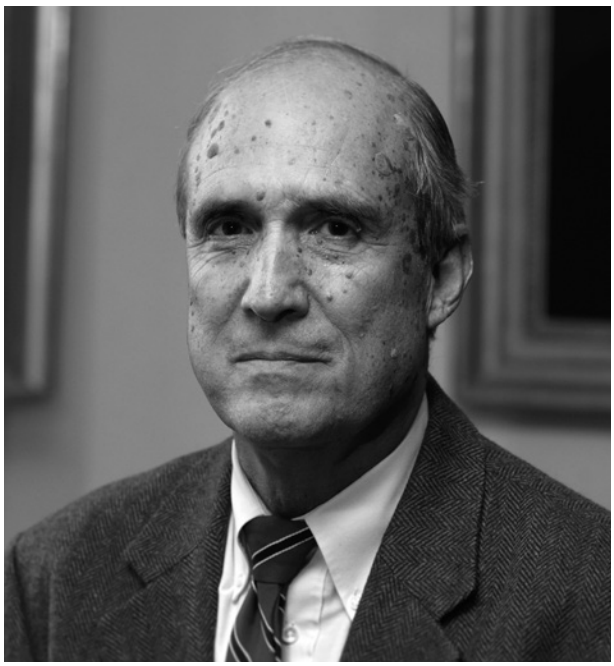
Robert A. Berner

(1935–2015)

Geochemist who quantified the carbon cycle.



YALE UNIV.

From how minerals form in sediments to how carbon dioxide is regulated in the atmosphere, Robert Arbuckle Berner quantified elemental cycles across the Earth system. He developed the first whole-Earth mathematical model of CO_2 exchange, which revealed marked changes in our planet's past atmospheric levels and the rates at which natural processes might remove anthropogenic CO_2 from the atmosphere.

Born in 1935 in Erie, Pennsylvania, Berner died on 10 January in New Haven, Connecticut. He was encouraged to develop an interest in geology by his older brother Paul, a (now-retired) petroleum geologist. Berner attended the University of Michigan in Ann Arbor for his undergraduate and master's degrees. There, he spotted fellow geology student Betty Kay. They married in 1959 and formed an inseparable bond, working and writing papers and books together for decades.

Berner received his PhD in 1962 from Harvard University in Cambridge, Massachusetts. During his thesis work on the formation of iron sulfides in sediments, he discovered new minerals, among them greigite, and invented a type of electrode used for measuring sulfide content. His adviser was Raymond Siever, known for his work on the ancient marine silicon cycle, and Berner was also heavily influenced by Bob Garrels, who championed thermodynamics and the concept of geochemical cycles.

He moved as a postdoc to the Scripps Institution of Oceanography in La Jolla, California. After a short stay as assistant professor at the University of Chicago, Illinois, in 1965 he joined the faculty at Yale University in New Haven, where he remained until his retirement in 2006.

Soon after arriving at Yale, Berner realized that mineral formation in sediments depends on how fast chemicals are transported in and out of the sediments and how quickly organic matter is oxidized by microbes. He developed mathematical expressions for these mechanisms and so started the field of sediment diagenesis, which concerns the biological and chemical processes that occur in recently formed sediments. Berner and others went on to establish how sediment processes ultimately control the nutrient balance of the oceans and the concentrations of oxygen and CO_2 in the atmosphere.

In the early 1980s, Berner teamed up with Garrels and Antonio Lasaga to develop the BLAG (Berner, Lasaga and Garrels) model of global atmospheric CO_2 concentrations over geological time. This was the first global model aimed at quantifying all conceivable processes that control CO_2 exchange, and was largely based on Berner's earlier work on mineral-weathering reactions, ocean chemistry and early diagenesis. The BLAG model allowed geologists to understand for the first time how changes in rates of geological processes such as continental plate motion, for example, controlled past CO_2 levels.

Components since added to the model include the influence of biological evolution on the history of CO_2 concentrations, which hint at relationships between plant evolution and glaciation. These later models also reproduce a history of atmospheric oxygen, and show, for instance, how past periods of elevated oxygen concentrations correlate with spells of insect gigantism.

Bob focused like a laser beam on the problem at hand and was able to find simple and elegant solutions to complex geological problems. He exuded warmth and humanity. In my time at Yale as his PhD student, from 1982 to 1988, he often joined us for Friday happy hour at the local Whitney Winery, entertaining us with stories of science's colourful characters.

He was a Francophile and loved the winery's outside terrace because it reminded him of Parisian cafés. It was more expensive to sit there so Bob inevitably picked up the bill, and sometimes invited us home afterwards for a meal and to sample his (not so fine) wines and whiskey. Fine wine was saved for the celebration of new PhDs. Bob and Betty invited the newly minted PhD to their home for a luxury dinner. Afterwards, the entire lab would descend, often for a long night of ping-pong and poker.

In material things, Bob had simple tastes. When he and Betty inherited a powder-blue Chevy Nova, Bob gleefully announced that it was his first car with a radio, and invited a group of graduate students to ride with him through New Haven listening to old-time radio stations. Bob later purchased a Honda Civic, which he named Harvey, that had a tape deck and door alarm. He made a 4-track tape recording of piano and percussion parts, which, when played in the car with front doors ajar, mixed perfectly with the car alarm. Bob had a party to celebrate, packing graduate students into the car to enjoy his composition, 'Harvey and the four Bobs'.

He was, however, a serious pianist and classical composer, devoting much time to music after his retirement (see go.nature.com/bnq4a2).

Bob was a loving family man and a dedicated friend and mentor. He stressed honesty and integrity while showing that science was great fun. Bob touched the whole geological community. He is sorely missed. ■

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