NATIONAL ACADEMY OF SCIENCES

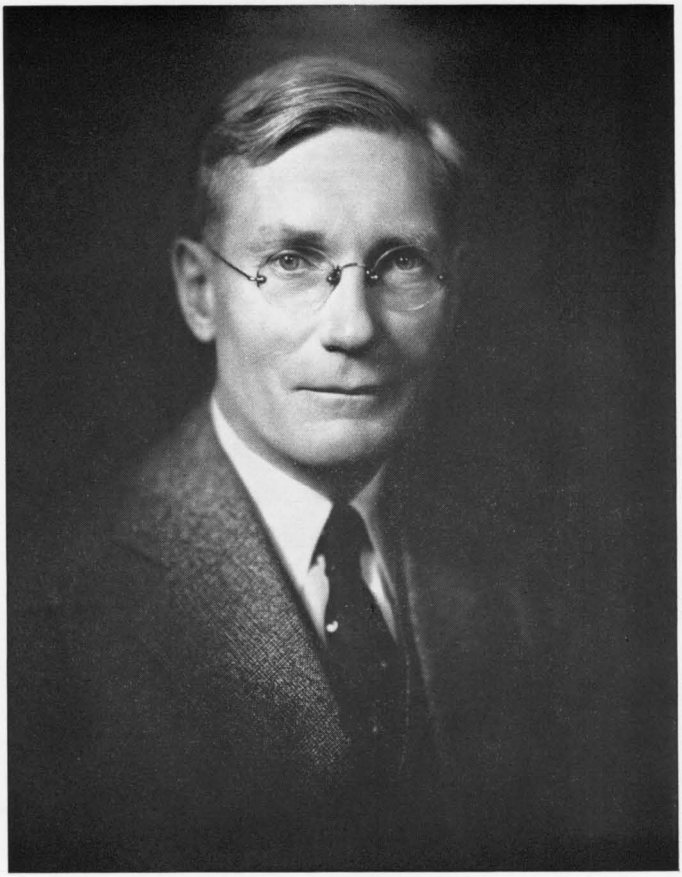
ROLLIN THOMAS CHAMBERLIN

1881—1948

A Biographical Memoir by

F. J. PETTIJOHN

Biographical Memoir



Rollin T. Chamberlin

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October 20, 1881–March 6, 1948

BY F. J. PETTIJOHN

ROLLIN THOMAS CHAMBERLIN, the only son of Thomas Chrowder Chamberlin and Alma Isabel (Wilson) Chamberlin, was born on October 20, 1881, at Beloit, Wisconsin. His father, Professor of Geology at Beloit College, became the President of the University of Wisconsin (1887-1892), and was later called by William Rainey Harper to the new University of Chicago to establish and head the University's Department of Geology. Rollin Chamberlin's early years were, therefore, spent in Wisconsin. At the age of eleven he came to Chicago where he was destined to remain until his retirement and death.

Rollin Chamberlin spent virtually all his professional life at the University of Chicago, as a student, both undergraduate (S.B. 1903) and graduate (Ph.D. 1907), and as a member of the faculty of the Department of Geology. No other person had as long an association with the department.

After receiving his doctor's degree from Chicago, he was employed by the U.S. Geological Survey (1907-1908) to investigate dust explosions in coal mines. During this work he came up with the idea of using rock dust to reduce the explosion hazards. He returned to Chicago as Research Associate in 1909, was absent a year (1911-1912) studying the iron ores of

Brazil, was appointed instructor at Chicago in 1912, and was subsequently promoted to Assistant Professor in 1914, to Associate Professor in 1918, and to Professor in 1923. In 1923 he became managing editor of the *Journal of Geology* and its editor in 1929. Rollin continued as teacher and editor until 1947, the year he retired from active duty. He died March 6, 1948, at the age of sixty-six, from a coronary thrombosis, his third in the last six years of his life. He was survived by his wife, Dorothy (nee Dorothy Ingalls Smith), whom he married on November 11, 1922, at the age of forty-one, and his daughters, Frances and her twin sisters, Isabel and Louise.

Such are the bare facts of Rollin Chamberlin's career. Into what kind of a world was he born and in what way did his life reflect the times in which he lived?

THE BACKGROUND

The second half of the nineteenth century and the first decade of the twentieth were a period of ferment and excitement in geology. This was the time of the establishment of the U.S. Geological Survey and the Geological Society of America; it was the age of opening up the mining districts of the West and the iron ores of the Lake Superior region, of the unraveling of the glacial history of the continent, of the unearthing of the dinosaurs. The main lines of geologic history and its major concepts took form during this period of explosive development, which produced such leaders as G. K. Gilbert, C. R. Van Hise, A. C. Lawson, and T. C. Chamberlin in America and H. C. Sorby, J. J. Sederholm, H. Rosenbusch, and A. Heim in Europe. Petrography came into being with the study of thin sections in polarized light. Glacial geology, Precambrian geology, and the study of ore deposits became disciplines in their own right.

After an initial decade of activity, the first half of the

twentieth century was, in contrast, a period mainly of consolidation, of backing and filling, with no expansive developments other than in petroleum geology and exploration geophysics. Mining districts grew old and were worked out; old ideas were warmed over and lost their freshness; the hypothesis of continental drift was not yet respectable. The established schools lived largely on their past capital and basked in their former glory.

With the conclusion of World War II, a new era erupted, characterized by a tremendous expansion in the fringe areas and in other earth sciences—in geochemistry and geophysics, in meteorology and oceanography. The effect of these developments was to infuse new life, new techniques, new ideas into a discipline grown old. Radiogenic isotopes provide a new clock, stable isotopes a thermometer, the airborne magnetometer and scintillometer new exploratory tools, other remote sensing devices a new look at the oceans and the atmosphere, while paleomagnetism awakened new interest in continental drift. Experimental petrology and x-ray crystallography came of age. The results were overwhelming. Some schools moved with the times; others resisted. Chicago was one of the first to accept change, to promote it; the school became a model for change in other places. The influence of Barth, Bowen, Libby, and Urey at Chicago is felt to this day.

The Department of Geology at Chicago, established in 1892, was, at its inception, extraordinary, fully representative of the youth and vigor of the times. T. C. Chamberlin was its intellectual leader. It became, overnight, the leading department in the mid-continent and challenged the older schools of the East—Harvard, Yale, Johns Hopkins. The *Journal of Geology,* founded at the same time by T. C. Chamberlin, became the leading independent geological journal in America. The three-volume Chicago textbook of Chamberlin and Salisbury

published in 1906 became the teacher's bible—after which virtually every textbook written during the next fifty years was patterned. Only the illustrations were changed. The department maintained its leadership without substantial change in thought or curriculum for several decades after T. C. Chamberlin's retirement. Only with the arrival of Bowen in 1937 was there evidence of the beginnings of a basic reorientation. It is in light of this background that we must look at R. T. Chamberlin's life and professional career. It spans the geological "Middle Ages" between the ebullient days of the nineteenth century and those of the present renaissance. Since all of Rollin Chamberlin's life and work was spent at Chicago, his career is inextricably bound up with the history of the department and is a mirror of the times in which he lived.

EDUCATION: FROM CHEMIST TO GEOLOGIST

Rollin Chamberlin's formal education began in 1889 at the First Ward Grammar School in Madison, Wisconsin. He attended this school until 1892 when his father left Wisconsin to go to Chicago. In Chicago, Chamberlin attended the Kenwood Grammar School, 1892-1895, and the Hyde Park High School from which he graduated in 1899. Rollin's interests in high school seemed largely to run to science, particularly physics and chemistry. His interest in the latter led to his setting up a chemistry laboratory in the basement of the family home in Chicago. The experiments performed were varied in character, leading among other things to the invention of a smokeless gunpowder—a line of experimentation that was terminated as a result of the complaint of the neighbors about the noise.

Following high school, Chamberlin spent one semester in 1899-1900 at the University of Geneva in Switzerland and one, in 1900, at the University of Zurich. Upon return to the United States he attended the University of Chicago, 1900-1903, and

received departmental honors in chemistry. He continued his studies at Chicago, as a graduate student in geology, and received his Ph.D. (*summa cum laude*) in 1907. His doctoral dissertation reflected his interest in chemistry and dealt with the composition of gases occluded in rocks. Thus ended Rollin Chamberlin's formal education.

Until his senior year in the University, Chamberlin had planned to become a chemist, having had for some years a great enthusiasm for the subject. Chemistry, plus languages, had been his chief concern at the Swiss universities in 1899 and 1900. But his stay in the Alps kindled a lifelong interest in mountaineering and the out-of-doors. Field excursions and travel to faraway places appealed to Rollin and, as these fitted better in the career of a geologist, his interest shifted from chemistry to geology. For a time he was interested in both, as his doctoral thesis shows, but the issue was soon settled. Rollin accompanied his father as an assistant on the University of Chicago expedition to China—an expedition conceived by Mr. John D. Rockefeller. This round-the-world trip was a turning point in the younger Chamberlin's career. It tipped the scales in favor of geology and gave him a taste for travel and adventure from which he never recovered. The magnificent mountain ranges he traversed sparked an interest in crustal deformation and structure—a subject to which Rollin Chamberlin was to make his own contributions in due time.

GEOLOGIST

Chamberlin's main interest was in the problems of diastrophism, mountain building in particular. One of his earliest papers dealt with Appalachian folds (*J. Geol.*, 18:228), a study based on a traverse along the track of the Pennsylvania Railroad between Tyrone and Harrisburg, Pennsylvania. Along the traverse, nearly one hundred miles in length and made on

foot, Chamberlin recorded many measurements of the dips of beds, his position being determined by railroad mile posts and telegraph poles (38 to the mile). From these data he prepared a cross-section with folded structures restored, calculated the apparent shortening of the earth's crust (his estimate later being confirmed by E. Cloos, *Bull. Geol. Soc. Am.*, 58:843), and calculated the depth of folding. A similar 135-mile traverse across the Colorado Rockies some years later made possible comparison of the two mountain systems. The Appalachians were considered to be a shallow, "thin-skinned" deformation; the folding in the Rockies was thought to involve a greater thickness of the earth's crust.

Chamberlin's interest in diastrophism extended to the larger problems. He was a supporter of the concept of the world-wide periodicity of diastrophism as the ultimate basis of correlation —a view strongly put forth by T. C. Chamberlin. He was interested also in the role of plutonism in the evolution of mountain chains. One of his papers dealing with this subject was whimsically titled "Whittling Down the Batholiths" (*Bull. Geol. Soc. Am.*, 38:109).

Chamberlin's interest in folds and overthrust faulting led to a period of pressure-box or structure model experimentation. Chamberlin's work with "pressure-box" models was considerable. Fashioned along the lines pioneered by Bailey Willis and earlier workers, his experiments had the same failings—wrong materials and improper scaling. It is of interest that three of Chamberlin's best-known students worked on model studies. F. P. Shepard, who got his doctor's degree at Chicago in 1923, was originally a structural geologist interested in the Rocky Mountain Trench. He was co-author with Chamberlin of a paper on some model experiments. T. A. Link, Ph.D. 1927, wrote a thesis based solely on experimentation. Shepard later became known as America's first marine geologist and

Link became one of Canada's leading petroleum geologists. Best known for his concern with model studies was M. King Hubbert, who, though he performed no experiments, placed the whole subject on a firmer footing by carrying over the theories of model scaling from engineering to geology. Hubbert, though nominally a student of Chamberlin's, can hardly be said to have done his work under Chamberlin's direction or supervision but, undoubtedly, his personal contact with the model studies of Chamberlin and his students while himself a graduate student at Chicago directed his attention to the problem of model studies. Hubbert provided the theoretical basis for model studies, though Hans Cloos and others had earlier achieved significant results by intuitive scaling.

Chamberlin's doctoral thesis on the gases occluded in rocks was a milestone in chemical geology—one which perhaps did not receive the attention due it at the time. The most recent work on the geochemical history of the earth and the acquisition of its atmosphere and the oceans by degassing of the mantle bears out the importance of Chamberlin's early work (see Rubey, *Bull. Geol. Soc. Am.,* 62:1111; *Geol. Soc. Am. Spec. Paper* 62:631).

So, also, it was with Chamberlin's work on glacial motion. His instrumental studies of ice movement and his demonstration of shear within the ice foreshadowed the sophisticated studies of what is now a science in its own right: glaciology. The methods initiated by Chamberlin have been refined and added to. The important point is the approach followed, namely instrumentation and measurements, which has now become the accepted pattern of study.

Chamberlin did not himself pursue the field of structural petrology of Hans Cloos nor the field of petrofabrics of B. Sander, though one of his students (J. T. Stark) did investigate the internal structures of a granite stock.

As far as this writer is aware, Rollin Chamberlin's name appears on no published geological map, that is, a map made from primary field observations. Chamberlin left field mapping to others, although his first assignment at the University of Chicago was to teach the summer field course, then given in the St. Croix region of Wisconsin and Minnesota. Chamberlin's contributions to tectonic theory were based mainly on exploration and field reconnaissance and on philosophical considerations. In some cases he relied on "pressure-box" experiments from which he reasoned by analogy to supplement data taken from the literature. On other topics, however, Chamberlin's publications were based on data collected firsthand. His work on the geology of the beds containing human bones at Vero, Florida, on the motion of glaciers, on the coral reefs of Samoa, and on the iron ores of Brazil falls into this category.

An objective examination of Rollin Chamberlin's earlier publications shows that many were records of work done to verify or test ideas earlier put forth by T. C. Chamberlin. Rollin Chamberlin's study of glacial motion was made to test ideas developed by the elder Chamberlin as a result of his studies of glaciers in north Greenland. The studies on the depth of folding in the Appalachians and Rockies were applications of a concept presented in the Chamberlin and Salisbury three-volume *Geology* (II:125). Even the study of gases occluded in rocks was an outgrowth of the planetesimal concept of earth formation and generation of the atmosphere and hydrosphere as formulated by T. C. Chamberlin. Rollin Chamberlin held rigidly to the notion of the permanence of the continents and ocean basins and he gave short treatment to the concept of drifting continents—as did most American geologists a few decades ago. He accepted the world-wide periodicity of diastrophism as the ultimate bases of correlation—a notion challenged in recent years.

In Chamberlin's later years he became involved in the

research program of the Yellowstone-Bighorn Research Association, of which he, Walter Bucher of Columbia, and especially W. T. Thom, Jr. of Princeton, were the moving spirits. For a period of years, from about 1932 to his retirement, Chamberlin and his students, Victor Church, E. C. H. Lammers, Vincent Nelson, and Leland Horberg among others, worked diligently on the geology and structure of the Wyoming-Montana region. Out of this work emerged an analysis and synthesis of the structural history of the region. These years were, in many ways, the most productive of Chamberlin's career. His work was more original, less hampered or restricted by his earlier indoctrination and training. Out of it came concepts of crustal deformation involving rigid block and incompetent sediments—principles of interest outside the geographic area from which they were formulated.

EDITOR

For nearly a quarter of a century Rollin Chamberlin was editor of the *Journal of Geology,* a journal founded and edited by his father and published by the University of Chicago. Rollin Chamberlin gave a considerable part of his life to the *Journal* and by his service to that publication rendered a great service to geologists and the science of geology. His association with the *Journal* exceeds in length even that of his father. Rollin Chamberlin was made a member of the editorial staff in 1912; he became managing editor in 1923 and editor in 1929. He remained in this capacity until his retirement on June 30, 1947. Readers and authors alike owe Rollin Chamberlin a great debt for this thirty-five years of painstaking and, at times, tedious labor. Many readers, perhaps, are unaware of the patient and unending effort contributed gratuitously by an editor in assisting authors in the preparation of their manuscripts for publication.

Rollin Chamberlin's service to the *Journal* did not consist

solely of the discharge of his editorial duties. He was also the author of many articles and reviews. His first contribution, "The Glacial Features of the St. Croix Dalles Region," appeared in Volume 13 in 1905. His last paper, "The Moon's Lack of Folded Ranges," came out in Volume 53, 1945. In all, Chamberlin wrote some thirty-six articles and countless reviews for the *Journal.*

MOUNTAINEER

Rollin Chamberlin had an abiding love of mountains. He was an inveterate mountaineer. He combined his love of climbing and exploration with his professional interest in the origin and structure of mountains. It was his stay in Switzerland, as a student in 1899-1900, that kindled his interest in high places. He made his first ascent, the Titlis, alone in 1900. For the next forty years he traveled far and wide and, whenever the opportunity arose, spent his time in climbing the highest peaks. He made his last climb, Storm Point, in the Tetons in 1940.

Some of his mountaineering adventures found their way into print. He describes, for example, his explorations in the Cariboo Mountains of British Columbia where, with Allen Carpé of the American Alpine Club, he made first ascents of nine peaks in this range (*Geog. Soc. Phila.,* 25:59 and 27:121). His ascent of Orizaba, North America's second highest peak (elev. 18,696 feet), a climb made with A. P. Coleman and H. F. Reid, is reported in the *Journal* of the American Alpine Club (I:2, 160-66). In all, Chamberlin had sixty-three notable ascents to his credit, including the Matterhorn and all the other more famous peaks in the Alps (twenty-three in all), various peaks in Alaska, the Pyrenees, the Tetons, the Sierras, the Cascades, and the Canadian and Colorado Rockies. One of his last climbs was the Grand Teton in 1938, on which excursion he was accompanied by his oldest daughter, Frances. The latter

was infected with her father's enthusiasm for the mountains and has a notable number of climbs to her own credit. Chamberlin joined the American Alpine Club in 1921, was a contributor to its journal, and presented the club with the gigantic ice-axe used by Professor Salisbury during the Peary Relief Expedition of 1895.

WORLD TRAVELER

Rollin Chamberlin traveled extensively at a time when world travel was far less common and far less easy than it now is. His first trip abroad was to Switzerland for a year of study when he was but eighteen. In 1909 he was a member of the Oriental Educational Investigation Commission to China—an assignment which involved a trans-Pacific journey with stops at Hawaii and Japan. The party assembled in Shanghai in February of 1909 and for nearly five months thereafter traveled by rail, river boat, sedan chairs, and Peking carts studying fifteen of the eighteen provinces of China with short excursions into Mongolia and Manchuria. The Chinese venture ended, the party returned by way of the Trans-Siberian railroad and Europe, across which they zigzagged from the North Cape to the Balkans. A partial account of this journey appeared in the *National Geographic Magazine* (XXII:1094-1119) and in the *University of Chicago Magazine* (March 1910:150-55).

In 1911 and 1912 Chamberlin was in Brazil studying the iron ores of that country. Upon completion of this task he visited Chile and other South American countries. In 1914 he visited Australia. In 1920 he participated in the Carnegie Institution Marine Biological Expedition to Samoa where he made a study of the coral reefs surrounding Tutuila. Interest in glacial motion took him to Alaska, Switzerland, and British Columbia. Other travel included attendance at the International Geological Congresses in Mexico in 1906, Canada in 1913, and South

Africa in 1929. In the course of time Chamberlin visited all the continents, Antarctica alone excepted.

Chamberlin's travels gave him a perspective few had and were perhaps the underlying reason for his interest in such subjects as continental structure, paleoclimatology, and mountain building. They certainly gave him a world-wide view held by few of his contemporaries. They also provided him with case histories and examples which he used effectively in discussion of controversial problems and which made him a formidable opponent.

His travels, as well as his writings, brought him into contact with the world's leading figures in geology. Many of these distinguished geologists were afterwards guests in Rollin Chamberlin's home in Chicago. Some of us were privileged to be included on such occasions.

THE MAN

The intellectual legacy left by Thomas Chrowder Chamberlin and Rollin D. Salisbury was husbanded and perpetuated in the Department of Geology after the death of these preeminent geologists. The senior faculty, and many of the junior staff also, were products of the early department, so it is small wonder that the general outlook and program inherited should be retained with little change for several decades. It is not surprising, therefore, that Rollin Thomas Chamberlin, named for the two principals, and wholly educated in the department when it was at its prime, should reflect in his professional outlook and orientation the tradition and philosophy inherited from the elder Chamberlin and Salisbury.

The relationship between father and son was very close indeed. As Rollin Chamberlin himself wrote in the memoir on his father: "They had many things in common and their companionship was most congenial. From early childhood the

father talked to his son as to a grown person and so spontaneously there developed a complete understanding between them" (National Academy of Sciences, *Biographical Memoirs,* 15:391).

It is all the more remarkable, therefore, that, though he was not an innovator, nor one to depart much from traditional thought patterns, Rollin Chamberlin established a place for himself as an individual and as a scientist of some stature. He had, indeed, severe handicaps to overcome—having so preeminent a father and remaining in the institution in which he was educated—yet to a considerable degree he overcame them. His work on the degassing of rocks and the field measurement and study of glacial motion, as well as some of his work on continental evolution, was highly original and foreshadowed developments of more recent times.

Perhaps Rollin made his mark as a teacher as much as a scholar and an editor. At Chicago, he taught the courses in structural geology and shared the teaching of the course entitled "Continental Evolution" (first designated Geology 15-16, later Geology 215-216), a course geared to the second two volumes of *Geology* by T. C. Chamberlin and R. D. Salisbury. This course, together with its prerequisite, "Geologic Processes" (first taught by R. D. Salisbury and later by J H. Bretz), was the backbone of the Chicago curriculum for nearly four decades. These courses were taken by every Chicago student and were, for them, a memorable experience.

At an earlier stage in his career, Chamberlin taught the introductory courses in geology based on the well-known text, *College Geology*—an abridged version of the larger three-volume work. *College Geology* was ultimately revised by Rollin Chamberlin (and P. MacClintock) and brought out as two smaller volumes.

Chamberlin's basic honesty, sympathetic outreach, and

generosity with his time encouraged students to work with him. He sponsored more doctoral theses, perhaps, than any other member of the department at Chicago. In the later years many theses grew out of his association with the Yellowstone-Bighorn Research Association and its field camp at Red Lodge, Montana.

Rollin established a place for himself and grew steadily in stature. His achievements were recognized outside of the University. He served as Vice President of the Geological Society of America in 1933 and Vice President and Chairman of Section E, Geology and Geography, of the American Association for the Advancement of Science in 1933. He was awarded an honorary Sc.D. degree from Beloit College in 1929, was elected to the National Academy of Sciences in 1940, and became a member of the American Philosophical Society in 1943.

Rollin Chamberlin was a rather nervous individual. He was a pipe smoker whose pipe was continually going out, and a visit with him in his office was a conversation broken by intervals of silence for relighting his pipe. His energy was in part expended in his active life outside of the office. Of lean and wiry build, he engaged in strenuous sports. He was something of a baseball player in his early days, a very good handball player, at one time champion of the University, a tennis player all through his later years, and an active mountain climber all his life until a heart ailment put an end to all athletic activities. He was a baseball "fan" and had an astonishing knowledge of teams, players, and famous plays.

Rollin had a good sense of humor. He enjoyed a joke on himself, as well as on others. He was basically a conservative—in the best sense of the word—very loyal to the University of Chicago, but unhappy with the Robert M. Hutchins regime, and quite outspoken when he felt a principle was involved.

His open-mindedness and honesty made him a warm per-

sonal friend of all who knew him and, when disagreements arose, won the respect even of those who disagreed with him. He contributed much to the department at Chicago.

ACKNOWLEDGMENTS

Though the author alone is responsible for this memoir and for the judgments reflected therein, he has received help from many persons and sources. In particular, some factual details have been checked or supplied by Mrs. R. T. Chamberlin and Frances Chamberlin (Mrs. David A. Carter), and by J H. Bretz. Much information is contained in Fisher's history of the Department of Geology at Chicago (privately published) and in memorials prepared by J Harlen Bretz (*Science,* 108 [1948]:50), N. L. Bowen (*Proc. Geol. Soc. Am.,* 1948:135), D. J. Fisher (*Am. Phil. Soc. Yearbook* 1948: 244), and J. H. T. (*Am. Alpine J.,* 1949:205-6). Conversations with others who knew Rollin Chamberlin have helped fill in details.

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KEY TO ABBREVIATIONS

Am. Alpine J. = American Alpine Journal
Am. J. Sci. = American Journal of Science
Bernice Bishop Museum Spec. Publ. = Bernice Bishop Museum Special Publication
Bull. Am. Assoc. Petrol. Geologists = Bulletin of the American Association of Petroleum Geologists
Bull. Geol. Soc. Am. = Bulletin of the Geological Society of America
Carnegie Inst. Wash. Publ. = Carnegie Institution of Washington Publication
J. Geol. = Journal of Geology
Proc. Geol. Soc. Am. = Proceedings of the Geological Society of America
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