Marion Leroy Jackson--Soil Scientist of Worldwide Influence
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Marion Leroy Jackson will be remembered as an advisor and teacher of young scientists (graduate students, post-doctorates, and visiting professors) worldwide. He is an eclectic scholar of the mineralogy of Wisconsin and international soil areas as related to the geomorphologic and glacial history as well as to fertility and food supply and quality. He was born on November 30, 1914 on a farm near Reynolds in Jefferson County, Nebraska, the son of Cleveland Jackson and Belle Josephine (Hanson) Jackson. He was reared on a farm in York County, Nebraska, and in the 1920s was inspired as he noticed that the horizontal brown partings in the loess there had fossil leaf prints. The teachers of the one-room primary and the secondary schools gave him great inspiration and guidance. He was the highest ranking scholar and valedictorian in the class of 1932 at the York High School. An award of a tuition scholarship for the University of Nebraska assisted him to enter the College of Agriculture. In the summer of 1935, after his junior year, he was employed as a soil surveyor of the Conservation and Survey Division of Nebraska, headed by George E. Condra, and assigned to explore wind-erosion damage in Kimball County. Near the end of the summer he became better acquainted with Chrystie Marie Bertramson to whom he had been introduced at Lincoln by her brother, Rodney. Her family farmed in eastern Kimball County and she taught school to earn money to attend the University. He received the gold medal for being the highest ranking scholar in each of his four years at the College of Agriculture, the Phi Beta Kappa election and citation as the highest ranking scholar of the University of Nebraska class of 1936; and was conferred the bachelor of science degree "With High Distinction."

He worked for over a year as Land Classification Aide, U.S.D.A. Resettlement Administration, headquartered at Lincoln Nebraska, with field work in northwestern South Dakota, leading to the master of science degree in soil science, University of Nebraska in 1937. On September 2, he and Chrystie were married and traveled to the University of Wisconsin-Madison. He continued graduate work under Emil Truog, and completed his Ph. D. degree in 1939. Through the years, Chrystie's dedicated support in field observations, editorial and logistical work, and joint attendance at professional meetings made important career contributions. They have four children: Marjorie L. (1938), Virginia L. (Conlon) (1942), Stanley B. (1943), and Douglas M. (1953).

As a postdoctoral appointee (1939-1941), he is one of the few still-active scientists whose career covers one-half of the centenary of the College of Agricultural and Life Sciences observed in 1989. He progressed through the professional ranks (instructor, 1941-42; assistant professor, 1942-45; associate professor, 1946-50; professor, 1950-74) and received the Franklin Hiram King distinguished professorship of soil science in 1974. He chaired the Faculty Divisional Committee of Physical Sciences and Mathematics from 1952 to 1955. He supervised 58 Ph.D. students and 38 post-doctorates and published more than 240 scientific papers, and two textbooks entitled "Soil Chemical Analysis" and "Soil Chemical Analysis-Advanced Course". He is author or coauthor of individual chapters and sections in more than a dozen books, symposia, and encyclopedias.

During leaves he lectured at Purdue University, December 1945 to June 1946 and at Cornell University, February 8 to March 20, 1959 and was Distinguished Visiting Professor at the University of Washington Quaternary Research Center in Seattle, March 27 to June 8, 1973. He filled more than 20 other lectureships, of which seven were in various foreign countries. He served as a national and international society committee man on soil chemical analysis, fertilizers use, society finance and budget, and funding of delegates for travel to soil congresses. He served for ten years on the National Research Council committee on clays, leading to the formation of the Clay Minerals Society. He has been an Experiment Station review panelist for the USDA Cooperative Research Service, at the University of Hawaii Agricultural Experiment Station (1966) and at the Cornell University Agricultural Experiment Station (1971). He has served as external examiner of doctoral theses for the University of Queensland, Australia, Punjab University, Calcutta University, University of Delhi and University of Poona, India. He served as review editor for the National Research Council, the *Soil Science Society of America Proceedings*, *Soil Science*, *American Mineralogist*, *Analytical Chemistry*, *Clay and Clay Minerals*, *Journal of Geophysical Research Science*, *Geoderma*, *Quaternary Research*, and several other major journals. He was on the organizing committee for the monograph, *Minerals in Soil Environments*.

While carrying on soil research with X-ray diffraction and teaching an X-ray diffraction course in the College of Engineering, in the 1940s, he also carried out extensive field experiments. Combinations of liming with high rates of fertilization with phosphate and potassium in experiments that he established in Clark, Sauk, and Dane Counties gave spectacular corn and alfalfa responses. Alfalfa was "restored in the north." High rates of fertilizer application on corn, combined with high stand densities of 17,000 per acre increased corn yields in four replicates to exceed 140 bushels per acre, in spite of Wisconsin's cool, moist weather. This work lent impetus to the College of Agriculture programs under which the average corn yield in Wisconsin was raised from 44 to over 90 bushels per acre. His research included analysis of the nutrients carried away in runoff waters from soils under various crops managed by the Conservation Experiment Station at La Crosse.

The seat of soil acidity, the proton (hydrogen) donors, which required the application of agricultural lime, had been of interest to soil scientists. The fact that the exchangeable aluminum was a proton donor (by hydrolysis) was pointed out by Jackson, and this helped clear up a controversy concerning "acid clay." The presence of polymeric hydroxy aluminum in soils was shown to confer hysteretic pH-dependent charge, previously attributed to the "broken edges" of silicates. He and his associates showed that positively charged hydroxy aluminum, which neutralized the permanent negative charge of the clay layers, progressively lost its positive charge (deprotonated) with rise in soil pH with liming, thus activating "latent acidity" the source of which had long been a puzzle.

Analytical methods developed in the laboratory for fractionation and quantitative determination of different forms of soil phosphorus are still used by scientists throughout the world. The full spectrum of phosphates was determined, from calcium to iron and aluminum phosphates and iron-oxide-occluded forms, the latter having wrongly been called "silicate lattice" form. An important finding was that liming, through changing the soil pH, increased phosphate availability by lowering the iron and aluminum activity and not, as previously taught, by conversion of the phosphate to a calcium phosphate form.

His success in obtaining support from the National Science Foundation and the Atomic Energy Commission led to an emphasis on basic research. His investigations of chemical weathering of soil minerals led to a description of the stability sequence of clay-sized minerals. Weathering release of potassium, magnesium, aluminum, and other ions were shown to influence soil pH, soil cation exchange capacity and the availability of plant nutrients. That climate, vegetation, and geomorphic sites determine the solute composition of the soil matrix solution was shown to prevail rather than an equilibrium with the inherited minerals in soils. He and his students found that the solute composition in the soil then determined the minerals forming or formed authigenically. The wedge-configuration formed by crystal layers at the lateral boundaries of vermiculite and mica (the XY cleavage planes) was shown to be the site of fixation and release of the plant nutrients, potassium and ammonium, as explained in his lectures and publications.

In the 1960s and 1970s he led interdisciplinary investigations of wind-blown minerals in cooperation with the Universities of Chicago, California and Hawaii, and the National Center for Atmospheric Research at Boulder, Colorado. A method for isolation of quartz was developed. By means of the oxygen isotopes ratios, the quartz contained in the fine silt of shales, silt stones, loess, and till was found to be a composite of quartz from low temperature origin (cherts and overgrowths) with that from high temperature igneous and metamorphic rock origin. Large areas of aerosol-derived soils were found to be from dusts of arid lands of the continents. For example, dusts of the continents were brought down by rains to Pacific pelagic sediments and to soils of the Hawaiian and Korean mountain tops. Also, dusts of the Sahara, transported across the tropical Atlantic Ocean to the Canary and Caribbean islands, were also found in the southeastern part of mainland United States. The proportions of quartz of high and low temperature were found to be different in silts in the Northern Hemisphere from those of the Southern Hemisphere, as a very distinct reflection of the known fact that the Northern Hemisphere continents have traversed across the tropical and equatorial zones during the Post-Precambrian times while the southern parts of the Southern Hemisphere continents have not. Therefore, the lower oxygen isotopic ratios of quartz in the latter reflect a higher proportion of igneous rocks than in the sediments of the Northern Hemisphere wherein a higher proportion of cherts was indicated. He showed by fission-track dating that micas of Antarctica were formed by weathering four million years ago. He discovered by electron microscopy that microspherules from space deposited on the snows of Antarctica had nanometeoritic impact craters on their surfaces with iron oxide crystals exposed in the crater bottoms.

Having noticed the devastating and fatal effects of diseases of the cardiovascular system (nearly 50% of the U.S. deaths) and cancer (20% of U.S. deaths), including those of some of his students and colleagues, and relatives (he was orphaned by age 12), he spent several years in the 1980s investigating possible soil nutritional deficiencies as partial influences on death rates. Rates in Wisconsin and Florida were found to vary greatly in various counties and relate to soil quality through deficiencies of such elements as selenium, copper or zinc. Blood levels of selenium were shown to relate inversely with the rates in many states of the U.S. and provinces of China. He was invited to address the National Academy Sinica in Canton, Shanghai, Nanking, and Peking, China in 1982, and the European Academy of Sciences and Medicine in West Germany on the geochemistry of trace elements in soils as related to health in 1986.

A number of citations and awards were voted by his scientific colleagues, including Fellow of the American Society of Agronomy, the Soil Science Society of America, the American Association for the Advancement of Science, and the Mineralogical Society of America. He served as president of the Soil Science Society of America and of the Clay Minerals Society. He received the Soil Science Achievement Award of the American Society of Agronomy (the Society's highest scientific award) in1958, the second year it was given. The Soil Science Society conferred on him Distinguished Member in 1983 and the Distinguished Career Award in 1986. He was conferred the Honorary Doctor of Science degree , by the University of Nebraska in 1974 and was elected to the National Academy of Science of the U.S.A. in 1986.

Letters from around the world supported his nomination to these awards. They characterized him as a truly eminent scholar, a great educator, a man of vision, scientific integrity, extraordinary leadership, and boundless energy. A professor of soils in another state went so far as to say that he regarded him as "having the greatest total knowledge of soils in breadth and depth, of any living soil scientist." Many of his students and colleagues mention with enthusiasm the decisive influence he had on their lives ind careers.

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