



James Edward
Church:
Bibliography
Of a Snow Scientist

by Helen J. Poulton



BIBLIOGRAPHICAL SERIES NO. 4

Introduction . . .

Dr. James Edward Church— Specialist in Snow

By GEORGE HARDMAN

DR. JAMES EDWARD CHURCH, a Latin and Greek scholar and critic of art at the University of Nevada, would seem a most unlikely prospect to engage in the field of snow surveying. This kind of work is rough and requires unusual strength and endurance. However, "Doc" Church was an unusual man.

Of average height and build, he possessed unsuspected energy and stamina. His weight, ideally adjusted to his height and frame, held exactly constant throughout his long working life. Dr. Church never owned an automobile and never learned to drive. He walked much, and when walking was too slow, rode a bicycle. Volunteers seemed to be available whenever a car or pickup was needed. A real gentleman of the old school, his character and intensity of purpose attracted people who could help in his projects without any apparent effort on his part.

The beauty of the snow-covered Sierra Nevada Mountains overlooking Reno appealed to the artist in Dr. Church. He and his young wife made many weekend walking trips in winter through the Mt. Rose and Hunter Creek mountains. Bedding and food were hauled on a sled. They tramped the hills by day and made camp wherever night overtook them. Later, household duties occupied Mrs. Church, and Dr. Church continued his winter outings alone. In those early years the lure which drew him to the mountains was sheer love of the beauty of the snow-covered landscape.

But Dr. Church was more than an admirer of beautiful scenery. The scientific side of his mind perceived that the winter accumulation of snow was related to the quantity of water discharged by the streams which were fed by melting snow. The drive of the true scientist to learn the why of things took over and Church began the research into the relationship between snow and runoff that was to be a consuming interest for the rest of his life.

People throughout the ages have noted the accumulation of snow on the mountains in winter and the stream flow from the

snow banks in summer, but practically no data on the relationship between these two phenomena existed when Church began his research. Equipment to measure the amount of water in the snow was not available. One could drive a stick through the snow and find its depth but this was not enough. The amount of water in snow per foot of depth, or the density of the snow, varies as the winter season advances and also from year to year. Hence, some means of determining the inches of water held in the snow cover was needed.

Church worked on this problem and came up with an answer in the world famous Mt. Rose sampler. Essentially, it consisted of a steel tube long enough to reach through the snow cover and a scale to weigh the tube and its core of snow. A cutter on the instrument assisted in getting the tube through densely packed snow and in holding the core of snow inside it. Many refinements have been made in this equipment, such as lightweight aluminum alloy tubes and lighter and sturdier scales, but the underlying principle is unchanged.

The Mt. Rose snow sampler provided a necessary tool but much remained to be done before a measurable and predictable relationship between snow and runoff could be established. A usable measurement of snow for this purpose required that the accumulation of snow at determined measuring points must be reasonably uniform from year to year. When a satisfactory natural site is located, it must be prepared and marked in such a manner that it can be revisited as desired.

Many of those early "snow courses" were located on the headwaters of the Truckee River. They had to be visited and the water content of the snow determined several times each winter. The only equipment for travel over the snow was skis and "bear paw" snow shoes. The skis were long, heavy, and difficult to handle. The skier carried a long pole for balance and to assist in climbing. Riding the pole provided a reasonably safe method for descending steep slopes. A visiting Norwegian skier taught the early snow surveyors a few tricks about light skis, ski waxes, and short poles, which they were quick to adopt.

Many of the snow courses were located in inaccessible places high on the mountains. Often a long day on skis and snow shoes was required to reach a snow course. The snow measurements could not be taken at night and in any case a return trip by dark would have been extremely hazardous. Hence, the snow surveyor was occasionally required to spend the night at the snow course. Should a storm come up he might be immobilized for several days

before he could return. Temperatures in the high Sierra Nevada drop quite low and a night in the open was disagreeable at best and dangerous at the worst. Carrying enough food for a trip of several days in addition to the snow sampling equipment was also quite a problem.

These difficulties were resolved by the building of a number of small cabins in the more remote locations. They were provided with bedding and enough food and firewood for several days. Since snow at the cabin site might be 20 feet or more in depth, entrance by the normal means of a door presented a problem if not an impossibility. Dr. Church again was equal to the occasion and came up with the "Santa Claus" chimney which extended high above the cabin and protruded above the snow. The surveyor merely lifted a trap door and climbed down the chimney. Buried in 20 feet of snow the cabin was well insulated. Modern power-driven over-snow equipment has made most of the cabins unnecessary, but they served a good purpose in their time.

Many young men accompanied Dr. Church on the trips to the snow courses. They were interested in the work itself, but essentially they loved the outdoors and enjoyed skiing. Motorized equipment has taken away much of the romance that attended the early snow surveying operations, and commercial skiing facilities now provide the opportunities for recreation which the young companions of Dr. Church found in the snow survey trips. Present-day snow surveying operations are carried on by paid employees and only on rare occasions does a skiing enthusiast join in for the fun and relaxation.

With the Mt. Rose snow sampler perfected and an adequate number of snow courses established, data on the snow cover became available and Dr. Church was ready for the development of a mathematical relationship between snow measurements and stream runoff. Early in this period Church was asked to predict the rise of Lake Tahoe from his snow measurements. He was unable to do this at that time, but a few years later he had developed the snow survey-runoff relationship so well for the Lake Tahoe basin that he could and did accurately forecast the spring rise of the lake.

Early in his career in snow surveying, Dr. Church became associated with two men who contributed to the success of his work. H. P. Boardman, professor of civil engineering at the University of Nevada, supplied a knowledge of mathematics and developed the formula by which snow measurements are converted into forecasts of runoff.

Mr. S. B. Doten became director of the Agricultural Experiment Station shortly after Dr. Church began his work in snow. An Experiment Station project was soon developed and furnished the main support for Church's work for many years. It became the writer's unhappy duty while in the capacity (very temporarily) of Director of the Experiment Station, to close down this project. Dr. Church, then assisting the Republic of Argentina in developing a system of runoff and flood forecasts from snow surveys in the rugged Andes Mountains, was, in the eyes of the office of Experiment Stations in Washington, overage. Funds allocated by this office were the major support of the Experiment Station and the snow survey project could receive no further assistance where federal money was involved.

In his work, Dr. Church traveled widely, was on two expeditions to Greenland, and corresponded regularly with men in many countries. In fact, Dr. Church always had more irons in the fire than any one man could handle. One phase of an investigation would open up a whole flock of new possibilities.

I recall one instance when Director Doten requested Church to prepare some material for publication as a station bulletin. Church agreed, but to get the material in shape, asked to be supplied with an assistant for a few months. A student in engineering was engaged, and Church and he went to work. In due time Doten inquired as to progress on the bulletin. "Doc" was astonished. In working up the material for the bulletin a new field appeared, which demanded immediate investigation. The subject was so intensely interesting and the investigation so absorbing that the original assignment for the preparation of a bulletin for the Experiment Station was completely forgotten. Nevertheless, he was a most prolific writer and lecturer, as reference to the bibliography of his work will verify.

Introduction . . .

Friendships in Snow

By HORACE P. BOARDMAN

DR. JAMES E. CHURCH was very different from most inventors in that he was able to travel long distances in foreign countries and explain to interested people just what practical snow surveying had accomplished and would continue to accomplish in the future. This opportunity, mostly through his own initiative, was a very unusual one which few inventors enjoy.

The first foreign trip he undertook was with his wife when they spent two years from 1899 through 1901 in Europe, where he received the Ph.D. degree in classics from the University of Munich.

During two years' experience in Europe, because of his great interest in history, ethnology, and anthropology, they traveled during vacations in Greece and Italy. Undoubtedly this helped him later at the University of Nevada in the teaching of language and art appreciation, as well as establishing a habit which continued all his life.

His next trip to foreign soil was to Greenland when he was invited to join a scientific expedition to determine what effect the climate and geography of Greenland had on the danger in North Atlantic navigation.

The leader of the expedition was William Herbert Hobbs, who was head of the Department of Geology at the University of Michigan, Dr. Church's alma mater. This expedition, as far as Dr. Church was concerned, began with the summer vacation of 1926 and was continued in the summer of 1927 and also through the following winter. He returned to the University of Nevada in the fall of 1928.

The following note is quoted from an article of Dr. Church's: "In 1930 I was asked to organize the Committee on Snow of the American Geophysical Union but almost immediately, because Australia wished to join and the Committee was American only, the International Commission of Snow was organized by the International Union of Geophysics so that all countries could join, and because snow surveying would be its chief factor, I was made its President. It's now the International Commission of

Snow and Glaciers. About 200 members are in it with a large group from India. It gives us a deep friendship in snow."

The next visit of Dr. Church to foreign countries was in 1936 when the main object of his trip was to attend an international meeting of scientists interested in snow and ice. This meeting was held in Edinburgh, Scotland, but unfortunately Dr. Church was not present until that part of the program pertaining to his specialty, snow surveying, was over. His plan had been to visit all of the countries in Europe which were blessed or afflicted with heavy falls of snow, and in some cases, with extensive glaciers, before time for the international meeting in Scotland. In 1940, he recalled: "My travels took me to Ireland, England, Denmark (to see my Greenland friends), Sweden, Finland, Estonia, Latvia, Lithuania, and Russia.

"I planned to remain only ten days in Russia. I had purchased an intourist ticket for ten days at \$5.00 a day and therefore was due to leave at that time, since the Government was acting as guide. Unfortunately the remainder of my journey into Poland, Czechoslovakia, Bavaria (southern Germany), Switzerland, France, and return to Scotland became impossible because I had picked up a cold on the Norwegian Coast near Narvik and carried it all the way into Russia where I fell in my tracks."

Dr. Church worried as to what the Russians would do to him, but they promptly took him to a hospital where he was properly treated throughout five weeks of severe pneumonia. The skilful and life-saving treatment which he received in the Russian hospital naturally made a good impression. The Russians even offered to send him to a good sanitarium in Crimea in southern Russia to recuperate, all without expense to him, even including the hospitalization in Moscow. The Russians "allowed me to fly to London by Berlin and Amsterdam."

His arrival in Scotland was after the part of the program in which he was most interested had been finished. However, Carl Elges, a civil engineering graduate of the University of Nevada who had been working with Dr. Church for several years, was on hand and able to take part in the snow survey portion of the program.

After the end of the meeting in Edinburgh, Dr. Church went to Switzerland and helped the Swiss engineers in applying snow surveys and glacial studies to forecast discharge of the Rhine River through the lowlands of western Europe. His work there is aptly described in a 1949 issue of the *Nevada State Journal*,

which relates the general benefits and ideals developed in the cooperation of neighboring countries in snow studies.

Near the time of V-J Day, Dr. Church received an urgent invitation by telegram to be one of 40 American scientists to attend the 120th anniversary of the Soviet Academy of Sciences in Moscow. He noted: "The trip to Moscow was made by airplane via New York to Newfoundland, the Azores, Casablanca—a forced landing in North Africa—Tripoli, El Alamein battlefield, Cairo, Teheran . . . At Teheran we were joined by Dr. Saha of Calcutta University, one of the 130 guests who were assembling in Moscow . . . We flew to Baku and over the ruins of Stalingrad and finally Moscow."

The *Nevada State Journal* (September 1, 1945) recalled Dr. Church's remarks at a subsequent meeting of the Reno Exchange Club. ". . . 'When the Reds first introduced their communism as a form of government, they degraded the scientists—regard them as lower than the common laborer. But now' on his second trip to Moscow in the past dozen years 'they respect the scientists as one of the highest strata of society. The war's achievements emphasize that.'"

Following a conference in Los Angeles in 1947 between Dr. Church and Dr. S. K. Banerji, Director of Observatories, Delhi, India, Dr. Church was invited to India by the Central Waterways, Irrigation, and Navigation Commission of India.

He arrived in Delhi on March 8.

On March 23 Dr. Church and several prominent people connected with the proposed expedition left Delhi for Darjeeling but learned that considerable equipment necessary for the mountain journey had been delayed at Calcutta, due partly to transportation restrictions, as well as rioting and strikes. After considerable delay, the supplies were booked to Darjeeling by mail train.

The following is a quotation from an article by Dr. Church entitled "Snow and Life" published in the magazine *Explorer's Journal*, December 1960. "The new government of India needed forecasts to regulate its large reservoirs at the southern base of the steep Himalaya. Three trips by saddle and packers totaling 300 miles were made to the mountain passes but the winter snow was found scant and badly weathered by the proximity of the eastern Himalaya to the Equator. [In the far southeast, the Himalaya hugs the heat equator and the winter snow-line retreats far upward toward the peaks.] Snow survey sites were

few and distant. The U.S. Bureau plan of correlating precipitation with the annual streamflow was commended as a substitute. The problem is really one of cooperation between India, Nepal, and Pakistan. India and Nepal possess most of the stream sources and Pakistan has much of the streamflow.

"The Western Himalaya, particularly in Kashmir, appears from winter photographs, to be well clad with seasonal accumulation of snow and its slopes to be much gentler and reasonably accessible."

To survey the snow and watersheds of northern India, the Himalaya, and China, Dr. Church flew as far as Canton and Hong Kong and directed several expeditions by foot, car, and horseback into Sikkim, in the Tamur Valley, and to eastern Nepal border areas, occasionally traveling at altitudes of over 14,000 feet.

He selected three snow courses in the Nepal-Sikkim border area to provide high-level precipitation data. One of his Indian colleagues, K. K. Dutta, afterwards wrote: "The whole excursion was extremely enjoyable, especially due to the excellent leadership of Dr. Church. It was a wonder to see an octogenarian like him not only enduring all the strains of the journey, but always having an eye for the comfort of others."

One of his diary entries suggests his own enjoyment of the spectacular scenery of the Himalaya: "April 13; Singhik to Chuntang (14,900): Rickety Trails—all day in a deep V-shaped canyon up the Tista along washed-out trails over a rickety shelf and suspension bridges. A roll of the horse or a fall would have you too wrecked for the doctor's attention. But why worry? I dismounted only twice to take my load from the horse. Tomorrow much worse. Wonderful jungle and forest, . . . roses and rhododendron. Terrace farms inaccessibly high up the slopes. Cascades, ribbon falls. The snow on the south slopes descends to 13,500 feet. The ground is wet with winter rain and the Tista is unquestionably flowing snow water."

Dr. Church remained in India until July 23 to complete the reports of his studies in the Himalaya. His New Year's card of 1948, mailed from Buenos Aires, gives impressions of some of his experiences during that interval:

"LIFE'S SATISFACTIONS

I have seen the Himalaya rising
Like marble into the blue.
I have stood before the Taj Majal
at sunset.
I have shared prayer with the
'Blessed' Gandhi,
I would share them now with you."

"A week's cruise by air carried me far south to Argentina on the opposite side of the world and to midwinter in July," he wrote of the next phase of his journey. "The Argentina Division of Water Resources, known as Agua y Energia Electrica (Water and Electric Power) had begun snow surveys ten years previously and I had offered to detour to Buenos Aires for ten days for expenses.

"But meantime I had been informed that our Federal Government had refused me my expected vacation unless I returned first to set foot on American soil. Only one reaction was possible. I would go irrespective.

"How long will you stay?' was the immediate and oft repeated question. My answer was, 'I came for ten days but now I will stay as long as you wish or until my work is done.' The Minister of Industry and Commerce assured me, 'We have no quarrel with your country, but we will care for you as long as you remain.'

"Thus without contract, my ten days grew to eleven months and the initial visit to the northern Argentine Andes was expanded by their entire length to Tierra del Fuego near Cape Horn."

The tour of Tierra del Fuego was made between November 6 and December 9, 1947. In "Notes on a Tour" published by the American Geographical Society, Dr. Church wrote: "Tierra del Fuego, subpolar continental tip of pampas and cordilleras, is a land of fascination, both for its scenic grandeur and for its history. But today it has also a larger interest as a pioneer region. I traveled through the Argentine Territory of Tierra del Fuego late in 1947 as a guest advisor on an expedition carried out by the Navy (Ministerio de Marina) of the Argentine Republic. . . ."

Dr. Church returned to Reno from Argentina on July 2, 1948. In less than two weeks he was en route to Oslo, arriving there August 16 for a meeting of the International Commission of Snow and Ice. He remained in Oslo until September 5, then went

to Switzerland, where he assisted the Swiss in the development of a snow survey system on the Rhine and Rhone rivers, which also serve France and Holland.

"Barrier ranges and trunk streams merge national interests like children in a family," he wrote upon his return to Reno that winter. "My wanderings became adventures in international peace. At the end of the rainbow I sought and found friendship."

James Edward Church (1869-1959): Bibliography of a Snow Scientist

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THE CLASSICS PROFESSOR, in whose honor the new fine arts building at the University of Nevada is named, was internationally known as "The Father of Snow Surveying," a science to which he gave organization. He invented and perfected the Mt. Rose snow sampler and set up the Nevada snow survey system, which inspired or guided the snow survey projects in Newfoundland, Quebec, Alberta, British Columbia, Maine-New Hampshire, New York, Pennsylvania, the Continental Divide, the Great Basin, and the Pacific Coast. During 1926-28, Dr. Church was Associate Meteorologist with the University of Michigan Greenland Expedition; in 1947, snow survey adviser in India; in 1947-48, snow survey adviser in Argentina; and in 1948, consultant to Swiss snow men in setting up a system for the Rhine River. He served as president of the International Commission of Snow and Ice and chairman of the American Geophysical Union Committee on the Hydrology of Snow. He received a citation from the Central Snow Conference in 1941, a medal and honorary life membership from the Western Snow Conference in 1948 and 1959, an honorary LL.D. from the University of Nevada in 1937, and a citation as Distinguished Nevadan in 1958.

PART I. MATERIAL BY DR. CHURCH

ABSTRACTS

- "The Construction of Juvenal, *Satire I*." American Philological Association. *Proceedings*, XXXV (1904), Lxxi-Lxxxiv.
- "The Identity of the Child in Vergil's *Pollio*." American Philological Association. *Proceedings*, XXXVIII (1908), xxxii.
- "The Lesser *Hic*-Formulae in Roman Burial Inscriptions: Their Development and Significance." American Philological Association. *Proceedings*, XXXVII (1906), Xl,iii.
- "Old Problems in Horace and Vergil." American Philological Association. *Proceedings*, XXXV (1904), xcvi-xcvii.