Obituary: Gordon Dawson (1929-2022)

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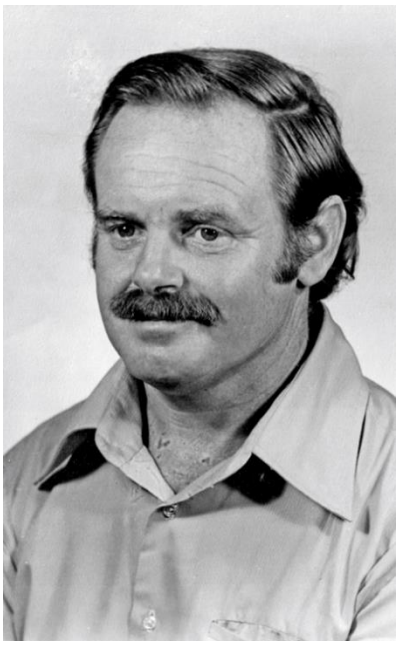
Gordon Bedford Dawson was born in Connecticut (USA) on 29th September 1929. Gordon had a rather disrupted childhood. His parents were divorced not long after he was born and soon after he travelled with his mother, Jean to London (UK), where she met and married Graham Dawson, a New Zealand architect. In 1937 the family moved to New Zealand, settling in Wellington. At this time New Zealand was in the depths of a polio epidemic and most schools were closed that year, disrupting Gordon's education for the first time. In 1938 he was enrolled at Friends School, a Quaker boarding school in Wanganui. In 1944 he moved back to live with his parents in Wellington and attended Wellington College until 1946, when his mother thought it would be a good idea to visit her family back in Redding, Connecticut for a family reunion. While there, his mother decided he should experience some American education. The American and New Zealand education systems were totally different and Gordon had to repeat a part year, and attend summer schools to catch up with the rest of his class. He particularly appreciated the English literature part of the American curriculum with Shakespeare, Chaucer etc. He completed his high school education at Redding in June 1948. His mother and two brothers had already returned to New Zealand and aged 18, he made his way alone by train across America, then by ship, back to NZ.



Gordon Dawson, about 1970

On his return from USA, he was somewhat unsettled. He wanted to work outdoors and soon got his first job with the New Zealand Forest Service in a remote village in the Pongakawa Valley, just north from Lake Rotoiti (between Rotorua and Te Puke). This is off the beaten track today and was really in the back-blocks in 1948. That job lasted only 6 months and Gordon returned to Wellington. One of their neighbours in Karori was Norbert Modriniac, who was superintendent of the Geophysical Survey (a branch of the Department of Scientific & Industrial Research - DSIR) and he suggested that Gordon go down to their office for an interview. After a brief interview he was offered a job and told to report to their office on The Terrace, pick up a train ticket to go to Rotorua.

Up to this time the New Zealand power supply was focussed on hydro-electricity, but two unusually dry years and the rapidly increasing energy demand post-war led the government to look at other power sources, notably coal and geothermal. At that time very little was known about geothermal energy: about what it was, where it was, and how it could be accessed. The DSIR had been conducting regional surveys in the Taupo-Rotorua area and Gordon was despatched to Taupo to assist with this work. He was the junior part of a three-man team of surveyors involved in geophysical surveys being conducted by DSIR.

Living conditions in the Forest Service had been hard, but they were equally hard with survey party. He spent much time in remote places, where they lived in tents or in small, un-insulated and poorly-heated, wooden huts. One winter it was so cold they had to drain the radiators of the vehicles every night because the DSIR was too mean to buy anti-freeze. Water inside the hut would be frozen by morning. They were tough conditions, but Gordon survived and this experience of the cold doubtless helped him when later he went to Antarctica.

Gordon often talked about those early days with the survey party, in which the two other members of the team were inveterate alcoholics. They would work hard for 3 weeks then the other two would go on a "bender" for about a week in a local pub. The others dared not drive, because being found drunk on the job would result in instant dismissal, and loss of a future pension. So, Gordon was tasked with driving the miscreants around as needed. This experience was a salutary lesson in life and did not lead him into alcoholism, or to total abstinence.

When he was not surveying (usually when the other two surveyors were AWOL), he helped out on the two DSIR drilling rigs, which were part of the initial exploration drilling being undertaken at Wairakei. At this time there was no job training and most skills were learned from mistakes.

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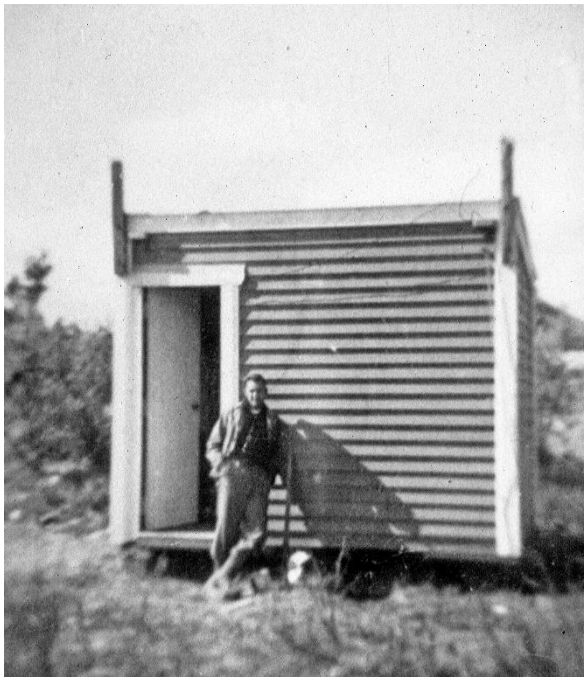
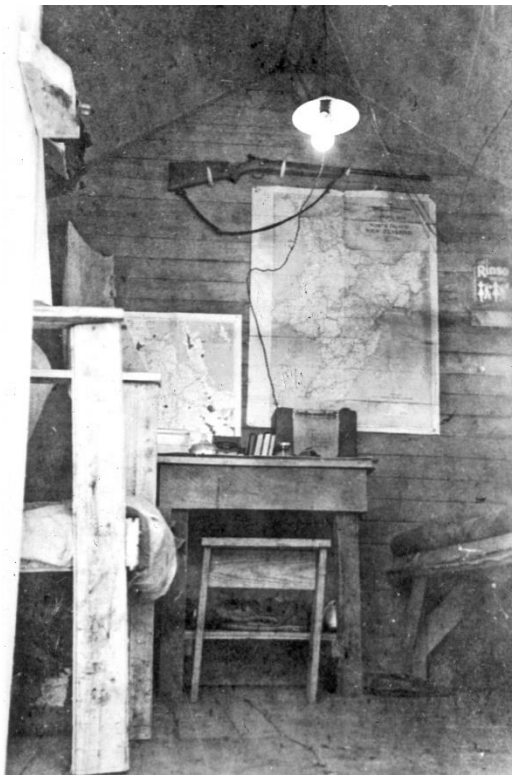


Typical 3x3m single-man's hut used on construction projects in 1950's

His very first geothermal job was helping with the drilling of hole WK-2A, a 4-inch hole, beside the Waikato River. They did not know they were drilling into boiling artesian conditions confined under a thin capping layer. Of course they soon had a major problem. The blowout preventer had not been installed and suddenly hot water came rushing up and filled the drilling pit with hot water. They had no pumps that could pump the hot water out, but they could and did pump cold water into the pit to cool off the hot water coming up the wellbore. In order to attach the blowout preventer to the wellhead, which by now was underwater, Gordon and the driller stripped naked and dived into the pit, and successfully bolted the blowout preventer to the wellhead and subsequently got the well under control. New Zealand's first and only submarine geothermal wellhead crew. Gordon was not one to stand by and watch others fix a problem.

In early 1951 he returned to Wellington and spent "an indifferent time at Victoria University", studying geology and zoology, but for a variety of reasons had difficulty passing the exams. In 1953 he applied for a job as technician with the Dominion Physical Laboratory (DPL, another division of DSIR) in Lower Hutt to assist with their geothermal programme. He was very fortunate here to be working with and mentored by several of the eminent scientists who were involved with the geothermal programme, and whose conventional strict scientific approach to problem solving would have great influence on Gordon's later geothermal career. Among these was John Banwell who later went on to lead the UNDP geothermal programme in New York. At DPL Gordon was involved with several projects associated with the geothermal programme: measuring the permeability of drill cores; investigation of two-phase flow in various pipeline configurations using air-water mixtures in perspex pipes; techniques to measure the dryness fraction of steam-water mixtures using alpha and gamma ray absorption.



Hut interior: Furniture consisted of bed, small table, chair and wood-burning stove. An ex-WW2 0.303 rifle was part of most men's kit.

In 1955 Gordon was transferred from DPL at Lower Hutt to the Geophysics Division of DSIR at Wairakei. At this time there was tremendous political pressure to prove geothermal as a viable power source, and a wide variety of geological, geophysical and engineering investigations were underway on a "*suck it and see*" basis. Many investigations proved unrewarding, but some bore fruit. Gordon was involved in a number of different lines of enquiry, initially in an assistant role but later as a field leader. His initial work at Wairakei revolved around near surface ground temperatures and the associated heat flow.

While there is an obvious general relationship between "hot ground" and geothermal activity, at this time there was no established methodology to measure and relate shallow ground temperatures and obtain cohesive, contourable results. Trial measurements were made at several depths down to 3 metres and various grid spacings. It was found that consistent and reliable results could be obtained from measurements at 1 metre depth. Gordon developed a standard 1 metre depth on a 100 metre (actually 100 paces) grid system which was used to map the Wairakei and Waiotapu geothermal areas. This was the first geophysical method in New Zealand that gave some demarcation, although approximate, of the extent of geothermal areas (Thompson et al, 1964).

After the ground temperature surveys, he became involved in measurements of heat flow within and from the ground surface. He was tasked by Eddie Robertson, later Director-General of the DSIR, to develop methods of measuring heat flow from thermal features such as fumaroles and steaming ground. There was no information in textbooks, so Gordon had to start from scratch: building and testing the survey equipment until a satisfactory version was found. He

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recognised the then current method of calorimetry measured lower amounts of heat and thought that a better measure of the total amount of heat could be obtained by measuring the velocity of steam emerging from the ground. He developed a fibreglass funnel to cover an area of thermal ground and collect the steam passing through it. The equipment he developed in the 1950's and early 1960's continued in use for more than 40 years; later apparatus was essentially a modified version of his equipment. During the 1950's it was not appreciated that the methods and equipment developed for evaluating heat flow measurements might have application elsewhere, and those involved were probably too busy to publish the results in scientific journals. However this omission was remedied later (e.g. Dawson, 1964; Dawson and Fisher, 1964; Robertson and Dawson, 1964; Dawson and Dickinson 1970)

Resistivity surveys proved to be by far the most powerful tool for locating and delineating deep geothermal resources - far outweighing chemical methods or any other physical methods. In places where there was subsurface data available from wells, there was an obvious correlation between areas of high temperatures and a low resistivity signature. It was tempting to correlate the low resistivity measured at the surface with high salinity waters in the deep geothermal reservoir. However later work showed that the low resistivity signature was largely associated with clay alteration particularly in the zone overlying the high temperature resource. Gordon played a major part in the development of equipment and techniques for this work, and especially in aspects of field equipment that improved efficiency, such as a method of automatically laying and picking up cable with a moving vehicle (Dawson and Rayner, 1971; Risk et al., 1973). Gordon became the field leader for the standard resistivity traversing measurements that defined the extent of almost all the high-temperature geothermal fields in New Zealand.

Electrical resistivity methods could not only delineate the lateral extent of geothermal fluids, but also provide information about their distribution with depth. The Geophysics Division of the DSIR began electrical resistivity soundings in the late 1960s, and Gordon was deeply involved in this work. He was introduced to this technique by Dr George Keller, Professor of Geophysics at the Colorado School of Mines (USA), and worked closely with him while he was on sabbatical in New Zealand (Keller, G.V. and Dawson, G.B., 1969). The technique was expanded to include electromagnetic and magneto-telluric methods. Gordon played a major role, usually as leader of the technical field staff in several of these projects, from the 1960's through to the late 1980's.

In addition to geothermal work Gordon was often involved in geophysical surveys to assist Ministry of Works engineers in building dams, pipelines, and transmission lines in the North Island. These included the Tongariro Power Project (Dawson, 1976; Hunt and Dawson, 1979), the Wheao River Power Project (Dawson and Hicks, 1980), the Maui gas field (Dawson et al., 1976), and many other smaller projects.

An interesting, but unpublished investigation that Gordon carried out was related to the high voltage DC power link between Benmore in the South Island and Haywards substation near Wellington. This was commissioned in 1965, but an intellectual question remained – Where did the return current go?? NZED commissioned Geophysics Division to run a series of standard resistivity setups throughout the lower North Island while the DC link was shut for a short time near midnight when general power usage was low. It transpires that the return current takes the shortest pathway to the sea and travelled along the coast in the sea water. During the field surveys for this work the Director of Geophysics Division, Trevor Hatherton, visited their camp and one evening he asked Gordon what career path he would like to follow, and Gordon replied that he would like to go to Antarctica. Many of the senior staff at DSIR had been part of the 1957-58 International Geophysical Year group so there was a strong Antarctica culture among the Geophysics Division staff.

The position of Scientific Leader at Scott Base in Antarctica was advertised 1966 and after some gruelling interviews Gordon was appointed. This involved "wintering over" from October 1966 until October 1967. He was also Deputy Leader of the Base for the Winter period. He had three staff under him in the Laboratory, to undertake continuous ionospheric observations. Gordon himself was responsible for measuring variations of the Earth's magnetic field and earth currents caused by the aurora, as well as looking after six seismographs.

For recreation on his days off, he learned to handle one of the huskie teams that were used at that time to support field parties and would take them for an exercise run. In the spring, he took advantage of an opportunity to join a party taking the dog teams about 20-30 miles north of Scott Base, to an Adelie penguin colony, and to visit some of the huts established by various British expeditions during the "Heroic Age" of Antarctic exploration.

In the early 1970s, New Zealand offered aid to Indonesia to prospect and develop their geothermal resources. Gordon was part of several small DSIR teams, working with GENZL, that went to Indonesia and made resistivity surveys which delimited the geothermal fields at Kamojang, Darajat and in Bali. Because of heavy rain in the wet season, they could work for only 2-3 months during the dry season. Gordon's job included responsibility for the field equipment; this involved dealing with the locals, and for this he learned some Bahasa Indonesia, which is the primary *lingua franca* of the country.

Apia 1986. Fale (Meeting House) built at Gordon's instigation beside the Apia observatory in Samoa

In 1985 Gordon was seconded to Samoa as Scientific Advisor to the Western Samoan Government, to supervise running the seismological and magnetic Observatory at Apia. This station had been established by Germany during their period of occupation prior to World War I, and was now operated by a small local staff. The Observatory was important because it was a part of worldwide international

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monitoring networks and the magnetic data collected at Apia was some of the longest recorded. He did virtually the same job there as at Scott Base. His term there was meant to be one year, but for various bureaucratic reasons it stretched out to 2½ years.

Gordon left his mark on Samoa. During his period as Scientific Advisor, the NZ government approved a project to carry out some long overdue maintenance on the Apia observatory. At that time there was no facility for what we would call a smoko room (nowadays staff cafetaria?). Anyway Gordon priced building a traditional Samoan fale as a communal room for the observatory staff and as the cost was less than 10% of the observatory maintenance budget, this was approved. All the materials except the corrugated iron roof was locally supplied. Each of the large logs used as uprights to support the roof was donated by a different family. The building remains today having survived several tropical cyclones.

Gordon was a very sociable person, and loved the outdoors. As with his scientific work he was most meticulous in everything he attempted and was a very good DIY exponent. As his family expanded he gradually expanded his garage to a three-bedroom house. He was a founding member of the Lake Taupo Yacht Club and assisted with building the original clubhouse then proceeded to design and build one of the first "trailer sailers" in Taupo. He was also a keen skier and a foundation member of the Taupo Ski Club, and as with the Yacht Club helped to build the original club chalet on Ruapehu. He was also an ardent radio-control model aircraft builder and flier and an active member of the local club. He did not evade civic duties: In his early days in Taupo, before the hospital was built, he was a volunteer driver with St John's and drove an ambulance taking patients in need of urgent medical attention to Rotorua hospital. He was a member of the Royal Society of NZ, the local Coastguard and branches of Probus and Toastmasters.

Gordon worked for the DSIR for 41 years, starting in 1950 as an unqualified "technician". With his enquiring mind and meticulous approach to everything he did, he gradually advanced through the ranks. He qualified for a NZ Certificate of Science in 1965 and was eventually promoted to the "scientist" grade, something almost unheard-of in the Public Service for anyone without at least a Bachelor degree. During his career he mixed comfortably with many world famous scientists and with people of many different cultures.

He retired in 1991 just before the DSIR was disestablished and transformed into the Institute of Geological and Nuclear Sciences. He enjoyed a long retirement in Taupo with his wife Merle who died in 2019. Gordon passed away after a short illness in Taupo Hospital on 15th August 2022, attended by his sister Laura and niece. Gordon is survived by his sons Graham and Ross.

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