Van Valen's first point is incorrect. Neither he (*1*) nor Ryther (*2*) discussed terrestrial plant productivity of the geologic past per se.

By "control" (*3*) I imply the "power to guide or manage" (Webster) and suggest that dominant land productivity has exerted control on atmospheric CO_2/O_2 ratios over the late Phanerozoic. Transport of reduced carbon and its history relating to marine "sinks" hinge upon the dominant land productivity that "controls" the amount of reduced carbon accumulating in the sinks. The predominance of land-derived particulate organics over marine-derived particulate organics in many marine rocks is well known. Times of maximum land exposure, and thus maximum land productivity, would be times of maximum transport and burial of terrestrial organics, causing imbalance in the carbon burial-weathering cycle and fluctuations in the atmospheric partial pressure of oxygen (pO_2).

Van Valen's (*1*) concentration-dependent regulation of oxygen (CDRO) lacks confirmation from the geologic record; Tappan's (*4*) work on pO_2 versus photosynthesis levels suggest that pO_2 may have fluctuated substantially at times; analysis of her work is basic to an evaluation of the CDRO.

Although most plant materials (cellulose, other polysaccharides, and lignin) often decompose quickly as a result of biological and chemical attack, vast amounts of sporopollenin (oxidative copolymers of carotenoid or carotenoid esters bound together in a matrix, or both) (*5*) in the reproductive spore walls of most modern and fossil vascular and nonvascular plants survive transportation and burial, and even recycling from older into younger sediments (*6*). Chemical maceration of many Precambrian and younger sediments indicates the vastness of this organic carbon reservoir that has remained unoxidized since formation.

Relatively slow regressional rates would allow terrestrial ecosystems to migrate with regressing seaways, stabilizing the lands and preventing massive erosion and consequent exposure of much reduced carbon to oxidation. Even the late Maestrichtian regression, which was ten times the general rate (*7*), was only 800 km per million years.

DEWEY M. MCLEAN
Department of Geological Sciences, Virginia Polytechnic Institute and State University, Blacksburg 24061

References

1. L. Van Valen, *Science* **171**, 439 (1971).
2. J. H. Ryther, *Nature (London)* **227**, 374 (1970).
3. D. M. McLean, *Science* **200**, 1060 (1978).
4. H. Tappan, *Palaeogeogr. Palaeoclimatol. Palaeoecol.* **4**, 187 (1968); in *Molecular Oxygen in Biology: Topics in Molecular Oxygen Research*, O. Hayaishi, Ed. (North-Holland, Amsterdam, 1974), p. 81; ____ and A.R. Loeblich, Jr., *Geol. Soc. Am. Spec. Pap. 127* (1971).
5. J. Brooks, in *Sporopollenin*, J. Brooks, P. R. Grant, M. Muir, P. van Guzel, G. Shaw, Eds. (Academic Press, London, 1971), p. 351.
6. D. M. McLean, *J. Paleontol.* **42**, 1478 (1968).
7. J. R. Gill and W. A. Cobban, *U.S. Geol. Surv. Prof. Pap. 776* (1973), p. 1.

26 June 1979; revised 27 July 1979

An Adaptation of the Jet Stream Microelectrode Beveler

The jet stream microbeveler reported by Ogden *et al.* (*1*) provides an easy and elegant way to bevel ultrafine glass microelectrodes for the injection of substances into cells. We have adapted their design to bevel electrodes used in dye injection and voltage clamp experiments in *Limulus* ventral photoreceptors, and we report a modification of their apparatus that is particularly simple and easy to use.

Abrasive particles (120-grit silicon carbide from Buehler Ltd.) (*2*) were washed and placed with a spin bar and saline solution in a small beaker above a magnetic stirrer. Electrodes (*3*) were lowered into the saline in the upper part of the beaker at an oblique angle and beveled to the desired impedance (*4*) by swirling the abrasive solution. This method provides good electrical contact and continuous control of the beveling rate (governed by the speed of the stirrer) while eliminating the need for a source of pressure and large volumes of fluid. Electrodes beveled by these means were found to have a true bevel with tips a few tenths of a micrometer in diameter as determined by transmission electron microscopy.

D. WESLEY CORSON
STEVEN GOODMAN
Laboratory of Sensory Physiology, Marine Biological Laboratory, Woods Hole, Massachusetts 02543
ALAN FEIN
Laboratory of Sensory Physiology, Marine Biological Laboratory and *Department of Physiology, Boston University School of Medicine, Boston, Massachusetts 02215*

References and Notes

1. T. E. Ogden, M. C. Citron, R. Pierantoni, *Science* **201**, 469 (1978).
2. We initially used the same 0.05-μm gamma-alumina micropolish as Ogden *et al.* (*1*), but we found that these fine particles were ineffective for beveling the low-impedance electrodes (20- to 40-megohm, KCl-filled, measured in artificial seawater) that we typically use in recording from *Limulus* photoreceptors. We found that a range (400- to 120-grit) of coarser silicon carbide particles was effective in beveling our electrodes. We suspect that particle size is a very important parameter that will probably have to be optimized for the particular type of microelectrode being beveled. Fortunately, a broad range of alumina and silicon carbide powders are available from Buehler Ltd., Evanston, Illinois.
3. We regularly bevel conventional (20- to 40-megohm, 2.5*M* KCl) and dye-filled (100- to 300-megohm, 200 m*M* phenol red) electrodes, using the beveler.
4. We are able to continuously monitor the impedance of the electrode by placing it in an active bridge circuit. We find it convenient to lower the impedance of the KCl-filled electrodes by a factor of 2 to 3. The dye-filled electrodes usually need more beveling, and their impedance is typically reduced by a factor of 3 to 5. When the desired impedance is attained, we can rapidly stop the beveling by switching off the stirrer.
5. Supported by grants from the National Institutes of Health and the Rowland Foundation.

8 June 1979

0036-8075/79/0921-1302$00.50/0