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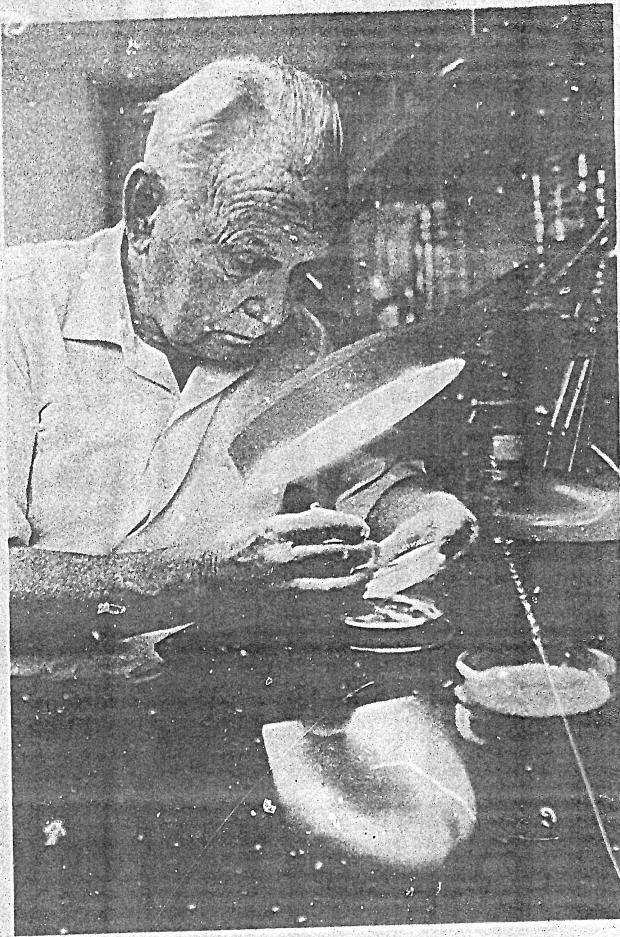
Memorial of Sterling Brown Hendricks
April 13, 1902-January 4, 1981

LINUS PAULING

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Sterling B. Hendricks was born in Elysian Fields, Texas, on April 13, 1902. He obtained the Bachelor of Chemical Engineering degree from Arkansas State College in 1922, the M.S. degree from Kansas State College in 1924, and his Ph.D. from California Institute of Technology in 1926. From 1922 to 1925 he worked part-time as an assistant in Southern Field Crops Investigations, U.S. Department of Agriculture, and he was an instructor in Kansas State College in 1923 and 1924, and a teaching assistant in CIT from 1924 to 1926. He then worked for one year as a Research Associate in the Geophysical Laboratory of the Carnegie Institution of Washington and for one year in the Rockefeller Institute for Medical Research; during these years he was associated with the pioneer X-ray crystallographer R. W. G. Wyckoff. From 1928 to 1940 he was Chemist in the Bureau of Chemistry and Soils of the USDA; and from 1940 to 1943 Chemist in the Bureau of Plant Industry, USDA. He became Chief Scientist in the Mineral Nutrition Engineering Research Laboratory, Agricultural Research Service, USDA in 1943, holding this position until he retired in 1970. After his retirement he continued to live with his wife in Crystal Spring, Maryland.

Among those scientists associated with the Mineralogical Society of America, Sterling was probably unique in having the broadest field of scientific work. He himself listed as his fields of interest the structural aspects of organic and inorganic chemistry, chemistry and physics of crystal structure, insecticides, phase rule, X-ray diffraction of solids, electron diffraction of crystals and gas molecules, soil chemistry, base exchange, plant physiology, plant nutrition, and photoperiodism. He might have added mineralogy, especially of the clay minerals, micas, and phosphates, metals and intermetallic compounds, and some other subjects. His effectiveness in attacking new problems was without doubt the result in considerable part of his extensive



experience in many fields. His earlier publications, including most of those of interest to members of the GSA, are listed in the bibliography; he also published 95 papers on organic chemistry and plant growth.

I first met Sterling in the fall of 1924, when he came to Pasadena to begin his doctoral studies. He was a keen and lively young fellow, full of energy. With his straw-colored hair and freckles, he reminded me of Peck's Bad Boy. A. A. Noyes, the director of the Gates Chemical Laboratory, suggested to

Bibliography of S. B. Hendricks

(omitting 95 papers on plant growth and organic chemistry)

1. (with Linus Pauling) The crystal structures of hematite and corundum.
J. Am. Chem. Soc. 47, 781-790 (1925)
2. (and Linus Pauling) The crystal structures of sodium and potassium azides and potassium cyanate and the nature of the azide group.
J. Am. Chem. Soc. 47, 2904-2920 (1925)
3. (with M. L. Huggins) Confirmation of the presence of a non-tetrahedral carbon atom in crystals of pentaerythritol.
J. Am. Chem. Soc. 48, 164-167 (1926)
4. Equilibrium in the system BaO-As₂O₅-H₂O (acid section).
J. Phys. Chem. 30, 248-253 (1926).
5. (with Linus Pauling) The prediction of the relative stabilities of isosteric isomeric ions and molecules
J. Am. Chem. Soc. 48, 641-651 (1926)
6. (and Constant Bilicke) The space group and molecular symmetry of β -benzene hexabromide and hexachloride
J. Am. Chem. Soc. 48, 3007-3015 (1926)
7. (with R. W. G. Wyckoff and T. P. McCutcheon) Crystal structure of hexammine cobalti-perchlorate
Am. J. Sci. 13, 388-398 (1927)
8. (and R. W. G. Wyckoff) The positions of the K. absorption limits of vanadium in various of its compounds
J. Phys. Chem. 31, 703-712 (1927)
9. (and R. G. Dickinson) Crystal structures of ammonium, potassium, and rubidium cupric chloride dihydrates
J. Am. Chem. Soc. 49, 2149-2162 (1927)

10. The crystal structure of potassium dihydrogen phosphate
Am. J. Sci. 14, 269-287 (1927)
11. (and R. W. G. Wyckoff) The space group of aluminum metaphosphate
Am. J. Sci. 13, 491-496 (1927)
12. The molecular symmetry of pentaerythritol
Zeitschr. Krist. 65, 680-711 (1927)
13. Molecular symmetry of acetyl pyrrole
J. Am. Chem. Soc. 50, 1205-1208 (1928)
14. The crystal structure of lithium chloride monohydrate
Zeitschr. Krist. 66, 297-302 (1928)
15. The crystal structure of the methyl ammonium halides
Zeitschr. Krist. 67, 106-118 (1928)
16. The crystal structure of ethyl ammonium bromide and iodide
Zeitschr. Krist. 67, 119-130 (1928)
17. The crystal structure of the monopropyl ammonium halides
Zeitschr. Krist. 67, 465-471 (1928)
18. The crystal structure of the triethyl ammonium halides
Zeitschr. Krist. 67, 472-481 (1928)
19. Crystal structure of urea and the molecular symmetry of thiourea
J. Am. Chem. Soc. 50, 2455-2464 (1928)
20. (and H. E. Merwin) Atomic arrangement in crystals of the alkali thiocyanoplatinates
Am. J. Sci. 15, 487-494 (1928)
21. (and W. H. Albrecht) X-ray and chemical investigation of various oxides of iron and cobalt
Berichte 61B, 2153-2161 (1928)
22. The crystal structure of the butyl-, amyl-, hexyl- and heptyl-ammonium halides
Zeitschr. Krist. 68, 189-203 (1928)

23. Diffraction of x-radiation from some crystalline aggregates
Zeitschr. Krist. 71, 269-273 (1929)
24. Electron diffraction by a copper crystal
Phys. Rev. 34, 1287-1288 (1929)
25. (with P. H. Emmett and Stephen Brunauer) The dissociation pressure of Fe_4N
J. Am. Chem. Soc. 52, 1456-1464 (1930)
26. (and W. H. Fry) The results of x-ray and microscopical examination of soil
colloids
Soil Sci. 29, 457-479 (1930)
27. (with M. E. Jefferson and J. F. Schultz) The transition temperatures of
cobalt and nickel. Some observations on the oxides of nickel
Zeitschr. Krist. 73, 376-380 (1930)
28. The crystal structure of primary amylammonium chloride
Zeitschr. Krist. 74, 29-40 (1930)
29. (and P. R. Kosting) The crystal structure of Fe_2P , Fe_2N , Fe_3N , and FeB
Zeitschr. Krist. 74, 511-533 (1930)
30. The crystal structure of cementite
Zeitschr. Krist. 74, 534-545 (1930)
31. Crystal structures of organic compounds
Chem. Reviews 7, 431-477 (1930)
32. (with Stephen Brunauer, M. E. Jefferson, and P. H. Emmett) Equilibria in the
iron-nitrogen system
J. Am. Chem. Soc. 52, 1778-1786 (1931)
33. The crystal structure of nitrogen tetroxide
Zeitschr. Physik 70, 699-700 (1931)
34. (with F. C. Kracek and E. Posnjak) Group rotation in solid ammonium and
calcium nitrates
Nature 128, 410-411 (1931)

35. (with F. C. Kracek and E. Posnjak) Gradual transition in sodium nitrate II. The structure at various temperatures and its bearing on molecular rotation
 J. Am. Chem. Soc. 53, 3339-3348 (1931)
36. (and W. L. Hill, K. D. Jacob, and M. E. Jefferson) Structural characteristics of apatite-like substances and composition of phosphate rock and bone as determined from microscopical and x-ray diffraction examinations
 Ind. Eng. Chem. 23, 1413-1418 (1931)
37. (and G. E. Hilbert) The molecular association, the apparent symmetry of the benzene ring, and the structure of the nitro group in crystalline m-dinitrobenzene, the valences of nitrogen in some organic compounds
 J. Am. Chem. Soc. 53, 4280-4290 (1931)
38. (and M. E. Jefferson and V. M. Mosley) The crystal structure of some natural and synthetic apatite-like substances
 Zeitschr. Krist. 81, 352-369 (1932)
39. (and E. Posnjak and F. C. Kracek) Molecular rotation in the solid state. The variation of the crystal structure of ammonium nitrate with temperature
 J. Am. Chem. Soc. 54, 2766-2786 (1932)
40. Lustrous carbon, a different form?
 Zeitschr. Krist. 83, 503-504 (1932)
41. (with J. C. Southard and R. T. Milner) Low-temperature specific heat III. Molecular rotation in crystalline primary normal amylammonium chloride
 J. Chem. Physics 1, 95-102 (1933)
42. β -Bromochlorobenzene and its congeners: various equivalent points in molecular lattices
 Zeitschr. Krist. 84, 85-96 (1933)
43. (and W. E. Deming and M. E. Jefferson) The refractive indices of ammonium nitrate
 Zeitschr. Krist. 85, 143-155 (1933)

44. (with A. Hettich) Molecular rotation in solid ammonium chloride
Naturwissenschaften 21, 467 (1933)
45. (with A. R. Merz and J. O. Hardesty) Optical properties of the double salt
 $(\text{NH}_4)_2\text{SO}_4 \cdot \text{CaSO}_4 \cdot 2\text{H}_2\text{O}$
J. Am. Chem. Soc. v. 55, p. 3571-3573 (1933)
46. (and R. L. Maxwell, V. L. Mosley, and M. E. Jefferson) X-ray and electron
 diffraction of iodine and the diiodobenzenes
J. Chem. Phys. 1, 549-565 (1933)
47. (and M. E. Jefferson) The optical anisotropy of molecular crystals I. Experimental
J. Optical Soc. Am. 23, 299-307 (1933)
48. (with C. W. Whittaker and F. O. Lundstrom) Reaction between urea and gypsum
Ind. Eng. Chem. 25, 1280-1282 (1933)
49. The crystal structure of $\text{CaSO}_4 \cdot \text{CO}(\text{NH}_2)_2$
J. Phys. Chem. 37, 1109-1122 (1933)
50. (with E. J. Jones) Sources of positive ions: thermionic properties of the
 system $\text{Li}_2\text{O}-\text{Al}_2\text{O}_3-\text{SiO}_2$
Phys. Review 43, 322 (1933) (abs.)
51. Cholesteryl salicylate
Zeitschr. Krist. 89, 427-433 (1934)
52. (with G. E. Hilbert, O. R. Wulf, and U. Liddel), A spectroscopic method for
 detecting some forms of chelation
Nature 135, 147-148 (1935)
53. The orientation of the oxalate group in oxalic acid and some of its salts
Zeitschr. Krist. 91, 48-64 (1935)
54. (with L. R. Maxwell and V. M. Mosley) Electron diffraction by gases
J. Chem. Physics 3, 699-709 (1935)

55. (with L. R. Maxwell and V. M. Mosley), Electron diffraction by gas molecules.
 I. Structure of phosphorus II. Valence angle of oxygen
 Phys. Rev. 48, 476 (1935) (abs.)
56. (and W. E. Deming) The optical anisotropy of molecular crystals as illustrated
 by some oxalates
 Zeitschr. Krist. 91, 290-301 (1935)
57. (and M. E. Jefferson) Electron distribution in $(\text{NH}_4)_2\text{C}_2\text{O}_4 \cdot \text{H}_2\text{O}$ and on the
 structure of the oxalate group
 J. Chem. Physics 4, 102-107 (1936)
58. (with W. L. Hill) Composition and properties of superphosphate-calcium
 phosphate and calcium sulfate constituents as shown by chemical and x-ray
 diffraction analysis
 Ind. Eng. Chem. 28, 440-447 (1936)
59. (with G. E. Hilbert, O. R. Wulf, and U. Liddel), Hydrogen bond between oxygen
 atoms in some organic compounds
 J. Am. Chem. Soc. 58, 548-555 (1936)
60. (with L. R. Maxwell and V. M. Mosley), The nuclear separation of the S_2
 molecule by electron diffraction
 Phys. Rev. 50, 41-45 (1936)
61. (with M. A. Rollier and L. R. Maxwell) The crystal structure of polonium by
 electron diffraction
 J. Chem. Physics 4, 648-652 (1936)
62. (and O. R. Wulf, G. E. Hilbert, and U. Liddel), Hydrogen-bond formation
 between hydroxyl groups and nitrogen atoms in some organic compounds
 J. Am. Chem. Soc. 58, 1991-1996 (1936)
63. The crystal structure of kaolinite, $\text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2 \cdot 2\text{H}_2\text{O}$, and the composition
 of anauxite
 Zeitschr. Krist. 95, 247-252 (1936)

64. (with J. Y. Yee and R. O. E. Davis), Double compounds of urea with magnesium nitrate and magnesium sulfate
J. Am. Chem. Soc. 59, 570-571 (1937)
65. (with M. J. Buerger) Polymorphism of antimony trioxide and the structure of the orthorhombic form
J. Chem. Physics 5, 600 (1937)
66. (with L. R. Maxwell and L. S. Deming), The molecular structure of P_4O_6 , P_4O_8 , P_4O_{10} , and As_4O_6 by electron diffraction
J. Chem. Phys. 5, 626-637 (1937)
67. (with W. L. Hill, M. E. Jefferson, and D. S. Reynolds) Composition of defluorinated phosphate
Ind. Eng. Chem. 29, 1299-1304 (1937)
68. (with M. J. Buerger) The crystal structure of valentinite (orthorhombic Sb_2O_3)
Zeitschr. Krist. 98, 1-30 (1937)
69. (with L. R. Maxwell and V. M. Mosley), Interatomic distances of the alkali halide molecules by electron diffraction
Phys. Rev. 52, 968-972 (1937)
70. The crystal structure of alunite and the jarosites
Am. Mineral 22, 773-784 (1937)
71. Crystal structure of the clay mineral hydrates
Nature 142, 38 (1938), Am. Mineral 23, 295 (1938)
72. The crystal structure of the clay minerals dickite, halloysite, and hydrated halloysite
Am. Mineral 23, 295-301 (1938)
73. The crystal structure of talc and pyrophyllite
Zeitschr. Krist. 99, 264-274 (1938)

74. (and M. E. Jefferson), Crystal structure of vermiculites and mixed vermiculite-chlorites
Am. Mineral. 23, 851-862 (1938)
75. (and M. E. Jefferson), Structures of kaolin and talc-pyrophyllite hydrates and their bearing on water sorption of the clays
Am. Mineral. 23, 863-875 (1938)
76. (and C. S. Ross), Lattice limitation of montmorillonite
Zeitschr. Krist. 100, 251-264 (1938)
77. Polymorphism of the micas and diffuse x-ray scattering of layer silicate lattices
Nature 143, 800 (1939)
78. The crystal structure of nacrite, $\text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2 \cdot 2\text{H}_2\text{O}$, and the polymorphism of the kaolin minerals
Zeitschr. Krist. 100, 509-518 (1939)
79. Random structures of layer minerals as illustrated by cronstedite ($2\text{FeO} \cdot \text{Fe}_2\text{O}_3 \cdot \text{SiO}_2 \cdot \text{H}_2\text{O}$). Possible iron content of kaolin
Am. Mineral. 24, 529-539 (1939)
80. (and L. T. Alexander) Minerals present in soil colloids I. Descriptions and methods for identification
Soil Sci. 48, 257-271 (1939)
81. (with L. T. Alexander and R. A. Nelson) Minerals present in soil colloids II. Estimation in some representative soils
Soil Sci. 48, 273-279 (1939)
82. (and M. E. Jefferson) Polymorphism of the micas
Am. Mineral. 24, 729-771 (1939)
83. (and R. A. Nelson and L. T. Alexander) Hydration mechanism of the clay mineral montmorillonite saturated with various cations
J. Am. Chem. Soc. 62, 1457-1464 (1940)

84. (and L. T. Alexander) A qualitative color test for the montmorillonite type of clay minerals
J. Am. Soc. Agron. 32, 455-458 (1940)
85. Variable structures and continuous scattering of x-ray from layer silicate lattices
Phys. Rev. 57, 448-454 (1940)
86. (with H. L. Marshall and W. L. Hill) Composition and properties of superphosphate. Conditions affecting the distribution of water, with special reference to the calcium sulfate constituent
Ind. Eng. Chem. 32, 1631-1636 (1940)
87. (and L. T. Alexander) Semiquantitative estimation of montmorillonite in clays
Soil Sci. Soc. Am., Proc. 5, 95-99 (1940)
88. Base exchange of the clay mineral montmorillonite for organic cations and its dependence upon adsorption due to van der Waals forces
J. Phys. Chem. 45, 65-81 (1941)
89. (with M. E. Jefferson) A motor-driven ionization spectrometer
Rev. Sci. Instruments 12, 199-203 (1941)
90. (and C. S. Ross) Chemical composition and genesis of glauconite and celadonite
Am. Mineral. 26, 683-708 (1941)
91. (and Edward Teller) X-ray interference in partially ordered layer lattices
J. Chem. Physics 10, 147-167 (1942)
92. (with L. T. Alexander and G. T. Faust) Occurrence of gibbsite in some soil-forming minerals
Soil Sci. Soc. Am., Proc. 6, 52-57 (1941)
93. (with C. S. Ross) Clay minerals of the montmorillonite group: their mineral and chemical relations and the factors controlling base exchange
Soil Sci. Soc. Am., Proc. 6, 58-62 (1941)

94. Lattice structure of clay minerals and some properties of clays
J. Geol. 50, 276-290 (1942)
95. (and W. L. Hill) Inorganic constitution of bone
Science 96, 255-257 (1942)
96. (with L. I. Alexander, G. T. Faust, Herbert Insley, and H. F. McMurdie),
Relationship of the clay minerals halloysite and endellite
Am. Mineral. 28, 1-18 (1943)
97. (with W. L. Hill and G. T. Faust) Polymorphism of phosphoric oxide
J. Am. Chem. Soc. 65, 794-802 (1943)
98. (with Lane Mitchell, C. T. Faust, and D. S. Reynolds), The mineralogy and
genesis of hydroxylapatite
Am. Mineral. 28, 356-371 (1943)
99. (with R. A. Nelson) Specific surface of some clay minerals, soils, and soil
colloids
Soil Sci. 56, 283-296 (1943)
100. (and S. G. Wildman and H. F. McMurdie), Morphology of latex particles as
shown by electron micrographs
India Rubber World 110, 297-300 (1944)
101. Polymer chemistry of silicates, borates, and phosphates
J. Wash. Acad. Sci. 34, 241-251 (1944)
102. Base exchange of crystalline silicates
Ind. Eng. Chem. 37, 625-630 (1945)
103. (with W. H. Ross and J. Y. Yee) Properties of granular and monocrystalline
ammonium nitrate
Ind. Eng. Chem. 37, 1079-1083 (1945)
104. (with C. S. Ross) Minerals of the montmorillonite group: their origin and
relation to soils and clays
U.S. Geol. Survey Prof. Paper 205-B, 23-77 (1945)

105. (and S. S. Goldich and R. A. Nelson), A probable differential thermal-analysis unit for bauxite exploration
Econ. Geol. 41, 64-76 (1946)
106. (with Sidney Gottlieb) Soil organic matter as related to newer concepts of lignin chemistry
Soil Sci. Soc. Am., Proc. 10, 117-125 (1945) (publ. 1946)
107. (with W. L. Hill, E. J. Fox, and J. G. Cady), Acid pyro- and metaphosphates produced by thermal decomposition of monocalcium phosphate
Ind. Eng. Chem. 39, 1667-1672 (1947)
108. (and L. A. Dean) Basic concepts of soil and fertilizer studies with radioactive phosphorus
Soil Sci. Soc. Am., Proc. 12, 98-100 (1947) (publ. 1948)
109. (with C. D. McAuliffe, N. S. Hall, and L. A. Dean), Exchange reactions between phosphates and soils; hydroxylic surfaces of soil minerals
Soil Sci. Soc. Am., Proc. 12, 119-123 (1947) (publ. 1948)
110. (with R. S. Dyal), Total surface of clays in polar liquids as a characteristic index
Soil Sci. 69, 421-432 (1950)
111. (and W. L. Hill), Nature of bone and phosphate rock
Proc. Natl. Acad. Sci. U.S. 36, 731-737 (1950)
112. (with Luis Bramao and J. G. Cady), The determination of halloysite and its use in the study of red soils
Trans 4th Internat'l. Congress Soil Sci. 1, 313 (1950)
113. (and R. S. Dyal), Surface measurement for ethylene glycol retention of clays and its application to potassium fixation
Trans. 4th Internat'l. Congress Soil Sci. 2, 71-72; 4, 60-61 (1950)

114. (with R. S. Dyal), Formation of mixed layer minerals by potassium fixation
in montmorillonite
Soil Sci. Soc. Am., Proc. 16, 45-48 (1952)
115. (and L. A. Dean), Radioisotopes in soils research and plant nutrition
Ann. Rev. Nuclear Sci. 1 597-610 (1952)
116. (with Luis Bramao, J. G. Cady, and Max Swerdlow,) Criteria for the characterization
of kaolinite, halloysite, and a related mineral in clays and soils
Soil Sci. 73, 273-287 (1952)
117. (with J. L. Martin Vivaldi), Reactivity of the hydrogen ions of clays in
nonpolar solutions I. Action of diazomethane
Anales edafol. fisiol. vegetal. 11, 601-629 (1952) (also in Compt. Rend. Congr.
Geol. Internat. 1952, no. 18, 85-100 (1953))
118. Acceptance of the Arthur L. Day Medal
Proc. Geol. Soc. Am. 1952, 56-57 (1953)
119. Screw dislocations and charge balance as factors of crystal growth
Am. Mineral 40, 139-146 (1955)
120. Clays
Agron. J. 49, 632-636 (1957)
121. (and L. T. Alexander) Soil. The basis of fertility
Yearbook U.S. Dept. Agric. 1957, 11-16