrinthine bureaucracies.

These and similar efforts catapulted Geoff into the international limelight and likewise resulted in further collaborative leadership roles. In 1998 he was named Project Leader of the International Geosphere Biosphere Project PEP 1, which is focused on compiling climate records along a N–S transect through the Americas. In January 2000, Geoff co-convoked a

workshop on ‘Paleoclimates of the central Andes’ held at the University of Arizona, sponsored by US NSF Earth System History and the InterAmerican Institute for Global Change Research. This resulted in a special issue of the journal *Palaeogeography, Palaeoclimatology, and Palaeoecology*, which Geoff edited. Geoff was an active partner with PAGES, the Past Global Changes Project of the International Geosphere–Biosphere Programme. The key to this activism was his scientific contributions to workshops and conferences, with a special emphasis on the PEP 1. Geoff recognized that future progress in paleoclimate research must involve a better understanding of atmospheric and oceanic circulation systems. Following on from a PAGES workshop on Hadley Cell dynamics in November 2002, Geoff took on a major leadership role authoring a successful proposal to hold an AGU Chapman Conference on “Tropical-Extratropical Climatic Teleconnections—a Long Term Perspective”. Moreover, working with the PAGES Scientific Steering Committee (an international body representing 15 different countries) in Banff in June of 2003, he helped craft the text for an initiative within PAGES on this very topic. The Chapman conference Geoff so carefully planned was held on February 8–11, 2005 at the International Pacific Research Center of the University of Hawaii.

The reconstruction and climatic interpretation of snowlines were a lifelong interest for Geoff, beginning with his M.S. thesis at the University of Minnesota. He followed in the footsteps of his advisor H.E. Wright, Jr., eminent pioneer of the Quaternary throughout the Americas, and took an active role in compiling the geomorphologic evidence and chronological data on glacier activity and paleosnowlines in the Andes of Bolivia and Peru. Geoff took on the challenging scope of terrain and paucity of data in the Central Andes with enthusiasm, always with a critical eye on the implications of his field evidence for understanding tropical and global climate. His graduate work produced a valuable dataset of Central Andean snowlines based largely on intensive mapping of glacial geomorphological features (cirque floor elevation, valley form, and moraines) from topographic maps and aerial photos. This work gave him an early appreciation for the spatial gradients in climate and glacier response over the profound topographical barrier of the Andes.

Geoff’s 1990 review paper is still widely cited as a comprehensive synthesis of Quaternary glaciations in the central Andes. The paper reviewed the nature, extent and chronology of glaciations, including a tabulation of all radiogenic dates with sample descriptions and significance of each site. Yet it was more than a simple chronologic summary, and provided valuable information on modern climate, snowlines and glaciology to give a context for evaluating snowline variations spatially with respect to climatic gradients. He also

discussed critically the paleoclimate implications of the Quaternary glacial sequence, in the context of other proxy evidence. This early work illustrates well Geoff’s powerful ability to assimilate a wide array of data into a clear and insightful narrative, and served to chart forth the direction of the succeeding 15 years of Andean glacial geologic research. Interestingly, his preliminary synthesis of the LGM in Peru and Bolivia implied asynchrony in the timing of glaciation with northern hemisphere. While extensive subsequent work by Geoff and his colleagues and students would refine the details, this active interest in the hemispheric asynchrony of glaciations provided formative motivation and impetus for the entire Andean Quaternary community.

Geoff also took a role in advancing the reconstruction of paleoglacier surfaces from geomorphologic remnants to improve ELA estimations using AAR methods instead of cirque elevations and THARs. In his 1992 work in the Bolivian Cordillera Real, Geoff tested his reconstructions using fundamental constraints of center-line basal shear stress to establish realistic area-altitude relationships. He then broadened the discussion of late Pleistocene temperature reduction based on the computed ELA depression by incorporating mass and heat balances. This important step made it clear that simple lapse rates applied to paleo-ELAs was inadequate to address climate changes. A better approach that incorporated a range of possible precipitation and temperature changes was required, and Geoff recognized how other proxy evidence, such as lake levels and pollen, were needed in association with snowlines.

He advanced this climatic analysis of snowlines with his 1994 paper entitled “Climatic Interpretation of Alpine Snowline Variation on Millennial Time Scales.” In this manuscript, composed over a single weekend, Geoff exemplified a rare ability to creatively synthesize complex dynamics into critical new insights of interpretation. He devised a sensitivity analysis incorporating both heat and mass balance terms to counter the overly simplified climate interpretations based on applying lapse rates to snowline changes to show that an average 1000 m LGM snowline depression was due to $\sim 6^\circ\text{C}$ temperature change. Geoff made the theoretical link to glacier boundary layer climate to substantiate the critical point that it is impossible to reduce the complex response of glaciers to one variable. Rather, climatic interpretations of alpine snowline variation should quantify a range of possible solutions. Furthermore, use of an equilibrium line altitude requires that internal glacier dynamics be ignored, so that the interpretation is restricted to millennial time scales. Subsequent work has reinforced these insights, and much discussion at the 2002 LGM Snowline Workshop in Glasgow, U.K., reported in this volume of *Quaternary International*, involved identifying theoretical weaknesses of simply applying lapse rates to midline altitudes of paleoglaciers.

Geoff's work on Lake Junin, Peru began in the early 1980s and exemplifies his ability to integrate data from a variety of sources to contribute to a deeper understanding of Andean paleoclimates. Geoff, with his students and colleagues, cored many dozens of lakes in the glacial valleys of the tropical Andes, and these records were used to develop records of upvalley deglaciation and vegetation change. He recognized early the potential in Lake Junin to develop a detailed record of hydrologic balance spanning the last deglacial hemicycle. Geoff appreciated how the oxygen isotope record from the carbonate sediments of Lake Junin would complement similar data from the nearby Huascaran ice core, which he helped to acquire in 1993. This enabled him along with his colleagues to derive an independent and quantitative measure of regional moisture balance over the late Quaternary, the first such record of its kind to be developed for the region.

Geoff also contributed valuable insights about the spatial variability of snowline changes, and the necessity of acknowledging gradients. This work was extended in subsequent analyses by Andrew Klein, one of Geoff's advisees, using remote sensing to identify paleoglaciers and evaluate climatic forcing over the wide spatial extent of the Central Andes in Bolivia and Peru. Moreover, the combination of many lake cores from formerly glaciated cirques convinced Geoff that the ideal glacier types for precisely constraining paleosnowlines were actually small cirque glaciers. This was confirmed by discussion at the Snowline Workshop, reported in this volume. However, the outstanding challenge as Geoff noted in his *Quaternary Science Reviews* perspective article on future research directions, remains identifying the chronology of glacial advances. Thus, he would continue to explore the integration of his lake sediment data and glacier moraine ages.

While coring Andean lakes, Geoff often wondered about the temporal relationship between the lake sediment records and the age of the numerous moraines that descend nearly to the shores of these large lakes. This led to his developing a collaborative effort involving numerous investigators at various institutions to apply cosmogenic radionuclides to date glacial advances in the Peruvian and Bolivian Andes. Results of this work coupled with data on glacial flour input into Andean lakes led Geoff to assert that the culmination of the last glacial maximum in the tropical Andes occurred earlier than that at higher latitudes of both hemispheres. This finding, in turn, has challenged the Quaternary community to reexamine the driving mechanism of tropical climate change on glacial–interglacial time scales.

One of Geoff's lasting legacies to Quaternary research has been his interpersonal care and mentoring of graduate and undergraduate students. His graduate

students have gone on to careers in academic and applied research involving tropical snowlines (four were in attendance at the Snowline Workshop), hydrology, natural resources, environmental geochemistry, and paleoclimate reconstruction throughout South and Central America and beyond. His style was never too overbearing, and he expected his students to work very independently. But his encouragement was always sincere, as he was. Geoff always made time for people, and truly respected others. One of the features most widely associated with Geoff is his broad smile, captured well in the accompanying photo taken at the Snowline Workshop by Steve Porter. He was a true gentleman, and loved to participate in the communal discovery. His favorite type of meeting was epitomized in many ways by the Snowline Workshop, where a small group of congenial scientists could think critically and share good fellowship.

It with genuine sorrow we bid farewell to our colleague, friend and mentor. Responses from many others who knew Geoff over the years in various capacities echo this profound sense of loss. Still, there is a resounding expression of gratitude for having had the opportunity to interact personally with him. Geoff deeply valued this community, and he left a great legacy in the priority he placed on how and with whom he worked. We are reminded by Geoff's death that life is very short, and ultimately success adheres closer to the quality than quantity of one's work.

A memorial fund has been established in Geoff's name to benefit outdoor camping training for youth; contributions can be made to: Geoffrey Seltzer Fund, YMCA Camp Widjiwagan, 2125 East Hennepin Avenue, Suite 150, Minneapolis MN 55413.

Examples of 1st Authored Publications by G.O. Seltzer

- 2002 Early Warming of Tropical South America at the Last Glacial–Interglacial Transition. *Science*, 296: 1685–1686.
- 2001 Late-Quaternary Glaciation in the Tropics: Future Research Directions. *Quaternary Science Reviews*, 20: 1063–1066.
- 2000 Isotopic evidence for Late Glacial and Holocene climatic change in the tropical Andes. *Geology*, 28:35–38.
- 1998 High-resolution seismic reflection profiles from Lake Titicaca, Peru/Bolivia. *Geology*, 26:167–170.
- 1994 Climatic interpretation of alpine snowline variations on millennial time scales. *Quaternary Research*, 41, 154–159.
- 1994 A lacustrine record of late-Pleistocene climatic change in the subtropical Andes. *Boreas*, 23, 105–111.
- 1992 Late Quaternary glaciation of the Cordillera Real, Bolivia. *Journal of Quaternary Science*, 7, 87–98.

1990 Recent glacial history and paleoclimate of the Peruvian–Bolivian Andes. *Quaternary Science Reviews*, 9:137–152.

1990 Climatic change and its effect on prehispanic agriculture in the central Peruvian Andes. *Journal of Field Archaeology*, 17, 397–414.

Bryan G. Mark
Department of Geography,
The Ohio State University,
Columbus, OH 43210, USA
E-mail address: mark.9@osu.edu

Donald T. Rodbell
Department of Geology, Union College,
Schenectady, NY 12308, USA

Julie Brigham-Grette
Department of Geosciences,
University of Massachusetts,
Amherst, MA 01003, USA

Jacqueline A. Smith
Department of Earth Sciences,
Syracuse University,
Syracuse, NY 13210, USA