to his purpose, *i. e.*, filling a given space with ornament pleasing to the eye.

Decorative art is limited by space, material, etc., and its interest often consists in the artist's effort to use these limitations; while the comparative freedom of pictorial art often causes it to degenerate into imitation —which, of course, is not art at all.

As the technic of art is properly a science, these remarks may not be entirely out of place.

MARGARET ARMSTRONG

THE PRESERVATION OF RECORDS

TO THE EDITOR OF SCIENCE: On reading the article on "Our Duty to the Future," by Professor C. E. Vail, in the December number of the *Scientific Monthly*, it occurred to me that we have at hand, available without special expense, better means of leaving permanent records for the future than any of our predecessors. Practically all printing is done from electrotypes; these electrotypes are made of metals that are not readily corroded by atmospheric action and under proper storage conditions would be very permanent.

In the production of practically all great books, or other records, engravings, etc., electrotypes are used. After serving their purpose in printing the edition many times they are but slightly worn and could be stored compactly in fire-proof and earthquake-proof, dry vaults. Sets of electrotypes, such as those employed in printing the Encyclopedia Britannica, and other reference works, would provide for future generations a considerable knowledge of almost everything of importance pertaining to this era.

Generally speaking, the preservation of records in this way would cost no more than the bullion price of the metal involved in the plates, as otherwise the plates would be remelted and the metal used over.

JOHN S. WRIGHT

SCIENTIFIC BOOKS

How to know the Mosses. By ELIZABETH MARIE DUNHAM. Boston: Houghton, Mifflin Co., 1916. 287 pages, illustrated. $1.25.

This little book is intended as "a popular guide to the mosses of the Northeastern United States" according to its subtitle or, as the cover states, "This handbook of mosses—the first intended for use without a microscope —throws open a new and fascinating field of study to the amateur botanist and nature lover. Keys to 80 genera and descriptions of over 150 species are given." In view of the limitations, and considering how difficult it is to really know the mosses thoroughly, Mrs. Dunham's conscientious effort to introduce a few of our most abundant and easily recognized genera and species to a wider acquaintance will certainly lengthen the season of out-door pleasures and interests for those who love nature at all times of the year! For "the mosses and lichens love the damp shade and the wet frosty season when other plants fade." To acquire even a bowing acquaintance with 80 out of the 200 genera represented in our flora and grow to recognize 150 species out of nearly 3,000, is to learn to have eyes that see and appreciate the subtler beauties of form and color.

The drawings in the text and the full-page illustrations will be found helpful and with the exception of a few indispensable technical terms the book is free from pedantry and unnecessary verbiage. E. G. BRITTON

NEW YORK BOTANICAL GARDEN

SPECIAL ARTICLES

THE EFFECT OF FINENESS OF DIVISION OF PULVERIZED LIMESTONE ON THE YIELD OF CRIMSON CLOVER AND LIME REQUIREMENT OF SOILS

THE practical significance which attaches to studies in the application of lime to soils is responsible for experimentation with pulverized limestone of varying degrees of fineness. Frear[1] cites, together with his own experiments, the comparatively few investigations pertaining to this problem. It has been stated by some authorities that limestone passing a 10-mesh sieve is satisfactory for field practise, while others have advocated material passing a 60-mesh sieve, some claiming that even finer pulverization is to be preferred. The following experiments were planned in 1914 to throw

[1] Frear, W., "Sour Soils and Liming," Dept. Agr. Penn. Bul. 261, 1915.

some light on the comparison of a uniform limestone, which had been subjected to varying degrees of pulverization, with calcium oxide. During the progress of the work, Thomas and Frear[2] published results which are similar to those obtained in the present instance.

Several soils which may be regarded as typical of rather extensive fertile areas were obtained through the courtesy of Drs. P. E. Brown, C. E. Thorne, C. A. Mooers, W. J. Schoene and W. P. Kelly; respectively designated as Carrington (Iowa) silt loam, Wooster (Ohio) silt loam, Cumberland (Tennessee) silt loam, Norfolk (Virginia) sandy loam, Sierra (California) sandy loam and Portsmouth (New Jersey) acid muck. Ten-pound earthenware pots were filled with soil and limestone of 20–40, 60–80, 100–200, 200 + mesh and calcium oxide (c. p.) were added in sufficient quantities to satisfy the lime requirements of the various soils as determined by the Veitch method. Fifteen crimson clover plants were grown in each pot maintained under optimum moisture conditions in the greenhouse. A summary of the results obtained on the five more important soils is recorded in Table I. It is evident that in general, in

TABLE I

Summary showing Relative Effect of Fineness of Division of Pulverized Limestone and CaO on the Yield of Crimson Clover on Various Soils

Treatment	Norfolk (Va.) Sandy Loam	Wooster (O.) Silt Loam	Carrington (Iowa) Silt Loam	Cumberland (Tenn.) Silt Loam	Av.
Check	100	100	100	100	100
20– 40-mesh limestone..	112	357	127	134	183
60– 80-mesh limestone..	138	364	123	243	217
100–200-mesh limestone..	134	419	130	248	233
200+-mesh limestone.....	146	404	142	262	239
CaO	161	398	153	208	230

all the soils studied, there is an increase in crop yield (dry weight) as the fineness of the limestone is increased. Averaging the five soils it will be seen that the yields with 200-M. are fully one third again as large as where 20-M. limestone was employed, and practically double the yield on the unlimed pots. There is little choice, however, between the 200-M. limestone and calcium oxide, the former giving maximum results on the Ohio and Tennessee soils, while the latter proved superior on the Norfolk and Iowa soils.

An analysis of these crops for total nitrogen (Kjeldahl method) indicated the same general relationship, as is shown in Table II. Namely,

TABLE II

Summary showing Relative Effect of Fineness of Division of Pulverized Limestone and CaO on Total Nitrogen (in Gm.) of Crimson Clover on Various Soils

Treatment	Norfolk (Va.) Sandy Loam	Wooster (O.) Silt Loam	Carrington (Iowa) Silt Loam	Cumberland (Tenn.)	Av.
Check	100	100	100	100	100
20– 40-mesh limestone..	159	438	117	136	213
60– 80-mesh limestone..	236	475	128	355	299
100–200-mesh limestone..	231	500	139	336	302
200 +-mesh limestone.....	255	475	154	373	314
CaO	268	438	157	300	291

as the fineness of division of limestone increased, the total nitrogen (in gm.) increased. Two-hundred-mesh limestone was again superior to calcium oxide in two of the four instances.

The California soil, being decidedly alkaline, responded unfavorably to the application of limestone. That is, the yield of clover as well as the total nitrogen decreased with increasing fineness of division of pulverized limestone. With the acid muck soil (Portsmouth), however, the results were similar to those obtained with the other typical soils, *i. e.*, an increase in fineness of division was responsible for an increase in crop yield and total nitrogen.

After the clover had been harvested, the lime requirements of the soils were again determined for the purpose of comparing the relative neutralizing efficiency of the different materials. As might be expected from theoretical considerations the lime requirement tended to decrease as a result of the applica-

[2] Thomas, W., and Frear, W., *Jour. Ind. Eng. Chem.*, Vol. 7, No. 12 (1915), p. 1,041.

TABLE III

Summary showing Relative Effect of Fineness of Division of Pulverized Limestone and CaO on the Decrease (in Per Cent.) of the Original Lime Requirement of Four Typical Soils

Treatment	Norfolk (Va.) Sandy Loam	Wooster (O.) Silt Loam	Carrington (Iowa) Silt Loam	Cumberland (Tenn.) Silt Loam	Av.
Check	0	0	0	0	0
20–40-mesh limestone	35	34	32	33	34
60–80-mesh limestone	54	95	58	58	66
100–200-mesh limestone	62	95	97	73	81
200+-mesh limestone	65	88	97	80	83
CaO	62	51	89	65	67

tion of limestone increasing in fineness of division as shown in Table III. The calcium oxide does not appear to be quite as valuable as the 200-M. limestone, which may possibly be due to the fact that the former proved initially superior in neutralizing the acidity, but allowed a subsequent accumulation of acidity to take place, while the latter neutralized the acidity more gradually and in a more progressive manner.

The writer has experiments in progress which indicate that increasing the fineness of division of pulverized limestone is responsible for increasing the biological activities such as ammonification, nitrification and nitrogen-fixation. A study is also being made of the effect of leaching upon the relative efficiency of different finenesses of division of pulverized limestone, with and without ammonium sulphate. This is carried out in galvanized iron tanks (containing 130 lbs. of soil) which have stopcocks permitting the collection of drainage water. In a sandy soil the growth of four successive crops indicates that the 60-M. is superior to the 20-M. or the finer grades of limestone, probably because in such deep pots (17 in.) and such a light soil, the finer material is washed down below the root zone.

NICHOLAS KOPELOFF

RUTGERS COLLEGE,
NEW BRUNSWICK, N. J.,
November 3, 1916

ILLINOIS STATE ACADEMY OF SCIENCE

THE tenth annual meeting of the Illinois State Academy of Science was held at Knox College in Galesburg on February 23 and 24. About one hundred members and delegates and some two hundred citizens of Galesburg attended the various sessions. Over forty new members were elected. Four sessions were held, as follows:

Friday afternoon, a general session at which the following papers were read:

"Safeguarding the Food and Water Supply, a Function of the State," by E. H. S. Bailey.

"Wireless Transmission of Messages in the Olden Time," by Francis E. Nipher.

"Botanical Installation in the Field Museum of Natural History," by Chas. F. Millspaugh.

"The Purpose of Science Teaching in a University," by W. A. Noyes.

"Plant Ecology and its relation to Agriculture," by Warren G. Waterman.

"Activated Sludge Process of Sewage Treatment," by Edward Bartow.

"Contribution of the College to High-school Science Teaching," by John C. Hessler.

On Friday evening, the members of the academy and delegates present and over a hundred citizens of Galesburg enjoyed a banquet at the Galesburg Club. A special session, marking the tenth anniversary of the academy, immediately followed the dinner. At this session, remarks suitable to the occasion were made by the following delegates from other organizations: Professor F. E. Nipher, St. Louis, American Philosophical Society, Academy of Science of St. Louis; Dr. W. A. Noyes, Urbana, National Academy of Sciences; Professor J. E. Wells, Beloit, Connecticut Academy of Arts and Sciences; Professor H. S. Conard, Grinnell, Iowa Academy of Science; Professor E. H. S. Bailey, Lawrence, Kansas Academy of Science; Professor W. H. Hobbs, Ann Arbor, Michigan Academy of Science; Dr. H. S. Pepoon, Chicago, Chicago Academy of Science; Dr. C. W. East, Springfield, Illinois State Board of Health; Dr. F. W. DeWolf, Urbana, Illinois State Geological Survey; Dr. A. R. Crook, Springfield, Illinois State Museum; Mr. E. B. Vliet, Champaign, Chemical Club, University of Illinois; Professor Edward Bartow, Urbana, Illinois State Water Survey; Professor F. L. Stevens, Urbana, Bacteriological Club, University of Illinois.

The following had accepted invitations to be present at this program but were unable to be pres-