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INTRODUCTION

Science, and the attempt to develop the academic standards of Australian universities, were the interests that dominated Dorothy Hill’s life. We refer not only to scientific endeavours as undertaken by herself and her colleagues, but also to basic approaches to administrative, commercial, educational and personal aspects of her life. Early in her career she learned how to develop and test hypotheses. To apply this philosophy to a wider range of problems, she had to be able to trust people and to make valid critical judgements; this required a high standard of conduct on her part as well as that of other people. Her students and the university staff responsible to her during her later years all attest to the fact that she could be utterly relied upon. Guile was a word she did not recognize. In an interview that she gave at the end of her career, she commented that she had been most concerned with the integrity of those with whom she had dealings of significance. This approach stood her in good stead in most of her dealings but, as one would expect, her judgements of the quality of fellow workers were not always faultless.

A second interesting aspect of her life was the extent to which she attempted to predict the ways in which geology would develop. She foresaw the need to use historical geology as a way of introducing students to the needs of various industries, at a time when it was commonly


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thought that oil would not be found in Australia and coal was not regarded as a valuable commodity; she saw the need to develop new aspects of palaeontological study, such as palynology, to interpret the thick sequences of freshwater sediments such as those in the Great Artesian Basin; she understood the opportunity for research on the Great Barrier Reef at a time when it was lauded as a great tourist attraction, but nobody had given much thought to the influence that its study might have on the understanding of Quaternary history; she understood how to use the regional mapping skills of the Bureau of Mineral Resources as a basis for the reinterpretation of the geology of the State; she realized the need for a Palaeontological Association for Australia to foster the production of new work and the publication of the results in journals that were devoted to problems of Australian geology; and she quickly saw that collaboration with European palaeontologists such as Glaessner, Ópik and Teichert, who landed in Australia in the 1930s and 1940s, would produce work that geologists could not otherwise have expected. In these and many other respects she took a lead, thus expanding the main thrusts of her subject and giving rise to many opportunities for geologists to expand their interests.

She was undoubtedly a great lover of Australian universities, and of the University of Queensland in particular. To many people it seemed that she sacrificed a career overseas because she wished to see the Australian universities reach the forefront of academic achievement; and she spent a great deal of her life working towards this end. In doing this she was critical of the situation in Queensland that prevented the building up of the staff of the university to an international quality and size. Senior administration was in the hands of bureaucratic administrators who had no experience of world university standards. The replacement of senior administrative posts took a long time to achieve, and it took the efforts of many people to convince governing bodies that public service procedures were not appropriate for the administration of universities. Other aspects of the university marred her appreciation of its standards. Superannuation was entirely under the scheme of the Queensland government and this could not be transferred on appointment elsewhere, nor could staff employed elsewhere transfer their previous entitlements into the scheme. This system prevented the recruitment of inter-State and overseas staff. It was also discriminatory with respect to women employees. Women also suffered from the fact that they were not regarded as suitable for senior academic positions in many departments. Consequently, Dorothy Hill sought to increase the impact of women in the university by encouraging women students to reach the highest levels possible in their work. Faculties such as Physiotherapy, which attracted many women students, were encouraged to develop high standards in their courses.

**BACKGROUND**

Dorothy recorded that all eight of her great-grandparents were English villagers. She was born on 10 September 1907 to Robert Sampson Hill and Sarah Jane Hill (née Kington) in Brisbane, where her father was employed in a large city store. Her primary schooling was at the suburban Coorparoo State School. As far as is known, no other member of the family showed any interest in science.

What influenced her to become a scientist and a geologist? Her secondary education at Brisbane Girls’ Grammar School (1920–24) included mathematics, chemistry and biology. Physics was not offered at the school. Classics was an important subject, her study of which
helped in her later cultural life and in her research work. Among her school prizes was the Phyllis Hobbs Memorial Prize in English and History, and appreciation of these two subjects enabled her to enjoy many aspects of her later life. For example, the reading of poetry gave her much enjoyment and relaxation in times of stress. She also won the school’s most prestigious academic prize, the Lady Lilley Gold Medal, as well as the Sports Brooch for her sporting achievements.

From her school science courses and from general reading, she learned that there were ample opportunities for a student to make original studies in Australia. Her first inclination was to study medicine, not to become a medical practitioner but to be able to enter a research laboratory. At that time the University of Queensland had no Medical Faculty, and students had to go to either Sydney or Melbourne to enrol. Her sister remembers their father commenting privately to her that Dorothy, the third child in a family of seven, had an outstanding mind and would have a distinguished career. Despite this acknowledgment in the family, it was still impossible for their finances to support a medical course in Sydney. Fortunately, Dorothy won one of the twenty Entrance Scholarships to the University of Queensland, and she chose to enter the Science Faculty, particularly to study chemistry.

All incoming students had to study mathematics, chemistry, physics and one other subject. Dorothy had studied biology at school, and so she chose geology in an attempt to broaden her education. Immediately, Professor H.C. Richards had an important influence on her. She records that he was a man of complete integrity, who had a strong sense of humour, was sympathetic in his relationships with students, and able to be a leader in academic and teaching affairs. What won her into geology was Richards’s personality and his interest in developing a wide range of science. Under his guidance, she graduated in 1928 (figure 1) with a first class honours degree in geology, and a Gold Medal for Outstanding Merit.
A second reason for her interest in geology was the opportunity to do field work. Although a city girl, she had a feel for the country, had learned to ride horses, and enjoyed the company of country people. She had country friends, including many people that she had met at university. It was during a visit to friends at Mundubbera that she collected the corals on which she published her first Australian coral paper. Much of the field work for her honours studies in the Brisbane Valley was done on horseback.

SPORTING AND SOCIAL LIFE

At school, Dorothy was active in sport, particularly athletics. Hurdling was her forte. At university she played hockey with such success that she became a member of the Queensland University Hockey Team, became a Blue in Hockey, and was chosen for the Queensland Women's Hockey Team. This was an important achievement because it opened up for her a range of social as well as sporting activities. She certainly enjoyed the social life of an undergraduate, and her private papers show how much she valued the student social whirl and the opportunity to meet a great variety of people on campus. Indeed, the university was so small that she had friends in all the major faculties, many of whom she mentions in her personal papers. She enjoyed especially the opportunity to mix socially with academic staff and their families, many staff being involved with coaching sporting teams and with dances and gala performances during the academic year. Field work also gave an opportunity for families to mix with students, and the wives of staff members accompanied student field excursions. She lamented that no contact of this kind occurs now, and in her view the students have thereby lost excellent opportunities to broaden their social lives and gain access to staff in an informal way.

She commented on the presence of radical students in the university—people who had a wide influence in the political sphere later in their lives. Despite these contacts she showed no signs of being involved in any political activities as an undergraduate. She also commented that when she was in Cambridge, the political left made an attempt to interest her in political issues from their point of view, but without success.

While she was in England, and had some independent income from scholarships and college appointments, she learned to fly, gaining an Air Pilot's 'A' Licence. We have not found in any of her papers the reason for such an activity, but she later had an interest in car rallying, another way of releasing her physical energies. It is clear that flying was just another activity in which her independent spirit broke away from the normal routines of academic life. There is no evidence in her personal papers or from subsequent events that she had any further involvement in aviation.

Her interest in undergraduate sporting achievements continued throughout her academic career. From 1947 to 1959 she was Patroness and Vice-Patroness of various student sporting bodies within the university.

INFLUENCE OF CAMBRIDGE

Hill's undergraduate work was of a sufficiently high standard to gain for her a Gold Medal as the most outstanding graduate of the year, the first time that a woman had gained that
honour in the University of Queensland. It also won her a Foundation Travelling Scholarship to the Sedgwick Museum (the Geology Department) in the University of Cambridge for 1930–32. Because she had done a year’s work on the basic topic of her PhD thesis before she went overseas, her supervisor assessed that she had already completed one of the three years necessary for PhD candidature. This work, started in Brisbane, was on the Carboniferous corals from Mundubbera, in the Burnett River Valley of South-East Queensland. Her main PhD work was on the Carboniferous corals of Scotland, and she was able to convince her supervisor that she had already put into effect all the preliminary reading for her study.

Her work in Cambridge left a lifelong impression upon her scientific and social life (figure 2). In the first place she learned what were the qualities of an international university, and how a major library supported her research. Late in her life, she indicated that although she made excellent and helpful association with other researchers, the main value was working in the library of the university and in the Sedgwick Museum. The Museum Library was well maintained and had a large range of current literature. It was the advantage of having so much material on hand that gave her the impetus to put together a strong personal library and a strong departmental library when she returned home.

In the UK she found that much of the seminal work in her research field was being undertaken by two or three persons. The most important of these were Stanley Smith of Bristol, whose real interest was in the skeletal structure of corals but who also had an understanding of the relationships between the soft and hard tissues; W.D. Lang, whose

Figure 2. With a group of students in Wales during a field trip with the Sedgwick Club.
taxonomic expertise was outstanding; and H. Deighton Thomas, who understood the importance of extensive well-preserved and curated collections for coral research. Lang and Thomas were at the British Museum (Natural History), in London. None of these people would have been regarded as being in the front rank of palaeontologists globally, but they set a pattern of investigation that Hill followed throughout her career. This made her work stately and meticulous, and left one feeling that she could be followed knowing that she had investigated details carefully.

She began to think about the problems caused by workers producing results from similar material but with different interpretations. How much of this was caused by a misunderstanding of the structures being described? Thus she set about defining the structural details of corals in terms of tissue patterns and skeletal deposition, and produced a paper on the terminology of rugose corals (1)*. This was a major step forwards in the understanding of the group, as most workers have now accepted her views. Then she began to think about the way in which coral structures were the outcome of depositional processes of microscopic features of the skeleton, and how these were formed from the soft tissues of the polyps. This began a series of works on fine skeletal structures and the way in which they were related to the septal invaginations or the basal plates of the polyp (2). This kind of work influenced her later studies, and those of her students. Although this work on crystal structure and skeletal features was begun in Cambridge, it reached fruition after her return to Queensland, when she published a paper (3) dealing with the skeletal growth of crystals in hexacorals with Professor Walter H. Bryan, who worked on the processes of crystallization in igneous rocks.

In Cambridge, her work was supervised by Dr Gertrude Elles, whose research was on graptolites. Along with Elles, Dr Oliver Bulman, also a graptolite worker, demonstrated how detailed morphology, on well-controlled palaeontological sequences, could be made to reveal refined stratigraphic results beyond anything she might have expected. Although her work had nothing to do with the graptolite researches, their guidance on stratigraphic palaeontology was of value to her. Obviously her PhD work was well appreciated because in 1932 she was awarded the Old Students’ Research Fellowship of Newnham College, Cambridge, and in 1934 she won the Daniel Pidgeon Fund of the Geological Society of London.

Elles and Bulman worked on well-controlled stratigraphic sequences in which a variety of fossil groups had given access to the general interpretation. Hill’s Australian work consisted of an interpretation of coral faunas from isolated limestones in thick sequences that had not been properly mapped, and from which other fossils had not been collected. This was frontier palaeontology, and she could not apply the principles of closely controlled stratigraphy to her work. Understanding the need to improve the geological mapping work in Australia, and the use of a variety of organisms for correlation, enabled her to see why a vast effort had to be put into Australian geology before European standards could be reached. Most European work on corals had been performed on well-mapped sections in which an understanding of sedimentary facies had been interpreted into the local stratigraphy. Little of this kind of work had been done in Australia, and she understood how much field interpretation had to be done to make her work on corals more effective. This accounts for her later emphasis on teaching students about the classical areas of study. American work was built on such classical bases also, but at least early in Hill’s research career she seemed to have a European bias to her work because of her Cambridge experiences. This limitation was overcome when Professor

* Numbers in this form refer to the bibliography at the end of the text.
John Wells of Cornell University visited Brisbane on study leave in 1954, during the preparation of the coral volume for the *Treatise on invertebrate paleontology*. He worked mainly on the younger scleractinian corals of the Mesozoic–Recent, whereas Hill’s work was on the older Palaeozoic representatives. The interaction of these two pre-eminent minds, coming from different backgrounds and with markedly different experiences of their science, enhanced the final product enormously, and made a real advance in the understanding of coral palaeontology. Not only were they involved with academic work, but they shared an interest in old cars. For Dorothy Hill, an Austin 7 was the epitome of the right thing in vintage cars, but we believe that John Wells would have preferred a De Soto. They became firm friends and continued to enjoy close collaboration long after the *Treatise* was finished. This was a very significant move for Hill, because in the 1960–80 period many American workers rose to prominence in coral palaeontology.

In 1971 an International Association for the Study of Fossil Cnidaria and Porifera was inaugurated, and Dorothy Hill was elected as the first president. This group resulted from the activities of Professor B.S. Sokolov in the USSR, Professor J.P. Chevalier in France, and Dorothy Hill. Many American workers were also active in this group, and foremost among them was William Oliver Jr, a student of John Wells’s.

Hill’s work in England brought her into contact with geologists and palaeontologists who set the tone of postwar studies in Britain. Friendship with such people enabled her to maintain contact with new developments and with opportunities for her graduates to visit Britain for postgraduate studies. Once she returned home in 1937, although she found visiting Europe very stimulating, she never wished to return to England to live. The reason for this is to be found in her deep love for Australia, and Queensland in particular, and her view that Australian universities needed to hold their successful researchers. She claimed that she did not feel isolated by living in Queensland, as she could get information by quick trips to Europe and by correspondence. She also learned to keep several projects operational at any one time, so that if there were a lack of literature or a failure to obtain specimens for comparison, she could change tack until the appropriate material arrived.

From a cultural point of view, Hill commented in an article written in the *University News* in 1976 (11) that Cambridge reawakened an interest in music and drama, but that she came especially to understand the effect of architecture on the human spirit. From our personal contact with her, we conclude that these aspects of her career in Cambridge meant more to her inner life and personal development than she would normally reveal on casual acquaintance.

**RETURN TO AUSTRALIA**

After seven years in England, all of them spent in Cambridge, Hill began to feel that university life in the fens was too removed from the wider aspects of life that she had enjoyed in Australia. Also, with her views on the research life of Australian universities, she felt that she must devote more time to research in Queensland. Professor H.C. Richards, when visiting her in Cambridge, indicated that he was keen to have her back in Brisbane. In 1937 he was able to use one of the new Council for Scientific and Industrial Research (CSIR) grants to fund her salary for a number of years. She notes in her personal comments that she ‘came back hot-footed’. The opportunity to work in Brisbane enabled her to develop several aspects of geological work that came to the fore later in her life.
As mentioned above, Hill realized that more basic work had to be done on local stratigraphy and facies. She understood that much work had to be done on the coral faunas themselves so that palaeontological workers could recognize the main coral units. Mapping was not one of the objects that she could pursue alone; in a country the size of Australia, mapping depended on the efforts of the Bureau of Mineral Resources and the State Geological Surveys. Consequently, her outstanding contribution to science from the period after returning to Australia was her ability to put into order the known coral faunas of Australia and to use them to outline a wide-ranging stratigraphy. She published many papers on coral faunas from localities in all States except South Australia. Examine her bibliography for the years 1938–43 and note that an enormous effort went into this basic taxonomic work. In these studies she used the methods that she had developed in her PhD work, and the criteria used in the descriptions have become the standards for coral work around the world. All these papers provided a framework for the 1943 paper (5) on the reinterpretation of the Australian Palaeozoic record. Although she realized that the understanding of coral faunas from isolated limestones in studying the regional geology left much room for later development, she felt that it was a necessary first phase in discovery of the elements of time stratigraphy in the large parts of the column for which only the most rudimentary knowledge was available. These publications drew attention to the quality of her work, her perceptive understanding of the fields of coral morphology, and the value of worldwide understanding of coral evolution to the interpretation of stratigraphy. Overseas geologists who needed to understand the stratigraphy of the corals that they encountered in the field sent specimens to her for examination. This work also encouraged Professor Raymond Moore, editor of the *Treatise on invertebrate paleontology*, to invite her to contribute to a volume on Coelentera ta.

In addition to her research, she was asked by Richards to deliver lectures in palaeontology and stratigraphy. There were only three staff members in Geology at the University of Queensland at that time: Richards, W.H. Bryan and F.W. Whitehouse. Whitehouse had held the first Foundation Travelling Scholarship and Hill held the second. Thus the Department had staff of the highest quality, even though it was small. Hill clearly held her own in that company, and Richards saw that she would be a fine addition to the permanent staff when the opportunity came. Professor M.I. Thomis has commented to us that although the University of Queensland is seen as entering the world scene only in the 1950s, the Geology Department had set its foot on the ladder of international success in the late 1930s. This was largely the result of the forward-looking approach by Richards, who had chosen Whitehouse and Hill, outstanding researchers and good teachers, for the early appointments to his staff.

**STUDENT COMMITMENT AND MORETON BAY**

In addition to her research work, Hill immediately began to interest undergraduate students in the possibility of research as a career. It is difficult for us today to understand how badly off Australian Science was in the late 1930s, because research was not considered a primary function of universities. At present, Australian universities are being revamped by people who have a nineteenth-century view of teaching undergraduates, and academics will have a similar problem to tackle if they are not careful. To foster a spirit of independent inquiry among students, Hill set out to interest them in projects quite unlike those that they encountered in student laboratories. She became involved with the Science Students' Association, and
encouraged a number of students to take up investigations into some interesting problems during the summer vacation. She saw this as a way of introducing students to field work and to the collection of data, as well as teaching them to write up results in an acceptable way. She was the adviser to several student trips involved with marine and geological studies in Moreton Bay. These activities declined after 1941, when the university was more concerned with wartime matters, but were revived again in 1946.

The results of these trips were written up as papers and were presented as bound volumes. Some items were of high standard and provided the basis for later work. Certainly, some well-documented collections from the sediment were studied in the laboratory, and provided opportunity for senior undergraduates to try their skills at interpretive work.

WOMEN’S ROYAL AUSTRALIAN NAVAL SERVICE (WRANS)

Back in Australia, Hill had only two years before war broke out with Germany, and four before Australia was heavily engaged with Japan. She and her sister Edna were involved with a naval group serving in a mine-watching role in Moreton Bay and the lower Brisbane River. It was suspected that Japanese planes were dropping mines in the entrance to the river in an attempt to stop the arrival of American supplies. New South Wales and Queensland had different railway gauges, and it was difficult to transport war supplies landed in Sydney to Northern Queensland. The shipping of American material into Brisbane therefore became a major operation. Dorothy took on a more active role after she came into contact with people who were working on cyphers in General MacArthur’s headquarters, where she joined a group of civilian women and became the officer in charge of a large number of undergraduates and typists. She also came into contact with Captain E.P. Thomas, R.N., who was the naval officer in charge of the Port of Brisbane. He convinced her that she could do a worthwhile job in the WRANS and, despite her interest in getting her university work off the ground, she felt that she should forsake that task until the war was over.

She enlisted as a Third Officer in the WRANS and undertook training in Sydney and Adelaide. Subsequently she became an Operations Staff Officer and assistant to Captain Thomas. Her work included cypher and coding, accepting responsibility for the safety of shipping, and communicating with service personnel including commanders and ratings from Australian, American and British services. Her commander reported that she had the capacity to interact successfully with male servicemen, including people such as argumentative tug-masters, who usually did what was required of them without understanding the administrative control quietly applied. In one of her personal papers she comments that cypher work left her with time to visit the university, and allowed some time to think about geological topics. However, she comments that she worked up to 80–90 hours a week at her WRANS duties.

At the end of the war she served on the Demobilisation Planning Committee, being the representative of the Women’s Services.
Consultation with Industry

On first returning from overseas, Hill made contact with people in government and private industry, and attempted to show them how historical geology could make a contribution to State welfare. She noted that almost all the chairs of geology in State universities were filled by mineralogists and petrologists, and that their courses concentrated on the ‘hard rock’ aspects of the subject. As a result, the coal, petroleum and gas industries were denied local graduates to join their workforces. Consequently she attempted to discover the areas in which an immediate input of specialist knowledge would add to soft-rock resource development. She undertook work for fifteen oil companies, exploring in regions where the geology was poorly known. Her knowledge of coral palaeontology enabled her to provide an outline of the stratigraphy from collections made by field geologists who needed to understand the broad geological relationships. One cannot point to the discovery of oil as the result of these investigations by Hill, but her contribution was made in an attempt to outline general structures on which further developments could take place.

It is interesting to read that in 1939 and the early 1940s she was in contact with the Chief Government Geologist of Queensland, asking that the collections of the Survey should be placed in a secure environment during the war. The information put together by many geologists should be accurately localized and held in useful form, even though access might be difficult. She also made herself available to study collections made by field workers in Central and Northern Queensland. In particular, also in 1939-40, she did work for Shell Petroleum, which was undertaking preliminary mapping and drilling work in the Permian of Central Queensland. Reading some of her identifications of fossils makes one realize just how little was known about faunas at that stage. This lack of knowledge made it clear to her that she would soon have to get postgraduate students working on faunas that came from the abundant Late Palaeozoic rocks. It was the common view that these rocks were the most likely to produce coal, oil and gas.

This work enabled her to see just where the major contributions to Queensland geology could be made. She also temporarily gave up her main work on Palaeozoic corals to do some original work on Permian faunas, particularly on those from Cracow, a mining town on the eastern side of the economically rich Bowen Basin (6). She quickly identified the gaps in what was known, and was able to guide students in the right direction. The Late Palaeozoic palaeontology of Queensland had not been studied in any detail since the work of Jack & Etheridge (1892), and Hill's observations showed that there was an enormous amount of work to be done. It is therefore interesting to see that her work for oil companies was not just a matter of specific identifications. Rather, she used her personal knowledge to equate a fauna at one locality with that at another. Correlations were based on her own experience, and it was this information that the companies wanted to have, even though she made no money out of this exercise. The receipts for her work make fascinating reading at the present time when consultants charge as much for an hour's work as she did for work that took months to complete. Her main object was to learn where the best problems were for her students. We are amazed at how much work she did for companies as part of her general work, because she must have been almost fully exercised by the teaching and administrative work that she did in the university. A letter from one of her English colleagues mentioned that she had heard from Dr Deighton Thomas that 'Dorothy had abandoned corals to work on Permo-Carboniferous faunas'. This gives a good indication of where her interests lay at that time.
PALAEOONTOLOGICAL RESEARCH AND APPLICATIONS AFTER THE WAR

We have previously given an account of how her work progressed until she joined the WRANS. After demobilization she concentrated on the preparation of the coelenterate volume for the Treatise on invertebrate paleontology, which was finally published in 1956.

After the discovery of archaeocyathid faunas in Antarctica, she began studying them with the use of the methods that she had evolved for understanding sections of corals. She attempted to reconstruct their skeletons in three dimensions and to make models of the skeletons of these animals. Most of the current literature on this group was in the Russian language. She learned enough Russian to assimilate this work and to develop an understanding of how the Russians viewed this enigmatic group of fossils. One of the highlights of her study of the Archaeocyatha was her examination of the material discovered by the Trans-Antarctic Expedition. One of the members of this expedition was Dr Jon Stephenson, one of her former students in Queensland. The study of this material produced a memoir of significance. After publishing a few smaller papers and reviewing the whole group in Biological Reviews in 1964 (8), she was asked to write the Treatise volume on Archaeocyatha, which appeared in 1972 (10). She is the only person to have produced quite separate volumes on different fossil groups for the Treatise, and one of these groups is treated in two volumes. Her work for the Treatise is outstanding because it set the standard for studies in the group for decades.

While immersed in this work, Hill took on the responsibility for visiting the field survey teams of the Queensland Geological Survey and the Bureau of Mineral Resources. In doing this she gleaned a first-hand knowledge of areas that had until then been unmapped, and she was able to help workers in the field with on-the-spot identifications. This activity supported her other main research interest, which was to put together a Geology of Queensland accompanied by a 'one inch = 40 miles' map of the State. In association with A.K. Denmead she edited the State Geology published by the Geological Society of Australia in 1960 (7). This found favour with working geologists and it was widely used by exploration companies. She still maintained her habit of keeping her record of geology up to date as it was done, and her series of maps was a remarkable endeavour wonderful to behold.

Subsequent to this she returned to the study of corals and, because of her now senior position in the university, she was given the money to appoint a research assistant, Dr John Jell. She also attracted a number of graduate students who began studying newly discovered coral faunas as well as Late Palaeozoic brachiopods. These students penetrated the market for palaeontologists throughout the country and had a pronounced effect on the economic and educational work done in Australia.

IMPORTANCE OF COLLECTIONS

Workers in the biological sciences know well the paramount importance of maintaining collections of specimens that stand as the reference points for future developments in that field. Scientists who are engaged in physical measurements of static objects fail to see the importance of such collections, and in some instances the collections have been destroyed because they occupy valuable space. Professor Richards understood the need to maintain such material; even in the early days of the Department he set up a small storage for
specimens that had been studied. A standard reference collection of fossils is absolutely necessary for further research. Dorothy Hill began to build up fossil specimens from Australian localities as well as others from the type localities overseas. Where she could not find a specimen from the type localities, she would obtain a thin section of a specimen that would serve as a basis for the comparison of Australian faunas.

In her reports on her activities to the CSIR in the first years after returning from Cambridge, one can see just how important the type collection was to her as she began to put together her first attempts at the Australian faunal sequence. The report for 20 October 1941 lists:

- Total Coelenterate slides in department = 2,157
- Total Coelenterate slides made by Hill = 1,002.

After the war, Hill convinced Professor Walter Bryan that the Geology Department should develop the collection more extensively and have it curated by a person specially appointed to do the job. This was particularly important because her honours and postgraduate students were bringing in collections that had to be curated so as to provide a basis for later work. Thus began the large collection that has proved of great value to workers within Australia and from overseas. A Keeper of Collections was appointed, and he and Hill built up the collection, largely based on work done by the staff of the department and the large number of graduate students they attracted. The specimens were catalogued with the use of the system that Hill had found useful in both the British Museum (Natural History) and the Sedgwick Museum.

Her respect for the importance of type material is shown up by her work for the *Treatise on invertebrate paleontology*. Wherever possible, she described and illustrated primary type specimens from the type locality. This prevented any attempt to reinterpret the taxa in terms of extraneous material, and her pattern has now been used by other authors.

**Undergraduate Teaching**

Hill was meticulous in preparing lectures and practical classes for students. Looking back from the present period, one can see how the presentation of morphological palaeontological and stratigraphic data was the controlling factor in her work. Most of her research was based on detailed stratigraphy, and because most of the early work was done on European sequences she encouraged students to investigate classical European sections. To do this she required an investigation into their sedimentary patterns and facies. Her lectures gave little attention to biological function, to genetics, to relationships between organisms, to evolution, or to biogeography, but rather addressed the Australian stratigraphy and the solution of problems by the interpretation of fossils. This was to some extent unfortunate because students with an inclination for biology were not attracted to courses that they regarded as orientated entirely to geology, and as a result the Geology Department lost some promising students. However, she was particularly successful in educating students to undertake work on the broad geological structure of the State. Both authors have friends who, undertaking work with a company as their first jobs, found that the undergraduate work that they had done provided a sound basis for stratigraphic mapping. The results of these efforts were strikingly good and provided much information for the companies or the State Surveys, as well as providing interesting topics for further research work.
Hill’s method of supervising honours students was unique. She did not give any lectures but provided intense personal supervision of journal reading, practical work and field results. Each student was visited each day for discussions of problems, new ideas were developed, and new literature was introduced. To introduce students to members of staff in other departments, she successfully arranged for visits to discuss problems in their special areas.

In other respects she continued to emphasize the importance of sedimentation and facies in her lectures. Fossils recorded one aspect of a system of sedimentation that produced a variety of facies, and the whole system of facies had to be considered if one were to achieve a historical analysis of the region. This approach was of significance to Australian students, who were working in sequences so different from those found elsewhere. For example, the Gondwana Carboniferous and Permian are grossly different from those of Europe and Russia, yet the problems of correlation with those type areas were foremost in the minds of the students. On the one hand, Hill emphasized the importance of being broad in the understanding of a problem; on the other, she also kept stressing the need to be fully competent in the understanding of detailed aspects of the whole system.

Her work for students and colleagues can be seen from the fact that they published three symposia held in her honour. They were edited by Campbell (1969), Denmead et al. (1974) and Roberts & Jell (1983).

**Great Barrier Reef Committee**

As one would expect, Hill was closely concerned with the scientific study of the Great Barrier Reef. The Geology Department was already heavily involved, because Professor Richards was one of those who had initiated the systematic study of the Reef. One of his main concerns was to understand its origin and history, and he saw that the initial study should be undertaken by studying three transects, one in the north, one at the latitude of Townsville, and one off Gladstone. A new committee was set up under the guidance of the Royal Geographical Society of Australia (Queensland Branch), largely because the then Governor of Queensland, Sir Matthew Nathan, who was very interested in that Society, agreed to be the President. Vice-Regal support for the new group was significant in view of the lack of money for research. The extent of the financial problem can be seen in that after three years of working to raise money, only £5318 was in hand.

Survey ships had occasionally been used to provide a base for making elementary geological observations and for the collection of zoological samples. The first serious attempt to gain new kinds of data came with the Michaelmas Reef boring in 1926. Then, largely as the result of British work, the Great Barrier Reef Expedition in 1926–29 (the Yonge Expedition) took place on Low Isles. This study had occurred when Hill was an undergraduate and it had made a deep impression on her. The onset of the Great Depression in 1929 did nothing to support the Committee, but by 1937 enough money had been raised to drill the Heron Island bore. The coincidence of this with Hill’s return from her PhD studies in England was also fortunate, as she was the appropriate person to study the core in association with Richards (4).

The site of the bore was significant for further development of reef studies. Professor E.J. Goddard, of the University of Queensland Zoology Department, tried to activate the Committee to develop a Great Barrier Reef Committee Marine Biological Station, but he...
died on Heron Island before the project was accepted. While Dorothy Hill was the third Secretary of the Committee, from 1945 to 1955, she also actively supported direct research work, and great efforts were made to establish a small shelter on Heron Island for students and research workers. This involved raising industry money, transporting materials by government supply ships, using vast amounts of personal work on carpentry, providing items such as a water storage tanks, and volunteer efforts during holidays on site in the island. By the end of 1952, 'the Committee had on the island a building that could be used by visiting scientists or students, or for stores for the subsequent buildings'. She put a great deal of effort into seeking a major grant to develop a larger research site on the island, and grants from the Rockefeller Foundation and the Australian Research Grants Committee eventually made it possible to build adequate accommodation for visiting scientists and students and also to improve the laboratory facilities.

After completing her term in office, Hill was active in developing a continuing geological, taxonomic and ecological understanding of the reef. She was a member of the committee, chaired by Dr M.H.C. Day, that investigated the setting up of an Australian Institute of Marine Sciences in Townsville. In 1975, a statutory body, the Great Barrier Reef Marine Park Authority (GBRMPA), was set up by the Commonwealth Government to administer reef affairs. By this time Hill had retired from her university post, and she was not involved significantly with the GBRMPA. However, she had let her views on the conservation and management be known widely, particularly in relation to the drilling of deep holes on the reef. Following Richards, she took the view that little would be known of the early history of the reef unless sedimentary cores were taken from its base. She pointed out that reefs had been mauled by natural causes and their capacity to regenerate was obvious. In the Quaternary the sea level had varied by more than 100 m, causing damage beyond anything that the crown-of-thorns starfish and the collecting of molluscs could produce. Unlike some biologists, who thought that regeneration would not occur after damage, she stood by the empirical geological evidence that regeneration was common. What is more, she held that the reef was in no danger of being destroyed by current practice. Having taken this stand, she was out of favour with many fellow scientists, particularly biologists. She incurred the wrath of students who had no historical understanding of the reef processes nor of the way in which sea levels had changed during the Quaternary.

One of the highlights of Hill's commitment to the Great Barrier Reef was the appointment of Dr W.G.H. Maxwell to a lecturing position in the Geology Department. His research was on the history of the reef and sedimentation on it, and he attracted many students to study the sedimentary and biological processes operating on the reef at present. Many fine papers were produced by this research group. Finally, Maxwell published a well-reviewed paper on the structure and development of the Great Barrier Reef in the volume of essays Stratigraphy and palaeontology in honour of Dorothy Hill (1969). This set the outline for his definitive work, a book entitled Atlas of the Great Barrier Reef. These studies outlined the history, sedimentation and biology of the reef as they were then known, and it gave great pleasure to Hill to see the work advanced to a level at which it could be summarized and presented to the rest of the scientific world.

Her long final illness prevented Hill from seeing the results of the work of the Bureau of Mineral Resources on the geological evolution of the Great Barrier Reef. Much of this was done by seismic sections and bottom sampling, and more recently by drilling on the outer barrier and by work in the deeper water by the Ocean Drilling Program. This has shown that
the reef is much younger than expected. As Hill noted in her papers in *Historical Records of Australian Science* (14,15), Professor H.C. Richards had indicated that one of the main reasons for setting up the Great Barrier Reef Committee was to discover information on the origin of the reef; she would be pleased to see the current work coming to a conclusion.

Dorothy Hill wrote a summary article (9) on the Great Barrier Reef in the volume that the Australian Academy of Science published on *Captain Cook, navigator and scientist*, edited by G.M. Badger. The history of the Committee was written by Hill in two articles (14,15). She treated her own work in a modest way, but it is significant that those who worked with her claim that her drive and enthusiasm as Secretary of the Committee played the vital role in establishing the research base at Heron Island. Without the establishment of that base, the work on the reef would have been much inhibited.

### Palaeontological Association of Australasia

In Hill's view, one of the main functions of teaching palaeontology was to encourage field workers to make good collections of the fossils that they encountered, and to equip them to make first attempts at an identification of species and an estimation of geological age. Her own students were made well aware of this in their practical work, and at least some of them were able to improve their mapping by several orders of magnitude as a result of this training. To improve their performance further, she organized the Queensland Palaeontographical Society with the specific purpose of illustrating the main fossils from the stratigraphic periods in the State. This was done by asking researchers who were familiar with each period to list and photograph significant species and to indicate their stratigraphic ranges. A separate booklet was produced for each geological period, and booklets were made available through the society or through the museums. A range of people, including amateurs, became more interested in palaeontology, and a considerable sum of money accrued.

In 1968, specialist groups of the Geological Society of Australia began to appear. One of these was the Specialist Group in Palaeontology and Biostratigraphy. After a few years it became apparent that colleagues in New Zealand would welcome closer contacts with Australian palaeontologists. By this time, the main purpose of the Queensland Society had been achieved in its publications and its committee began negotiations with the Specialist Group, asking that a new and wider-ranging society should be formed. The wisdom of this proposal was accepted by most members, and the Association of Australasian Palaeontologists was formed. The funds from the Queensland Society were used to found the Association, and Dorothy Hill made a significant personal gift to support it.

One of the Association's objects was to publish a journal, now known as *Alcheringa*. The policy of the journal was to publish material of local and international interest from authors of any nationality. In doing this it fulfilled Dorothy Hill's aim of making Australian publications good enough to serve the world's needs. At present, 21 volumes of *Alcheringa* have appeared. In addition, there had long been a need for monographic memoirs for the publication of larger works, such as studies of faunas of significance, or of major groups of organisms. Twenty volumes of the Association's *Memoirs* have now appeared. Hill's students and colleagues have maintained the publication of these works.
GEOLOGICAL INTERESTS OUTSIDE PALAEOLOGY

Hill had a concern to develop a geological history of Queensland as a major part of her contribution to geology. In particular, she wished to outline the stratigraphic and igneous histories, so as to provide a database for a tectonic record of Queensland. Some of this work was extended to other States. Her basic knowledge was of immense value in this, much of it having evolved from her work with field parties of the State Geological Survey and the Bureau of Mineral Resources. In at least some of this we can see the importance of her friendly cooperation with A.K. Denmead and N.H. Fischer, the respective directors of these institutions. Discussions with field workers attest to the strong influence that she had on the various field parties. Not only did she allow them to get a better control on the stratigraphic order in their mapping, she encouraged them to appreciate the value of their work for the understanding of the evolution of the continent.

Despite these interests in Australian geology, she did not keep up with wider tectonic advances of the late 1960s and 1970s. Unlike many other Gondwana geologists, she did not grasp the many features of the southern continents that implied continental movement. On the contrary, she did not accept that the mechanism for continental movement had been adequately explained—a view perhaps inherited from contacts with geophysicists in her Cambridge days—and she still used local conditions to explain the distribution of corals and many Gondwana features such as the Late Palaeozoic glacial deposits. As a result, she was not able to apply the results of global tectonics to her field and to palaeontological observations. This was very unfortunate because she was therefore unable to see how her work on Australian continental structure and the distribution of fossil faunas could be interpreted in terms of a general tectonic theory. Her study of Queensland geological structure and her understanding of sedimentary basin relationships were well in advance of their time. However, her interpretation of their tectonic meanings remained in terms of 1940–50 global ideas. Even in discussion she could never conceive of the possibility of global tectonics being of value.

PUBLICATIONS

When Hill returned from Cambridge, she was depressed to find that many local scientists saw overseas publication as the best way of establishing a career in science. Certainly, some aspects of Australian phenomena would best be published in Australian journals, simply because these studies had such a unique flavour that their conclusions could not be generally applied overseas. This included many geological, botanical, zoological and ecological investigations that were of immense interest to Australians. This was an example of local culture’s being debased for no good reason, yet many people considered that Australian publication indicated that the work was not of world class. The same kind of attitude is still present in that when scientists are asked to list the main publications in their field for formal assessment, higher ranking is placed on international journals because they are perceived as having wider exposure among scientists. Hill considered that Australia should build up local publications that would give opportunities for work of major significance to be published locally. As a result of this approach, a large part of her work on Palaeozoic corals was published by the Royal Societies of Queensland, New South Wales, Tasmania, Victoria, and
Western Australia, and by the Linnean Society of New South Wales. Her attitude was that if the work was of high standard it would attract attention. She was also impressed with the idea that many publications required extensive illustrations and that these would not be available in overseas journals. Such work should be published locally in the Museum Bulletins. In adopting this attitude she was correct, because her own work, published locally, was taken up by overseas workers.

This attitude led Hill to be a strong supporter of the *Journal of the Geological Society of Australia*, and she was its Editor from 1958 to 1964. Within the University of Queensland, she strongly supported the efforts by Professor Richards to establish Departmental publications that were sometimes reprints of work published in local journals but that also included papers published in their own right by the University Press. Hill used these publications for exchange purposes with overseas research organizations in an effort to build up the local libraries, as well as to inform the wider world of what was going on in Queensland. This was very successful and it provided a large number of reprints in the departmental library. In opposition to the views of librarians, she had local publications bound into a series of volumes on a variety of topics.

As indicated above, one of the greatest benefits of Hill’s PhD studies in England was her discovery of the value of a major library. When she returned to Queensland she had collected a large stock of reprints that enabled her to continue research, but she still found the university totally lax in its attention to its library: ‘the Senate thought that the Library was a shelf with a few books upon it. It was fatherless until Harrison Bryan and Greenwood got together.’ This was in the early 1950s. Bryan, the then University Librarian, was the son of Professor W.H. Bryan, Head of the Geology Department, and he no doubt saw at first hand the advantage of Hill’s interest in the Library. She accepted the opportunity to assist in developing the library for the benefits of all students and researchers, and gave a great deal of her time, money and administrative persuasion to build it up to its present high standard.

The Geology Department housed the Dorothy Hill Geology Library of the University, and it was staffed from the main library. Recently the university decided to house it with the other science and engineering libraries; the whole collection is now known as the Dorothy Hill Physical Sciences and Engineering Library. Although her name is preserved, she would not have been pleased to know that the library, on which she expended so much of her own effort and planning, has now been removed from the Geology Department.

**UNIVERSITY ADMINISTRATION**

Hill was President of the Professorial Board of the University of Queensland in 1971–92. This was a difficult period for university administrations. First, many reluctant students were being enrolled for military service in Vietnam. This produced some violent activity on campus, some of which Hill had to face personally. Then there were members of staff who felt that formal university education required a new stimulus. Many meetings of staff and students took place, some of which were noisy and out of control. The formal structure of teaching and research was under attack by people who thought that the university should have a more open approach to learning. Much of this activity came from the Arts Faculty, but it took no account of the problems associated with teaching in science-based courses, much of which depended on formal practical classes.
With her views on teaching and research clearly defined, and with her approach of involving students in research efforts as soon as possible, Hill found difficulty in understanding what the protesters wanted. She also noted a strong feeling of anti-semitism on campus, and having been involved in a war that people had hoped would destroy such attitudes, she felt deeply depressed. She could never have found the work of administration enjoyable under these circumstances. Colleagues report that she claimed that, as with research, she required a concise account of the nature of the problems, a collection of information from whatever sources were available, a hypothesis for solution to be derived, a testing of the hypothesis, and a final solution as she saw it. She feared that mistakes would be made, but she also knew that Administration had to make decisions or an uncontrollable situation would develop. Finally, she felt that all decisions could be reviewed in the light of subsequent experience.

The transparency of her attitude to the difficulties of that time were much valued by the majority of staff, and the Staff Association sent her formal thanks for her work. We have no doubt that dealing with ships’ captains during the war equipped her well for the task she performed.

**After Retirement**

On retirement from her chair, Hill had many aspects of work to continue. In particular, together with John Jell, she had several postgraduate students from Australia and overseas who were working on Palaeozoic corals of Australia. This work was of great importance to her because she thought that, with the development of new techniques for stratigraphic correlation, the fundamental use of macrofossils was being forgotten. Among these students were nationals from China, Mianmar, the USA and Australia.

She also felt that now was the time to put on paper the histories of some of the organizations and subjects in which she had worked. The first of these projects was her bibliography and index of Australian Palaeozoic corals, which was published by the University of Queensland Press (12). As indicated above, she had previously published a chapter on Captain James Cook and the Great Barrier Reef, in the Academy of Science volume. This alerted her to the fact that the history of the Great Barrier Reef Committee had not been properly recorded and that much of the early work done by this committee was in danger of being lost. She expended much effort in researching the records and added her own personal knowledge to the study. This will remain a most valuable resource for future historians.

In 1981 she published a history of the Geology Department during its first fifty years (13). For those who came later, this is a remarkable outline of the development of a department in a newly formed university, and how it lived through the Great Depression and the two World Wars. Those who were not involved with the organization learnt of the impact of Professor Richards on the department and the university, the State Geological Surveys, the teaching programmes in the secondary schools, and other scientific exercises in the Commonwealth. Hill left no doubt that wider aspects of the scientific life of Queensland had been extended by the development of the Geology Department.

For about fifteen years after she retired she came daily to the university to work. She walked to and from home every day, trying to keep herself in good shape. Her friends from
the staff ensured that her household was well supplied with daily needs. However, she had a fall that caused her to be hospitalized. After a long period of recovery she had an occasional loss of memory and ceased to come into the department. Subsequently her health declined further, and she suffered a final stroke.

Dorothy Hill never married. The Hill family were well bonded and supportive of one another. For the last four decades of Dorothy's life she and her sister Edna shared a house in Taringa, Edna suffering from a heart disease that required continual medical support. Dorothy took responsibility for caring for her. Nephews and nieces, whose families lived in the country, lived with their two aunts in Brisbane while they attended secondary school. Family responsibilities of this kind were accepted by Dorothy as part of the normal run of life until well after her retirement from the university.

**ACADEMIC AND CIVIL RECOGNITION**

Recognition of Hill's research within Australia and overseas allowed her to assume a leadership role within the university community in Queensland. Professor Thomis, in his assessment of the graduates of the university, considered Dorothy Hill to be the most outstanding of them all. Subsequently he noted that the award of the Nobel Prize to Professor Peter Doherty (F.R.S. 1987) would require him to rethink that comment. However, he noted that Hill's performance remained outstanding in that she led the university from the front during her whole time on its staff. Not only was she academically distinguished, she also took a leading role in its administration and development.

In 1956 Dorothy Hill was elected a Fellow of the Australian Academy of Science (AAS). She spent time serving on Academy committees, becoming Vice-President of the AAS in 1969, and on the death of Dr D.F. Martyn in 1970 she became President. She is the only woman to have occupied the position of President of the Academy. She did not seek re-election for a full term because she was President-elect of the Professorial Board in Queensland. In addition she did not like travelling to and from Canberra for meetings, and she felt that travelling inside and outside the country on Academy business would mean that she could not give sufficient attention to academic problems and to family support in Brisbane.

She was elected a Fellow of the Royal Society in 1965. She was only the second person on the University of Queensland staff to be so elected, the previous one being Professor B.D. Steele, the first Professor of Chemistry. She had a high regard for Steele when she was a student, and commented that he was 'an Olympian character' in the university during the early days. In addition, he saw eye to eye with Professor Richards in his views of what the university was all about. She saw her election to the Royal Society as a major step in continuing the work of Steele and Richards in establishing the University of Queensland as a place for research.

In addition to these achievements, Hill won the Daniel Pidgeon Fund and the Lyell Medal, and was made a Commonwealth Fellow of the Geological Society of London. She was awarded the Clarke Medal by the Royal Society of New South Wales, and received the Mueller Medal and the ANZAS Medal by ANZAS. She was awarded the W.R. Browne Medal and was an Honorary Member and subsequently President of the Geological Society of Australia. She received the civil honours of a C.B.E. for services to geology and
Biographical Memoirs

Dorothy Hill made a broad contribution to science in Australia at a time when both university and government science were in need of considerable improvement, and the benefits of research were not widely appreciated among university administrators. She discovered the use of fossil corals in sorting out the correlations of Palaeozoic rocks in Australia, took advantage of the vicinity of the Great Barrier Reef for research, expanded the knowledge of stratigraphy of eastern Australia, and used this newly available information for a revitalized interpretation of continental geology. In doing this she gave great support to field workers and students in their studies, and to the exploration companies working on the coal, oil, and economic sedimentary rocks of Queensland. Finally, she set standards for the preparation of large volumes such as those in the *Treatise on invertebrate paleontology*, which were her major contributions to the study of corals.

Dorothy Hill died on 23 April 1997. She never sought publicity for her work, nor did she seek to make an impact on the wider politics of the country. In this respect she did not attract national interest. In her adult life she was never a person for social activity, nor was she out to draw attention to her field of interest through her contribution to the industrial outcome of her work, although this was considerable. Throughout her later life she bore the stamp of having reached adulthood during the economic depression of the late 1920s and 1930s. She always attempted to get full value for any investment of time or money into a project. She wasted nothing. In the latter half of her life she was concerned with supporting her nephews and nieces and her siblings, rather than seeking recognition for her work.

As a result of these attitudes, she was not widely known to most Australians, although she contributed much more than many whose names are a byword. In her own right, she was known as an active sports person, a strong leader in academe, a powerful supporter of women's educational rights, a keeper of intellectual truth as she saw it, a maintainer of academic merit, and a member of her nation's armed forces. She took part in the education of a large number of students who supported her efforts to advance geology. These former students can be found in all aspects of the profession: scientific research, teaching, administration and economic geology. The extent to which she was valued is shown by the fact that three honorific volumes were published by her students in 1969, 1974 and 1983. To her colleagues she offered strong personal support and profound intellectual and lively criticism as required. For all these reasons she was an outstanding contributor to national life; she will be remembered by those with whom she worked as an outstanding contributor to Australia’s welfare. To her, that would have been the ultimate accolade.

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The frontispiece portrait was taken by the Australian Academy of Science. Figures 1 and 2 are from the John Jell Collection.

References to Other Authors


Bibliography

The following publications are those referred to directly in the text. A full bibliography appears on the accompanying microfiche, numbered as in the second column. A photocopy is available from the Royal Society Library at cost.