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LOUIS VALENTINE PIRSSON
1860—1919

A Biographical Memoir by
ADOLPH KNOPF

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Biographical Memoir

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L. V. Pirsson

LOUIS VALENTINE PIRSSON

November 3, 1860–December 8, 1919

BY ADOLPH KNOPF*

LOUIS VALENTINE PIRSSON was one of the eminent group of geologists—Cross, Iddings, Pirsson, and Washington—who in the early years of the present century dominated petrology, the science of rocks. At the time of his death in New Haven on December 8, 1919, Pirsson was Professor of Physical Geology in the Sheffield Scientific School of Yale University. As student and later as teacher, investigator, and administrator, he had been connected with the Scientific School almost continuously since 1879.

Pirsson was descended from English forebears. William Pirsson of Chelmsford, England, great-great grandfather of Louis, is the earliest of whom we have any record. His son, also named William Pirsson, came to America about 1796. Here he married Sophia Poole, and taught school until the death in England of his father, who left him a competency. His son, Louis's grandfather, married Emily

* A memorial to Louis Valentine Pirsson, written by Whitman Cross, was published in the *American Journal of Science*, 4th ser., L (1920), 173–87, and was reprinted in the *Report of the National Academy of Sciences* for 1920. A footnote in that report states: "For a full bibliography of Pirsson's publications, see the forthcoming biographical memoir to be prepared for the National Academy of Sciences by Joseph P. Iddings." However, Dr. Iddings died on September 8, 1920. The preparation of the biography of Pirsson was then assigned to Dr. Whitman Cross: he died in 1949 but had not written a second biography of Pirsson. Finally, the present writer was asked by the Home Secretary on December 11, 1956, to prepare the biographical memoir of L. V. Pirsson. In writing this memoir I was greatly aided by being able to draw upon a holographic autobiography of Louis V. Pirsson, covering his early life up to the year 1900, which was furnished me by the courtesy of his widow, Eliza Brush Pirsson.

Morris of New York. He was a manufacturer of pianos, and became sufficiently well-off to own a very comfortable home in the suburbs of Fordham, New York.

Louis's father was Francis Morris Pirsson; his mother was Louise M. (Butt) Pirsson. To them was born a son, Louis Valentine, on November 3, 1860, at the grandfather's house in Fordham. There Louis lived until the death of his mother, when he was four years old. He then came under the care of various relatives, especially of his paternal great-aunt, Mrs. Robert E. Launitz, the wife of the sculptor.

Eventually, because Louis's father had lost interest in bringing up his son, Thomas Lord of New York City, who had married a cousin of Louis's father, was persuaded to act as guardian and was appointed in 1869. Louis had inherited some property from his mother, to which had been added some bequests under her grandmother's will, and when Mr. Lord became the guardian of Louis the total estate amounted to \$10,000. From the interest on this sum Louis was supported, but later when he went to school and to college he was obliged to use part of the principal.

Shortly after assuming the guardianship, Mr. Lord came into a large income, and being fond of travel he decided to go abroad with Mrs. Lord for a year or two. Early in the summer of 1869, Louis was taken to the home of the Reverend William J. Blain, who lived on a farm of five acres not far from Amsterdam in Montgomery County, New York. Mr. Blain was a Presbyterian clergyman whose church was small and whose income was not large. "We lived very carefully but better than most of the farmers about us," so Pirsson wrote later.

Louis's tutelage by Mr. Blain began at once, with regular lessons in reading, writing, arithmetic, spelling, and geography. Later came Latin, taught with great thoroughness, some history and algebra, and the beginnings of Greek. "I early acquired a taste for reading, and as Mr. Blain had a good library I used to bury myself in books and have to be hunted out to go to my outdoor tasks and exercise."

Mr. Blain seemed to young Louis an extremely strict, stern man, who insisted upon the uttermost performance of all duties, both secular and religious. As Louis wrote in retrospect: "Until then I had largely run wild, and the strict training I received under a martinet like him was exactly what I needed. Disobedience or improper conduct he punished severely and I received a number of severe whippings at first which were of great benefit." Looking back on it all in later life, he saw that he owed Mr. Blain a very great debt of gratitude and consequently he regretted that he had never been able to give him his love.

Two or three years before Louis left the Blain household another boy, Thomas L. Williams, was taken to care for and educate. The two boys began to explore the neighborhood and soon came to know very well its natural history. Pirsson regarded this interest as the beginning of his scientific career. Up to the time he entered college, and even later, birds were his chief interest. "Only circumstances," he thought, "prevented me from being a zoologist."

When Louis was nearly sixteen years old, Mr. Lord decided to send him to a boarding school so that he might mix with other boys and see more of life than the quiet of Mr. Blain's household afforded. Early in August of 1876 he was entered at the Amenia Academy at Amenia, Dutchess County, New York. There he studied Latin, Greek, algebra, French, and English. In 1878 the Academy was moved to New Marlboro, Massachusetts, and was subsequently known as the South Berkshire Institute. The headmaster, to whom Louis became strongly attached, was an enthusiastic Yale man, and this influenced him to choose to continue his education at Yale, with which decision Mr. and Mrs. Lord agreed. Because of his scientific bent, he decided to enter the Sheffield Scientific School. At that time the Scientific School was loosely affiliated with Yale; it had begun in 1847 as the "Scientific Department of Yale College" and had taken upon itself the responsibility of the teaching of science. It required Latin as an entrance requirement, but no Greek; its course was three

years long instead of four, and led to the Yale degree of Bachelor of Philosophy.

Louis entered the Scientific School in 1879, with three conditions—in Latin composition (which he had never studied) and in trigonometry and solid geometry (in which he had poor and insufficient preparation). By the end of the first term, he had succeeded in clearing off these conditions. On his return to college in the fall of 1880, he elected to take the course in chemistry, not so much from love of that science, but partly because he had not done too well in mathematics and partly because he thought it offered a practical way of making a living after graduation. About the middle of this year he encountered difficulties because his guardian had become involved in financial straits. This unhappy state persisted for the next three years, by which time Pirsson had succeeded in becoming self-supporting. Philosophically he wrote: "It was very disagreeable and a hard lesson, but in the end a good one."

About this time he became acquainted with a classmate, Herbert Faulkner, and this acquaintanceship ripened into close friendship. Many years later, in 1946, Herbert Faulkner's son, Waldron, edited and privately printed a little volume of 92 pages named *Fly-fishing Days, or the Reminiscences of an Angler*, by Louis V. Pirsson, the results of notes written by "Uncle Louis" during a tedious convalescence in 1918.

In June, 1882, Pirsson graduated with honors. He spent the summer with the Lords at Jamestown, Conanicut Island, Rhode Island; and then began a period of seven years in which Pirsson was finding himself. He continued his studies at the Sheffield Scientific School in chemistry, especially in analytical chemistry, and supported himself by becoming laboratory assistant and by tutoring. In fact, as his reputation grew, tutoring proved to be more remunerative than the assistantship. In 1885 he was reengaged for the whole year as assistant in analytical chemistry by Professor Oscar D. Allen at a salary of \$500, and together with fees from tutoring he earned about \$1000.

He spent the summer fishing in the Adirondacks and near Bread Loaf Inn, Middlebury, Vermont.

In 1886 H. L. Wells was put in full charge of the analytical laboratory and Pirsson was chosen as first assistant and E. S. Sperry as second. Pirsson's salary was advanced to \$800, and together with tutoring he earned about \$1300 during the school year. He began to feel well-off, for he had begun to save money and to have a growing bank account. The academic year 1886-1887 passed smoothly and pleasantly.

About this time Professor George J. Brush, then the Director of the Sheffield Scientific School, pointed out to Pirsson that there was no future for him at the School, with Wells just ahead of him, and that he ought to look for a larger position elsewhere. In consequence of this advice he shortly afterward accepted an offer of the professorship of analytical chemistry at Brooklyn Polytechnic Institute, at a salary of \$2000 a year. Acceptance of this offer turned out to be a grievous mistake. Pirsson soon found that there was no real demand at the Institute for a thoroughly trained analytical chemist. Instead, he was obliged to teach several classes in elementary chemistry; two courses of lectures in physics, one elementary, the other advanced; a class in physical geography; and several other subjects. He soon sent in his resignation, to take effect at the end of the year, which "dragged to a tiresome close." It proved to be the darkest hour that preceded the dawn.

In the spring of 1889 Arnold Hague of the United States Geological Survey, who with J. P. Iddings and W. H. Weed as assistants was engaged in the geologic survey of Yellowstone National Park, wrote to Professor Brush and asked him to recommend a field assistant for J. P. Iddings to serve during the coming summer. Brush suggested Pirsson to him, and when Hague offered the assistantship to Pirsson, he accepted at once. He spent the field season as volunteer assistant to Iddings, who was studying the geology of the east side of Yellowstone Lake in the foothills of the Absaroka Range. Pirsson records that Iddings was deeply absorbed in his work. Although

anxious to learn, the young assistant did not learn much geology from Iddings, but he did profit by acquiring other useful information. He found Iddings to be "a very agreeable field companion." In view of the fact that young Pirsson knew little or no geology, he was indeed fortunate in having been given the opportunity to do his first field work under so able and withal so kindly a chief as Joseph Paxson Iddings. At the end of the field season he returned to New Haven with his mind fully made up to go into Geology. In his own words, "It attracted me as nothing had ever previously done."

He at once began to study crystallography, advanced mineralogy, and petrography. A circumstance now favoring him was that he had accumulated \$1200 in the bank and consequently could give his whole time to his studies, uninterrupted by the necessity of earning money. The work that he did under Professor Samuel Penfield, who was already well on his way to becoming the foremost American mineralogist of his time, was particularly valuable and stimulating to Pirsson. The care, thoroughness, and accuracy that Penfield insisted on, coupled with his contagious enthusiasm, opened a new world to Pirsson. He began to feel that at last he had found what he had long wanted, and forthwith he "plunged into mineralogy heart and soul."

The college year passed happily and profitably. Early in 1890 Pirsson completed his first piece of original research—a chemical, crystallographic, and optical study of the mineral mordenite, a zeolite he had collected from an amygdalar basalt during the field season in Wyoming. The mordenite occurred as minute crystals (1 mm. in length and breadth and 0.4 mm. in thickness), and the results obtained by Pirsson show the value of his long training in analytical chemistry and Penfield's insistence on care, thoroughness, and accuracy.

Before the end of the college year the Geological Survey again offered Pirsson the opportunity of doing summer field work as assistant to Iddings in Montana, with a small salary sufficient to

cover expenses. As he was eager to obtain more field experience, he gladly accepted. He spent the summer in Montana as assistant in mapping the Livingston quadrangle, a large region on the eastern border of the Rocky Mountains notable for its highly interesting and diversified geology. In this work his chief, Iddings, was associated with Walter Harvey Weed, and the results of the survey were published jointly by Iddings and Weed in 1894 as the first of the folios of the Geologic Atlas of the United States.

Late in the fall Pirsson returned to New Haven. He had been notified that he was to receive the remainder of his estate and accrued interest, amounting in all to \$5600. He thereupon resolved to use most of this fund to go abroad to increase his knowledge of geology. In February of 1891 the estate was settled—just in time, for his savings had now been used up.

In March he sailed for Germany and went to Heidelberg. Here he settled down for the summer semester to acquire German and to study mineralogy and petrography under the great master, Carl Heinrich Ferdinand Rosenbusch, who in those years drew so many Americans to Heidelberg. Iddings, Pirsson's chief, had been a student under Rosenbusch in 1879; George H. Williams, who at Johns Hopkins became America's first great teacher in petrology, had taken his Ph.D. under Rosenbusch in 1882; Penfield, who had so powerfully inspired Pirsson, had spent the summer semester of 1884 at Heidelberg under Rosenbusch, "with great benefit to his future work"; and many others were to follow. Pirsson learned much, although, as he admits, he did not know enough German until near the end to profit fully by his opportunities. However, he enjoyed every minute of his time in Heidelberg.

At the end of the semester he went on a walking tour through the Black Forest, to Switzerland, and then to the Auvergne in company with J. Morgan Clements, and in October he reached Paris. At first he worked under Lacroix, famous as mineralogist, petrographer, and subsequently also as volcanologist. A little later Pirsson worked under Fouqué, heard his lectures and those of Mallard and

others, and saw a good deal of Michel-Lévy; he was indeed fortunate to be exposed to the light of this remarkably brilliant galaxy of French investigators.

About the beginning of 1892 Pirsson received simultaneously two offers—one to become State Mineralogist of Missouri, and the other, from Professor Brush, to become instructor in mineralogy and lithology in the Sheffield Scientific School, under Professor Penfield, at a beginning salary of \$1000. The offer from his alma mater he accepted at once, and entered on his duties in the fall of 1892.

The following summer was spent in the Castle Mountain district, near White Sulphur Springs, Montana. Weed had commenced the geologic survey of the district in the previous year, and Pirsson now joined him as a volunteer assistant. Together they completed the field work that summer. The petrographic and chemical investigation of the igneous rocks was done at the Scientific School by Pirsson, who himself made fourteen complete chemical analyses of representative rocks. A joint report on the geology of this interesting district was issued in 1896 as Bulletin 136 of the U.S. Geological Survey.

When Pirsson returned to New Haven in the fall of 1893 he was given charge of the classes in geology; moreover, he was relieved of his work in mineralogy and his salary was increased to \$1500. He taught the physical side of geology, and the paleontologist Charles E. Beecher gave the historical side. This arrangement continued until Beecher's untimely death in 1904, after which Professor Charles Schuchert took over Historical Geology. As a result of the appointments of Pirsson and Beecher, geology was for the first time made a definite department of instruction in the Sheffield Scientific School. In the catalogue of the School for 1893-1894, there appeared for the first time, under the courses of graduate instruction, the description of a course for advanced students in lithology. This course included microscopical petrography and dealt with the history, origin, and classification of igneous rocks. Thus was begun Pirsson's advanced instruction in petrology, "which in the years following attracted

numerous graduate students, and led to the training of many men who were to become distinguished in the field of physical geology." So wrote R. H. Chittenden, the last Director and historian of the Sheffield Scientific School.

When the field season of 1894 came around, Pirsson again joined Weed in Montana as a volunteer assistant, that is, an assistant without remuneration, and assisted in the study of the Little Belt Mountains and the Highwood Mountains. On his return to New Haven in the fall, he was offered an appointment at Johns Hopkins University as successor to the brilliant petrologist George H. Williams, who had recently died, cut down at the height of his powers. The Scientific School, however, offered him a three-year appointment as Assistant Professor of Inorganic Geology at a salary of \$2000; and, so wrote Pirsson, "of course I stayed."

At the end of the three-year term he was promoted to full rank with the title of Professor of Physical Geology, a position he continued to hold until the time of his death. As a professor of the first rank, he was also appointed a member of the Governing Board of the Sheffield Scientific School. In the same year (1898) Director Brush retired and was succeeded by R. H. Chittenden, a distinguished physiological chemist and brilliant administrator. In the following years Pirsson became Secretary to the Governing Board, and subsequently he was chosen Class Officer of the Senior Class, charged with general oversight of its work and discipline; he also served for five years as one of the three representatives of the School on the University Council. In 1912 he was elected a member of the Board of Trustees of the Scientific School and served for several years on its executive committee. According to Director Chittenden, "Owing to his good judgment and breadth of vision, he was a valuable counselor whose opinion carried great weight."

During the earlier years of Pirsson's tenure in the Department of Geology of the Sheffield Scientific School he decided to maintain his connection with the U.S. Geological Survey. He was thus able to continue his investigation of the geology of Montana. It was a

fortunate decision, as the remarkable discoveries made during the field season of 1894 were to demonstrate. We are reminded again of Pasteur's dictum that only the trained mind can profit by its good fortune. In the summer of 1894 Weed in association with Pirsson mapped the geology of the Fort Benton quadrangle for the Geologic Atlas of the United States. The quadrangle comprises 3,375 square miles, and Weed and Pirsson completed its mapping, on the scale of 4 miles to the inch, during that summer—a notable achievement. In the quadrangle are the Highwood Mountains, which contain a remarkable assemblage of laccoliths, stocks, and dikes. These igneous masses are made up of highly interesting alkalic rocks. Among the notable discoveries, especially in view of the speed at which the geologists must have been working, was the recognition that the Shonkin Sag igneous mass is a laccolith within which drastic differentiation has taken place. Subsequently the Shonkin Sag mass has become the world's most intensively studied laccolith. After some wavering between the interpretation of differentiation in place and the interpretation of successive injection of diverse magmas, Pirsson reaffirmed his original main conclusion. The striking rocks that Weed and Pirsson named shonkinites were also found during that field season. Another notable achievement was the discovery of the rock they named "missourite." It is a coarse-grained rock composed of pyroxene, olivine, and leucite—a rock of exceptional interest, as it proved to be the deep-seated, "plutonic" equivalent of the lava called leucite basalt. For a long time the missourite from the Shonkin stock of the Highwood Mountains was the only unaltered phanero-crystalline leucite-bearing rock known. Eventually, Lacroix, who had recognized that the Highwoods were underground equivalents of Vesuvius, in 1917 found blocks of missourite at Monte Somma, on the flank of Vesuvius.

So much material had been accumulated during the several field seasons in Montana, not only by Pirsson but also by Weed (which Pirsson obligingly agreed to study), that Pirsson decided not to go out to Montana during the field season of 1895, but to remain in

New Haven and work up the material. As a result of this decision several important papers were soon published which established Pirsson as a petrographer of the first rank.

In the following summer of 1896 he again joined Weed in Montana to assist in a study of the Judith Mountains. This mountain group, situated in the north center of Montana, was then a remote region which could be reached only by a stage ride of 112 miles by the shortest route from the railroad. As Weed was engaged that summer mainly on work in the Butte district, Pirsson was left alone in the Judith Mountains to do the detailed mapping of 300 square miles of country. The intrusive igneous masses of the area proved to be of great interest, and Pirsson set up the Judith Mountains type of laccolith—plano-concave in cross section—in contrast with the Mount Hillers type—plano-convex, as the laccoliths of the Henry Mountains in Utah had been conceived to be by Gilbert.

Back in New Haven from the field season, Pirsson worked hard on the Judith Mountains report, but this task, superposed on his regular duties of teaching and other routine work, brought on by March of the following year a bad attack of nervous dyspepsia, from which it took him two years to recover. At the end of that academic year he was promoted, as already mentioned, to a full professorship in Physical Geology. In the summer, instead of going to Montana, he went with Penfield and Iddings to Europe to attend the Seventh International Geological Congress in St. Petersburg. Before the sessions of the Congress in St. Petersburg he joined the excursion to Finland, and after the sessions of the Congress he was a participant in a long excursion through Russia: down the Volga by steamer to Saratov, then across the Caucasus to Tiflis, and from there to Batoum, Baku, and the Crimea. At Odessa the Congress officially ended, and Pirsson returned by way of Kiev, Warsaw, and Berlin to Hamburg, from which he sailed for home.

The field season of 1896 proved to be Pirsson's last one in Montana. A large backlog of material remained to be worked up, however, and the final publication resulting therefrom was the notable

Petrography and Geology of the Igneous Rocks of the Highwood Mountains, Montana, a volume of 208 pages published by the Geological Survey in 1905.

From 1900 onward Pirsson generally spent the summers at Holderness, on Squam Lake, New Hampshire. As a result of his exposure to this new environment, rich in igneous rocks but geologically almost unknown, he produced a series of contributions to the geology of New Hampshire, in part in association with his close friend, Henry S. Washington, and in part with William North Rice.

In 1902 he was married to Miss Eliza Trumbull Brush, the daughter of Professor George J. Brush, the former Director of the Sheffield Scientific School. This marriage proved to be eminently congenial and happy.

Clearly, the main event in the scientific life of Pirsson was his participation with Cross, Iddings, and Washington in evolving a quantitative classification of igneous rocks, later known as the CIPW system, from the initials of the surnames of its four authors. It was developed as "an entirely new system for the classification and nomenclature of igneous rocks."

Ever since 1888, when Iddings had translated from the German the handbook of Rosenbusch on the *Microscopical Physiography of the Rock-making Minerals*, he had become much concerned over the problem of a satisfactory classification of rocks. In 1892 he had resigned from the U.S. Geological Survey and had accepted an appointment as Associate Professor of Petrology at the University of Chicago. In the following year he wrote to Whitman Cross of the U.S. Geological Survey, George H. Williams of John Hopkins, and Pirsson of Yale to obtain their combined judgment on the wisdom of certain generalizations in petrology, in order to meet "the demands of the classroom." In response, a series of conferences was held, but progress on the cooperative project came to a halt because of the untimely death of Williams in 1894. Eventually, Henry S. Washington joined the group, and the four petrologists met in conference at Washington, D.C., in December, 1899. The conferees

agreed at this meeting that the classification of the igneous rocks should be quantitative; that it should be based on the chemical composition of the rocks, expressed however in terms of the constituent minerals; and that therefore the basis of the primary subdivisions of the new classification should be chemico-mineralogical. All rocks of the same chemical composition were to be grouped together, and because igneous rocks are made of minerals that range in all proportions from 0 to 100 percent, such continuous series should be subdivided on a fivefold basis. When the final draft of this manuscript was finished and unanimously adopted, Iddings was credited by the admission of his colleagues with having largely supplied the necessary drive and energy. However, so completely had the ideas of the four conferees become fused that it is impossible to tell which features or ideas were contributed by whom. As Iddings and Washington said, all four "had pooled our interests equally in the beginning, had contributed our views and criticisms freely, and had worked according to our opportunities; so we should share equally whatever praise or opprobrium might be coming to us."¹

Cross has given us an intimate estimate of Pirsson's influence on his associates in the great enterprise: "The group of men who accomplished this task—consisting of Pirsson, Iddings, Washington, and the writer—embraced men of different temperaments and mental characteristics, with views originally conflicting on many points. Success in reaching an agreement was rendered possible only through the influence of qualities such as Pirsson possessed in most notable degree. These qualities were recognized by his colleagues in making him the 'moderator' of numerous conferences where he was charged to bring about the necessary moderation of extreme views occasionally expressed as well as to guide the discussions. His judicial tem-

¹ This brief account of the origin of the *Quantitative Chemico-mineralogical Classification and Nomenclature of Igneous Rocks* is based on the history given in the Memorial of Joseph Paxson Iddings (*Geol. Soc. Am., Bull.*, 44 [1933]:360-62) by E. B. Mathews, who had access to the unpublished autobiography of Iddings, entitled "Recollections of a Petrologist."

perament and constructive ability made him a very effective member of the group.”²

The results of their united labors were published in the *Journal of Geology* in 1902 under the title of “A Quantitative Chemico-mineralogical Classification and Nomenclature of Igneous Rocks.” A year later the work was issued in book form entitled *Quantitative Classification of Igneous Rocks*, with the subtitle “Based on Chemical and Mineral Characters, with a Systematic Nomenclature,” and it was preceded by a masterly review of the development of systematic petrography in the nineteenth century, written by Whitman Cross. The authors proposed also a nomenclature based on the megascopic characters of rocks, for use in the field.

The effect of the volume was little short of sensational. An entirely new system for classifying igneous rocks as well as an entirely new nomenclature for them was presented. This classification, now generally known as the CIPW system, is rigorously quantitative and is based on the chemical and mineral composition of the rocks. The actual minerals that make up rocks are not used as the basis of classification, however, but certain ideal minerals of simple composition are used, whose amounts in a given rock are calculated from the chemical analysis of the rock according to certain fixed rules. Consequently the CIPW system is now regarded as a means of classifying magmas, not the rocks formed from them. The system has had a powerful influence in inculcating quantitative concepts, in greatly stimulating the study of the chemistry of rocks, and in advancing our ideas of heteromorphism, i.e., that rocks of unlike mineral composition can form from chemically similar magmas according to the physical conditions that prevailed during their crystallization. The CIPW system is still widely used both here and abroad, but not entirely in the way its authors envisaged.

As a result of Pirsson's teaching duties, among which was instruction in the elements of Petrology to students in mining, forestry,

² Whitman Cross, “Louis Valentine Pirsson,” *Am. J. Sci.*, 4th ser., 50 (1920):181.

civil engineering, and chemistry, he came to feel the need of a concise treatise that would give an elementary account of rocks and rock-making minerals and that would classify rocks on the basis of their megascopic properties, that is, by those properties determinable by the unaided eye. In 1908 he published such a book under the title of *Rocks and Rock Minerals: A Manual of the Elements of Petrology without the Use of the Microscope.* It evidently met a widespread need and proved to be eminently successful. In this book Pirsson advocated using the megascopic classification of igneous rocks that had been outlined in the *Quantitative Classification of Igneous Rocks* (pp. 180-85). Strangely enough, many of the rock names were taken from the older systems and were redefined, e.g., granite became a granular rock composed of feldspars and quartz, a definition that would include anything from alaskite to quartz gabbro. The strangeness arises from the fact that in the *Quantitative Classification of Igneous Rocks* the authors had written: "The present confusion in petrography is in no small degree due to redefinition of old terms, and to this confusion we have no desire to add." After agreeing fully with this remark, Alfred Harker in his review of the *Quantitative Classification* added that this redefining of terms is a "licence which would not be patiently conceded in any other branch of science." More than fifty years have since gone by, but the licence is still with us.

Another need that Pirsson began to feel as the result of teaching the first course in Physical Geology was a more suitable textbook. He was teaching to large classes of students, many of whom had a professional interest as well as a cultural interest in the subject. The extant books tended to emphasize the side of geology that deals with the development of the landscape, from the belief that this aspect is of a greater cultural value and because it requires less grounding in chemistry, physics, and mathematics. Pirsson concluded that in order to rectify this situation a textbook having a more nearly even balance was necessary. In planning the new book that was to embody this feature of better balance, he examined many of the current text-

books in order to find what relative weights their authors had given to the different branches of the subject, as represented by the space they had allotted to them. According to Cross,³ he found that every author had weighted his own specialty most highly. Omitting the personal specialty of the author of each book, Pirsson obtained an average of the weights given by the several authors to the principal topics, aside from the one in which they had shown bias. He felt that he could attain a more nearly proper balance for his projected book by using this average than by taking one based on his own judgment. In consequence he adopted this average in writing *Physical Geology*.

In 1915 Pirsson and Schuchert brought out the *Text-Book of Geology*, of which Part I, *Physical Geology* (issued also as a separate volume) was by Pirsson. The volume rapidly achieved notable success. Soon a second edition was called for and Pirsson completed the task of revision in May, 1919, shortly before his death in that year, and the new edition was published in 1920. A third edition, revised by several members of the Department of Geology of Yale University, was published in 1929; by that time *Physical Geology* had become the most widely used textbook of elementary geology in America.

Late in his fifties Pirsson began to suffer from arthritis, which despite all that could be done continued to increase in severity. After some months of intense suffering, which he endured with noble fortitude, he died on December 8, 1919, in his sixtieth year.

Professor Pirsson's contributions to petrology were widely recognized. He was a member of the Geological Society of America (Vice-President, 1915); of the Geological Society of Washington; of the Connecticut Academy of Arts and Sciences; of the American Academy of Arts and Sciences; of the American Philosophical Society; and of the Geological Society of Stockholm. He was elected to the National Academy of Sciences in 1913. From 1899 until his death he served as an Associate Editor of the *American Journal of Science*.

³ *Ibid.*, p. 182.

KEY TO ABBREVIATIONS

- Am. Geol.=American Geologist
 Am. J. Sci.=American Journal of Science
 Ann. Rep.=Annual Report
 Econ. Geol.=Economic Geology
 Geol. Soc. Am. Bull.=Geological Society of America, Bulletin
 J. Geol.=Journal of Geology
 Nat. Acad. Sci., Biog. Mem.=National Academy of Science, Biographical
 Memoirs
 U.S. Geol. Survey=United States Geological Survey
 Yale Bicen. Pub. Contrib. Miner. Petrog.=Yale Bicentennial Publications:
 Contributions to Mineralogy and Petrography
 Yale Sci. Mo.=Yale Scientific Monthly

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