Memoirs of the National Museum of Victoria 18 May 1970

https://doi.org/10.24199/j.mmv.1970.31.01

GROWTH OF THE MINERAL, ROCK, METEORITE AND TEKTITE COLLECTIONS IN THE NATIONAL MUSEUM OF VICTORIA

By A. W. Beasley
Curator of Minerals, National Museum of Victoria

Abstract

The rate of growth of the Collections has varied considerably during different periods since the Museum was founded 115 years ago. Growth was rapid during the period when the first Director, Professor McCoy, made numerous purchases of overseas minerals and rocks. When there was no full-time Curator of the Collections, and during periods when there was no Curator, the rate of growth was generally slow and erratic. The Collections began to increase markedly in size and importance following the appointment of a full-time Curator in 1946, and this increase has been maintained to the present time. Beneficial results also followed the appointment of Honorary Associates in Mineralogy, and through them many hundreds of specimens have been donated. During the past 115 years large numbers of specimens have been amassed, and the collection of overseas minerals and rocks is the most extensive in an Australian museum.

Much information is recorded for the first time, and references are given to publications associated with this historical research. As the Collections of minerals, rocks, meteorites and tektites have grown they have been arranged more systematically, and greater use has been made of them by the general public, students and research workers. This increase in use of the Collections is continuing and may be related to greater interest, particularly in economic geology, planetary science, gemmology and lapidary.

Introduction

During the past 19 years the author has gained a close knowledge of and witnessed considerable growth in the mineral, rock, meteorite and tektite collections under his curatorship at the National Museum of Victoria. This paper places on record information concerning this growth together with that during the preceding 96 years. The history of the first hundred years of the Museum has been recorded by Pescott (1954), but no specific research into the growth of any of the departmental collections has previously been recorded. Registers, catalogues, lists and correspondence dating back to the very early days of the Museum have been examined.

The geological collections have been built up through the years in various ways. The nucleus came from purchases, but considerable additions came through donations from individuals and mining companies. The collections have also been augmented by exchanging duplicate materials with organizations and private collectors. Additions have been made by Museum staff members collecting specimens on official field excursions and on other occasions.

Foundations—1854 to 1870

The foundations of the present extensive collections were laid through the efforts of Professor Frederick McCoy, who was appointed Director of the National Museum in 1858. Prior to his appointment, and following the establishment of the Museum in 1854, a small collection of minerals and rocks had been assembled mainly through the efforts of Captain Andrew Clarke, Surveyor-General of Victoria, and Mr William Blandowski, the first official appointee to the Museum staff. Most of the specimens were of local origin and many were of economic significance, as in the early colonial days there was a natural emphasis on useful materials.

Professor McCoy was the Professor of Natural Science at the University of Melbourne and Palaeontologist of the Geological Survey of Victoria, as well as

being Director of the Museum. He was largely responsible for having the Museum located in the University grounds from 1856 to 1899. McCoy had formerly been Professor of Geology and Mineralogy in Belfast, and he was particularly interested in geology. He built up the collections mainly through purchases from the German dealer, Dr August Krantz of Bonn. Purchases of minerals, rocks and meteorites from Krantz were made mainly between 1858 and 1868. In 1858 a collection of 4,000 mineral specimens was purchased from Krantz for £200. The hand-written lists of these specimens are still used by the Mineralogy staff to check information. In 1860 a collection of 1,000 rock specimens was bought from the same dealer for £54. Almost all of the rock specimens had been trimmed to a size approximately 3 inches x 4 inches x 1 inch, which facilitated their storage in cabinets as cardboard tray dimensions could be standardized; it also helped in the arrangement of attractive displays, particularly those of a systematic nature. This rock collection contained a wide range of types from many different overseas localities. Fortunately, the Krantz numbers, printed on a small rectangular-shaped piece of paper glued near a corner of the specimen, have not been removed from the rocks and minerals.

Other purchases made from Krantz were for smaller numbers of specimens. In 1858 a collection of 324 cut and polished minerals and rocks (agate, serpentine, marble, etc.) and 60 'choice' mineral specimens were bought. The first meteorites in the Museum collection were purchased during 1859 in a collection which contained 42 specimens of polished carnelian, sardonyx and onyx. Two pieces of the Toluca meteorite (weighing 1 lb. 10¼ oz. and 1 lb. 3¼ oz.) from Mexico cost £7 7s. 0d. and £5 11s. 0d., while 24 small pieces of the Ilimaes meteorite from Chile cost only £1 11s. 0d. Most of the overseas meteorite specimens now in the Museum collection were purchased from Krantz. Further purchases made during 1860 consisted of 293 specimens of minerals and rocks (including ornamental stones), 110 mineral and rock specimens mainly from German localities, and 63 mineral specimens. Thirty mineral specimens of 'large size' were bought from Krantz for £30 in 1861, as well as a collection of 181 minerals which included many from Norway. The series of purchases continued in 1862 when 153 mineral specimens were purchased for £105 10s. 0d. and a set of rare economic minerals was bought for £30. During 1863 a collection of 80 mineral specimens was purchased and in 1864 some 154 rocks and 46 minerals were bought. The cost of the rock specimens was one shilling each. Ordering at about that time was starting to decrease, but 74 mineral specimens and two meteorites were bought in 1866; one of these was a 10¼ lb. piece of the Toluca meteorite (price £15) and the other a polished slice of the Verkine meteorite from Siberia. In 1868 specimens of several stony meteorites including the Pultusk meteorite from Poland and the Knyahinya meteorite from Czechoslovakia were purchased together with 62 mineral specimens.

The collections of overseas minerals and rocks purchased from Dr Krantz are particularly comprehensive and almost all of the specimens are of high quality. Many of the large attractive specimens are at present displayed in the Mineral Gallery. Special mention may be made of the beautiful polished agates from South America and India, the crystallized hematite from the Island of Elba and the outstanding manganite specimens from the Harz Mountains, Germany. These specimens are now worth many hundreds of dollars. As well as providing much material for Museum display, the Krantz collections have proved very useful for reference purposes, as they contain rare minerals and rocks, and specimens from type localities. In many cases it would be difficult or impossible to collect similar specimens now due to political barriers and because many localities have been worked out or are inaccessible. After reading the numerous hand-written letters from Dr

Krantz to Professor McCoy, it is clear that the Museum owes much to these men for its fine geological collection. Krantz's prices appear to be reasonable by present-day standards. It is apparent that McCoy kept on ordering collections although the Museum did not have the money to pay for them at the time. In many of Krantz's letters courteous requests are made for overdue payments, and there were some lengthy delays in the settlement of accounts.

In 1856 the Museum acquired a 1½ ton meteorite, known as the Cranbourne No. 2 meteorite, largely through the efforts of McCoy. This meteorite had been found several years previously about 2 miles E. of Cranbourne, Victoria, and had subsequently been despatched to the British Museum in London. The history of this meteorite following its discovery and prior to the time of its arrival at the National Museum has been described by Walcott (1915). It is the largest meteorite in the Museum collection and there is no larger meteorite in any other collection in E. Australia. Unfortunately, McCoy's endeavours to secure the Cranbourne No. 1 meteorite (3½ tons), found 3½ miles S. of Cranbourne, were unsuccessful; it was sent to the British Museum in 1865.

The Geological Survey of Victoria was closely associated with the National Museum in its early days. The Geological Survey Laboratory was housed in a room adjacent to the Museum in the University grounds, and specimens collected by Geological Survey officers were placed in the National Museum collection. Ulrich, one of the Geological Survey staff, made use of the specimens in the Museum collection in describing the mineral species of Victoria in an Intercolonial Exhibition Essay (Selwyn and Ulrich 1867). This was published as part of the Official Record of the Intercolonial Exhibition of Australasia held in Melbourne during 1866 and 1867. In 1868 'A Descriptive Catalogue of the Rock Specimens and Minerals in the National Museum collected by the Geological Survey of Victoria' was published. This was prepared by Selwyn, Director of the Geological Survey, and members of his staff, and listed specimens collected during the early geological mapping of the State—the work which produced the well-known quarter sheet series of maps. The rock specimens listed in the catalogue were transferred to the Geological Survey Museum at a later date, but the minerals (more than 250 specimens) as well as a number of australites were retained. It is interesting to note that the australites are listed as 'obsidian buttons' and an 'obsidian ball'. Although not recognized as such, they were the first australites in the Museum collection. In 1869 the Geological Survey of Victoria, a branch of the Mines Department, was terminated for economy reasons and the staff disbanded. Later it was re-established, but again in 1878 it was suspended. It is fortunate that many specimens collected by Geological Survey officers in those early days were lodged in the National Museum collection, for there could have been danger of specimens being lost during periods of suspension.

A 6½ lb. bluish-green, waterworn topaz was donated to the Museum in the late sixties. This specimen, portion of a very large crystal, had been found at a depth of 60 feet during alluvial mining in the Cooyal Creek area near Mudgee, N.S.W. Liversidge (1875, p. 203) and also Chalmers (1967) have referred to this outstanding topaz specimen.

It was not many years before Professor McCoy was experiencing considerable difficulty in finding space adequate to display and store the growing collections in the Museum. In making a request to the Government for the provision of more space, he indicated that he was unable to properly display specimens in the very important branch of economic geology. Space shortage gradually became worse, and in 1870 the mineral and rock collections were temporarily transferred to the newly formed Industrial and Technological Museum (now called the Institute of Applied Science of Victoria).

The Period 1870 to 1899

The Industrial and Technological Museum was opened in the Public Library building on 8 September 1870, with an inaugural lecture by Professor McCoy who had been one of the Commissioners recommending its establishment. For the next 29 years the National Museum mineral and rock collections were under the care of Industrial and Technological Museum staff which included Mr J. Cosmo Newbery, Mr (later Professor) G. H. F. Ulrich, Mr O. R. Rule and Mr R. H. Walcott. During this period there was a steady growth in the collections through donations and purchases.

Ulrich (1870) described certain specimens in the Museum collection in his 'Contributions to the Mineralogy of Victoria', and gave further information about maldonite, the new mineral species that he had named and described from Maldon, Victoria (Ulrich 1869).

An early acquisition was a collection of 275 rocks bought from Ward and Howell, dealers of Rochester, New York, U.S.A. The collection consisted largely of rocks from U.S.A., but also contained some fine specimens of 'landscape' marble from England as well as rock specimens from Germany and other foreign countries.

In 1886 an 18 cwt. nickel-iron meteorite was donated to the Museum by Mr A. H. Padley, following its discovery on his land about 5 miles SE. of Langwarrin railway station, Victoria. This meteorite became known as the Langwarrin meteorite and was later studied by Walcott (1915) and Edwards and Baker (1944) who recognized it as one of the Cranbourne meteorites, derived from the breaking up during flight of a single large mass of nickel-iron when close to the earth's surface.

In 1887 comprehensive collections of Italian rocks and minerals were acquired through the Mines Department of Victoria. It is interesting to note that the hand-written Catalogue which lists and describes each of 200 Italian rock specimens concludes with the word 'Amen'. The Italian collection of 100 minerals included many fine crystallized specimens from Sicily and Elba such as native sulphur, celestite, aragonite, hematite and pyrite. In August 1887, 800 minerals and 250 rocks from overseas localities, also belonging to the Mines Department, were transferred to the Museum. This was a particularly valuable acquisition; many of the specimens are rare and they come from localities widely scattered through the world. Most of these overseas specimens had come originally from the collection of the pioneer British mineralogist, Dr Thomas Thomson, but some came from Dr A. Krantz and other early collectors. At about the same time a representative collection of 50 mineral and rock specimens from Finland was acquired as well as suites of specimens from Borneo, Sumatra and other islands in the East Indian Archipelago. These came from the Geological Survey Departments of Borneo, Java, etc., and included rocks from Krakatoa, the volcano in Sunda Strait (between Sumatra and Java) which erupted with tremendous explosive violence in 1883.

In 1893 a collection of 300 mineral and rock specimens from Italy, France, Austria and Switzerland was purchased from Dr G. Jarvis of Turin, Italy. One hundred of these were volcanic rocks from Italy. A hand-written catalogue accompanying the collection gives a description of each specimen, precise locality information and data about the origin and uses of many of the rocks. This informative catalogue makes interesting reading, and is still used for checking and reference purposes.

In 1893 and the years immediately following, approximately 200 specimens of zeolite and secondary carbonate minerals from Victorian localities were donated to the Museum by Mr James Mitchell and Mr O. R. Rule who collected them from basalt quarries in Melbourne (Collingwood, Richmond and Footscray), as

well as from Phillip Island and near Flinders. The Melbourne basalt quarries are no longer accessible, and it is fortunate that the specimens were collected when the rock was being quarried.

A valuable donation came in 1895 from Mr A. E. Savage who presented a collection of minerals from Broken Hill, N.S.W., which contained fine specimens of cerussite, pyromorphite, smithsonite, embolite, stolzite and other secondary minerals from the oxidized zone of the silver-lead-zinc lode. This near-surface zone was soon worked out in mining operations, and such mineral specimens are now very rare.

At about this time use was made of the minerals in the Museum collection by Mr John A. Atkinson in compiling 'A Locality List of all the Minerals hitherto recorded from Victoria' (Atkinson 1896). This publication is a useful one, but its existence does not appear to be widely known.

In 1897 some fine crystal groups of crocoite (a rare lead chromate mineral) and cerussite from Dundas, Tasmania, and pyromorphite from Zeehan were donated by Mr James Mitchell, and a number of mineral specimens from overseas localities were purchased from Mitchell in 1897 and 1898. They included crystallized specimens of alexandrite, xenotime, descloizite, wulfenite, monazite, colemanite, boleite and other rare minerals. Mitchell was the Australian agent for Dr A. E. Foote, the mineral dealer of Philadelphia, U.S.A., and these minerals came originally from him. It is fortunate that they were purchased, as they include some particularly fine specimens and certain ones represent the only example of that mineral species in the Museum collection.

During the latter part of the nineteenth century, specimens of Victorian minerals and rocks were presented to the Museum from the Mines Department from time to time. Entries in old registers indicate that they came from the Mines Department Laboratory, and it is presumed that they include some of the interesting specimens submitted to the laboratory for identification and examination.

The Period 1899 to 1931

In 1899 Sir Frederick McCoy died and the Museum was moved from the University Grounds to the buildings occupied by the Public Library and the Industrial and Technological Museum in the city. Following this move the mineral and rock collections which had been housed in the Industrial and Technological Museum were transferred back to the National Museum, with Mr R. H. Walcott's part-time services. Walcott was designated Curator of the Geological and Ethnological Collections, a position he held on the National Museum staff until 1914. He made use of the Victorian mineral specimens in the Museum collection as well as the library facilities in compiling 'Additions and Corrections to the Census of Victorian Minerals' (Walcott 1900). This materially supplemented the list of Victorian minerals prepared by Atkinson (1896).

Professor Baldwin Spencer, the Museum Director from 1899 to 1928, was a noted biologist and anthropologist but was not greatly interested in geology. Nevertheless, during his term as Director there were some noteworthy acquisitions and the collections gradually increased in numbers and importance. Between 1900 and 1907 several purchases of outstanding and rare mineral specimens were made from James Mitchell, other individuals, and dealing firms. They included choice specimens from overseas countries as well as from Australian localities.

Unfortunately, on 10 January 1901, the Mineral Collection suffered a serious loss when the best gold specimens on display were stolen. This loss continued to be felt until the E. J. Dunn Collection of 625 gold specimens was purchased in 1948.

In 1905 a stony meteorite known as the Ellerslie meteorite was donated by

Mr Henry Crawford. This 22½ lb. meteorite had been found by Crawford five years previously on the Ellerslie Estate about 80 miles N. of Bourke, just across the Queensland border. A collection of gemstones and ornamental stones (both cut and uncut) was purchased from Mr E. Schafer of Melbourne in 1907. They were largely from Australian sources and included some beautiful cut tourmaline from Kangaroo Island, South Australia.

A giant crystal of selenite (a variety of gypsum) from the Mount Elliott Mine, S. of Cloncurry, Queensland, was received by donation in 1908 from the Directors of the Mine. This monoclinic crystal measures 30 inches in length and the crystal faces are 4½ inches wide. A crystal of this size is very rare indeed. Another outstanding donation made in 1908 was a large amethyst geode from Uruguay, South America. This magnificent specimen was presented by Mr L. F. Benjamin, a Melbourne jeweller, and has been admired by the public in the Mineral Gallery for many years. The first major purchase from an English dealer was made in 1908 when 70 mineral specimens from Great Britain and other European countries were bought from F. H. Butler of London.

An interesting collection of rocks from Antarctica obtained during the 'Discovery' National Antarctic Expedition in 1907 and 1908 was donated to the Museum in 1909. Two important purchases of minerals were also made in 1909. A collection of 100 minerals from overseas localities was purchased from Dr F. Krantz (a nephew of Dr A. Krantz) of Bonn, Germany, and a collection of 25 minerals was bought from the Foote Mineral Company of Philadelphia, U.S.A. Both collections contained rare species, and the prices for the individual specimens were quite reasonable, although £6 5s. 0d. was paid for a specimen of natrochalcite from Chile. Another purchase from Foote for a smaller number of specimens was made in 1910.

In 1911 a large block of magnetite containing 28 magnetite crystals was presented by the Chillagoe Railway and Mining Company. This oustanding specimen came from Mt. Lucy, S. of Chillagoe in North Queensland. Most of the crystals are dodecahedra and some are very large, ranging up to 5 inches in diameter. Two large and heavy specimens of ripple-marked sandstone (Grampians Group) were also donated in the same year. These specimens from near Woorndoo, Western Victoria, exhibit natural casts of ripples made by current action on the bottom of an extensive lake about 325 million years ago. Measuring approximately 4 feet × 2 feet × 5 inches each, one can imagine the difficulties experienced in bringing them to Melbourne.

The last purchase of specimens from Dr F. Krantz was made in 1912 when 95 rock specimens were bought, most of which were rare rock types not previously represented in the Collection. Another important addition made during 1912 was a collection of malachite and azurite specimens from Burra, South Australia. These were donated by Mrs Caroline Rigg, and included some particularly fine specimens that have helped to make the Museum collection very rich in Burra material.

In 1913 a nickel-iron meteorite which had been found in 1903 some 4 miles S. of Yarroweyah, Victoria, was purchased from Mr T. Holden for £6. This 21 lb. Yarroweyah meteorite, which had been discovered on Holden's farming property, is one of Victoria's few meteorites. It has been studied and described by Walcott (1915).

The growth of the collections was not very great during the 1914-1918 World War. However, the war stimulated prospecting in Australia for certain minerals, and some good specimens of wolframite, cassiterite, native bismuth, molybdenite and other economic minerals were donated to the Museum. In 1915 a collection of nearly 100 mineral specimens mainly from Australian localities was received as a donation from Reverend A. W. Creswell.

For a long time the lack of a full-time geologist on the staff, to care for the geological collections (other than fossils) had been felt. This situation was remedied in September 1919, when Mr P. B. Nye was appointed to carry out such duties, with the title of Petrologist. Nye was enthusiastic and, due to his personal efforts, there were some useful additions to the collections. Unfortunately, he resigned in 1920 and moved to Tasmania.

In 1919, the Museum purchased a collection of Australian auriferous minerals assembled by the late Mr G. H. Hone, at one time a mining valuer to the Commonwealth Taxation Department. Although the entire collection comprised only 32 specimens, they were a notable addition in that most were specimens of gold tellurides from Western Australia.

From 1920 to 1931 the most notable acquisitions were meteorites. In 1921 the 14 lb. Roper River meteorite which had been found by an aboriginal 50 miles from Urapunga, on the Roper River, Northern Territory, was presented by Mr T. Sayle of Whitfield, Victoria. In 1923 a 1¼ ton meteorite, discovered S. of Cranbourne, Victoria, was bought by the Victorian Mines Department and presented to the National Museum. Edwards and Baker (1944), who described the meteorite, recognized it as one of the Cranbourne meteorites and it has become known as the Cranbourne No. 4 meteorite. In 1926 the 9½ lb. Pevensey stony meteorite was purchased from Miss Ethel Godfrey for £10. It had been found in 1869 on Pevensey Station, about 12 miles S. of Hay, New South Wales.

In 1926 the Museum benefited from an exchange of mineral specimens with the Royal Ontario Museum, Canada. Specmiens of spencerite, ferrierite, ellsworthite and other rare minerals not previously in the Collection were received.

The Period 1931 to 1950

Mr D. J. Mahony, a petrologist on the staff of the Victorian Mines Department, was appointed Museum Director in 1931, holding the position until 1944. On Mahony's recommendation, Mr S. R. Mitchell, son of James Mitchell, was appointed Honorary Mineralogist in 1931. Mitchell was a metallurgist associated with various mining ventures in Australia, and a keen mineral collector who took advantage of every opportunity to secure specimens for the Museum and for his private collection. Mitchell paid frequent visits to the Museum from 1931 until his death in 1963, and over the years donated some hundreds of minerals and rocks to the Collections.

In 1932 the Museum acquired approximately 100 minerals and rocks which had been displayed in the Melbourne Aquarium, situated in the Exhibition Buildings. It is fortunate that they were secured, as the Aquarium was subsequently destroyed by fire. The collection contained 40 mineral specimens from the old Broken Hill Proprietary Mine at Broken Hill, New South Wales, and included some fine specimens of cerussite and embolite. Another notable acquisition in 1932 was a suite of minerals and rocks from the South Mine at Broken Hill, donated by Broken Hill South Limited.

Before 1933, owing to staff shortages, there were very few exchanges of specimens with other museums and mineral collectors. However, a valuable exchange was made in 1933 with the Australian Museum in Sydney. Choice specimens of molybdenite, wolframite and cassiterite from the New England district of New South Wales were received as well as sturtite and manganhedenbergite from Broken Hill. In 1934 a collection of 20 minerals and rocks from Western Australia was obtained through an exchange with Dr E. S. Simpson of the Western Australian Government Chemical Laboratories. Simpson was an outstanding mineralogist, and information concerning several minerals that he sent to the National Museum had previously been recorded by him in scientific journals. They

included palygorskite, amblygonite, cummingtonite, margarite, gedrite, lithiophilite and rosterite, some of which were not represented in the Collection.

Gradually over the years the number of australites in the Collection had been increasing. On his expeditions to Central Australia, Baldwin Spencer had obtained some from Charlotte Waters and other places. In 1935, however, the size of the Australite Collection increased considerably when 330 specimens from Mulka, South Australia, were purchased from Mr George Aiston, a protector of aborigines at Mulka. These and other Mulka australites have been examined recently by Baker (1969).

The growth of the Collections was retarded during the Second World War, but there were some important acquisitions. One was a stony meteorite found by Mr S. McEachern near Caroline, South Australia. Stillwell (1941) has described it, naming it the Caroline meteorite. In December 1941, a small piece of the famous 'Welcome Stranger' gold nugget (the largest nugget found in the world) was donated by Mrs J. A. Deason. This nugget was discovered by John Deason and Richard Oates at Moliagul, Victoria, in 1869. The donated specimen had been kept in the Deason family for many years, and is reputed to be the last remaining piece of the nugget. In May 1942, forty overseas mineral specimens were received by donation from the Prahran City Council, Victoria. Originally they had been purchased from Foote, the dealer of Philadelphia, U.S.A. The Koraleigh stony meteorite, described by Edwards and Baker (1943), was donated by Mr F. A. Cudmore, in 1943. Cudmore found the meteorite near Koraleigh, N.S.W., about 20 miles NW. of Swan Hill. As fewer than 2,200 meteorites have been found in the world, a meteorite donation is important.

In 1944 Mr R. T. M. Pescott was appointed Museum Director, and it was largely through his efforts that Mrs Sylvia Whincup was appointed to the position of mineralogist in 1946. After she joined the staff the Collections grew more rapidly, and a start was made to arrange the Mineral Reference Collection systematically according to the Dana Classification.

In August 1946 the O. R. Rule Collection of more than 650 mineral specimens was purchased for £275. Mr O. R. Rule had been a member of the Industrial and Technological Museum staff, and had looked after the Geological Collection from 1872 to 1892. His personal collection consisted largely of overseas minerals bought from Krantz and Foote and contained many less common minerals which are valuable for reference and research purposes. The collection also contained many beautiful polished agates from India and South America, some of which are now on exhibition.

Mrs Whincup was interested in gemmology, and realized that there was a need to set up attractive displays of gemstones and ornamental stones. As the Museum had very little precious opal the Trustees purchased a valuable collection of Australian opal from N. H. Seward in 1947. This included specimens of boulder opal from Southern Queensland, rough and cut stones from New South Wales, and some good quality cutting opal from Coober Pedy and Andamooka in South Australia.

In May 1947 a 37¼ lb. piece of the Henbury nickel-iron meteorite was purchased for £12 3s. 9d. from Mrs W. Gill of Camberwell, Victoria. This large fragment had been found adjacent to one of the Henbury meteorite craters about 70 miles SW. of Alice Springs, Northern Territory. It is by far the largest piece of Henbury meteorite in the Museum collection.

Late in 1947 a large polished slab of orbicular granite from Karamea, New Zealand, was received as a donation from the Government of New Zealand. This very rare variety of granite contains 'orbs' or spheroids consisting of alternating

concentric zones of black mica (biotite) and white oligoclase feldspar embedded in a matrix of normal granite.

The Museum benefited considerably by exchanges with Dr E. L. Calvert and Mr E. Beach, two Californian mineral collectors, in 1948; choice specimens of bakerite, colemanite, hureaulite, priceite, benitoite, neptunite, diaboleite, meyerhofferite, crestmoreite, gillespite, sanbornite, descloizite and certain other rare minerals from U.S.A. and Mexico were received. Most of these mineral species were not previously represented in the Museum collection.

In May 1948 the J. Hornsby Collection of 385 mineral and rock specimens was donated by his daughter, Mrs J. A. C. Firth of Geelong. Mr Hornsby had been associated with gold mining in the Maldon district of Victoria as early as 1872, and the collection was particularly rich in minerals from that area. It also contained many fine specimens from Broken Hill and other localities in Australia and overseas countries.

The most important acquisition received during 1948 was the E. J. Dunn Collection of minerals and rocks. Mr E. J. Dunn (1844-1937) was a pioneer geologist in Australia and South Africa who built up a large private collection. He joined the Geological Survey of Victoria in 1864 and was its Director from 1904 to 1912. Part of the E. J. Dunn Collection was purchased from his daughter, Miss Lilian P. Dunn, for the sum of £785. The remaining part was donated by Miss Dunn and other members of the Dunn family. The purchased part consisted of 625 gold specimens from Australian, South African and New Zealand localities, and 67 uncut diamonds from the Kimberley mines in South Africa. The gold collection illustrates well the different forms and modes of occurrence of native gold and includes some beautiful gold crystals. Many of the specimens are of great historical value, as they were used for the illustrations in Dunn's book, *The Geology of Gold,* published in 1929. Owing to the working-out of most of the mines, the gold specimens are now largely irreplaceable. The collection of diamonds shows the variation of crystal form and colour that may occur, as well as the various classes of gem and industrial stones. The donated section of the Collection consisted of more than 1,500 specimens from Australia and overseas countries and included such rare minerals as stichtite, enhydros and awaruite.

The policy of exchanging certain duplicate material with selected private collectors was continued in 1948 when a useful exchange was made with the Reverend A. E. Gardner of Canberra Grammar School. Exchanges of mineral specimens with this secondary school teacher have continued to the present time and many fine specimens have been donated by him.

The Period 1950 to 1969

Mrs S. G. Whincup resigned early in 1950 and Dr A. W. Beasley, a graduate of the Universities of Queensland and London, was appointed to the position of mineralogist, commencing duty in July of that year.

Late in 1950 the Museum purchased an interesting collection of gemstones from the estate of W. F. Petterd, author of the Tasmanian Mines Department publication 'Catalogue of the Minerals of Tasmania' (1910). The collection included diamonds from Inverell and Bingara in New South Wales, emerald crystals from Emmaville (N.S.W.) and faceted sapphires and topaz from Tasmania and Queensland. Most of the uncut and cut specimens were from Australian localities.

As a token of their gratitude for assistance rendered during an expedition to Australia, the Denver Museum of Natural History in Colorado, U.S.A., donated in 1951 a valuable and historic collection of gold specimens to the Museum. This was a portion of their John Campion Collection, and consisted largely of crystalline, leaf and wire gold from the famous Wapiti Gold Mine, Farncomb Hill,

Colorado. The total weight of gold in the donation was 15 ounces. Most of the specimens are of great beauty as well as being of scientific interest because of their rare form.

Another noteworthy acquisition received during 1951 included specimens of the rare minerals marshite from Broken Hill and chillagite from Chillagoe, Queensland. They were acquired through an exchange with Dr L. J. Lawrence of the University of New South Wales.

Dr C. M. Focken was appointed Director of the Museum (now Institute) of Applied Science of Victoria in 1951, and he soon sought the assistance of Dr Beasley in an examination of that Museum's collection of economic minerals and rocks stored in their basement area. This work resulted in the transfer of 358 mineral and 149 rock specimens to the National Museum.

A collection of minerals from Arizona, U.S.A., was received in 1953 through an exchange with Dr A. L. Flagg of the Arizona Bureau of Mineral Resources; it included choice specimens of carnotite, dioptase, wulfenite and vanadinite as well as the rare copper silicates shattuckite and bisbeeite which were not formerly represented in the Museum collection. A suite of minerals from the Northern Territory, including uranium minerals from Rum Jungle, was acquired by exchange in the same year from the Commonwealth Bureau of Mineral Resources, Geology and Geophysics.

As the result of a collecting expedition organized by Mr E. D. Gill (National Museum) and Dr G. Baker (CSIRO), 366 australites were added to the Museum collection early in 1953. Most were found in the Childers Cove-Stanhope Bay region, SE. of Warrnambool in Western Victoria; they were subsequently described by Baker (1956).

During 1954 Dr George Baker of the CSIRO Mineragraphic Section, University of Melbourne, made two valuable donations. One was a collection of sand stalagmites which he had described (Baker 1942) from caves in Loch Ard Gorge near Port Campbell, Victoria, and the other a collection of pisoliths, ooliths and other calcareous growths from limestone caves at Port Campbell, studied by Baker and Frostick (1951). Baker also donated pisoliths from Angel Cave, Cape Schanck, Victoria, and from the North Broken Hill Mine which had been described in an earlier paper (Baker and Frostick 1947).

In response to a request for specimens to incorporate in exhibits dealing with Australian lead and zinc minerals, Zinc Corporation Limited donated a suite of spectacular specimens from their Broken Hill mine in 1954. Another notable donation in the same year was a collection of 70 Australian minerals from the estate of Mr Charles Hill of Hawthorn, Victoria. It included specimens of torbernite, antunite and other uranium minerals from Mount Painter, South Australia.

The Museum benefited at about this time from exchanges with the Hobart Museum and the American Museum of Natural History. Good specimens of anglesite, stichtite, stannite, magnetite and dolomite were received from Tasmania and a number of rare minerals from America.

The first of a series of donations of overseas minerals and rocks from Mr A. J. Magri, a keen private collector of Kilsyth, Victoria, was received in 1955. These donations have continued to the present time and have helped to fill various gaps in the Collections.

In October 1955 an offer to purchase the mineral collection of Mrs P. James of Abbotsford, Victoria, for the sum of £16 16s. 0d. was accepted. The specimens had originally come from the private collection of Mr S. R. Mitchell and consisted mainly of economic minerals. A specimen of the rare mineral willyamite (a variety of ullmannite) from Broken Hill was a particularly welcome acquisition.

For a number of years Mrs Kathleen Woodburn, a well-known naturalist and

writer, had been seeking help and advice from the Museum and making donations of specimens. Mrs Woodburn was a keen collector and, following her death in 1955, her geological collection was donated to the Museum. It included approximately 285 mineral and 90 rock specimens, being particularly rich in material from the Northern Territory.

Following earlier research on Queensland heavy mineral beach sands, Dr Beasley made a study of heavy black sands on Phillip Island, Victoria (Beasley 1957). This resulted in a suite of Phillip Island sand samples and microscope slides of heavy mineral fractions being added to the Collection.

In 1956 Dr George Baker was appointed Honorary Associate in Mineralogy. He was well known for his research on australites (Australian tektites), and it was largely through this work that the Australite Collection had gradually been increasing. An interesting collection of australites from the Cavendish district, Victoria, was donated by Mr E. V. Lewis of Cavendish in 1956. In the same year a further collection of australites from the Childers Cove-Stanhope Bay region, SE. of Warrnambool, came to the Museum. They were found by Mr Brian Mansbridge and Mr Colin Drake, two keen young collectors who lived near Warrnambool; it brought the number of australite specimens found by them in that region and presented to the Museum between 1954 and 1957 to a total of 326. Another notable acquisition was a suite of Philippine Islands tektites donated by Dr H. O. Beyer of Manila.

Australian mining companies continued to donate economic minerals to the Museum, particularly when specimens were requested for display purposes. One such donation in 1956 was a collection of manganese ores and other minerals from Western Australia, presented by Westralian Ores Pty. Ltd. of Perth.

Many ministers of religion are interested in geology, and some have private collections. One such person was the Reverend E. H. Chapple of Melbourne who had been appointed Honorary Conchologist in 1933. His collection, consisting mainly of Australian rocks, was presented to the Museum in 1956 following his death.

Pieces of three stony meteorites from U.S.A. were donated by Dr George Baker in 1957. They were the Plainview meteorite from Texas and the Alamogordo and Pasamonte meteorites from New Mexico. Another donation in the same year was a collection of minerals and rocks from the estate of the late W. H. Ferguson of East Camberwell, Victoria. Mr Ferguson had been a geologist with the Geological Survey of Victoria, and most of the specimens were from Victoria and other Australian states.

The most important acquisition in 1958 was the G. B. Pritchard Collection which was purchased from his widow for the nominal sum of £50. Dr G. B. Pritchard was a well-known geologist who for many years had been Lecturer in Geology at the Working Men's College (now called the Royal Melbourne Institute of Technology). The collection was a particularly comprehensive one, comprising 1,019 mineral and 271 rock specimens from many different parts of the world. Another valuable acquisition in 1958 was a collection of 32 gemstones including polished Coober Pedy and Lightning Ridge opals from Mr G. Schlemme of Melbourne.

As early as 1907 Mr Felix Westwood of Footscray, Victoria, had donated specimens of gypsum from near the Kensington Railway Station, and further donations of minerals from other Melbourne suburbs were made in subsequent years. Following his death in 1959, Westwood's collection of 420 mineral specimens was presented to the Museum by his niece. It consisted mainly of secondary carbonate and zeolite minerals from the old basalt quarries at Footscray and Collingwood and included some particularly fine specimens of acicular aragonite.

purchased after Mr Mitchell's death for the sum of £250. The Collection comprised nearly 2,000 mineral specimens, 60 rocks, 45 tektites and fragments of two meteorites (the Henbury and the Canyon Diablo). It contained native gold, diamonds, precious opal and specimens of many other minerals from Australia and overseas, some of which can no longer be obtained.

As the result of a systematic search for australites at Port Campbell, Victoria, organized by Mr E. D. Gill of the National Museum, a specimen of special interest was added to the Collection early in 1964. This was an excavated block of compact soil (humus podsol) containing an australite *in situ*; the australite occurred at a depth of 12 inches below the surface of the ground (Gill 1965). At the same time, a number of australite specimens found at Port Campbell by members of the search party were added to the Collection.

Specimens of hematite-quartzite, hematite and other iron ores from the Hamersley Range in Western Australia were donated by Enterprise Exploration Limited in 1964. Another acquisition in the same year was the Corowa nickel-iron meteorite, described by Baker, Gittins and Donnelly (1964). It had been discovered during the ploughing of a wheatfield approximately 4 miles from Corowa, N.S.W., and was presented by the property owner, Mr D. McGillivray. This meteorite belongs to a rare class known as a nickel-rich ataxite and is the only representative of its kind in the Museum Collection.

The Australian Institute of Aboriginal Studies in Canberra gave 60 australites from Mulka, South Australia, as well as 79 from other localities, to the Museum in 1964. Originally they were part of the S. R. Mitchell Collection of geological specimens and the Mulka australites had been studied by Baker (1969), but they had been wrongly included in the S. R. Mitchell Anthropological Collection purchased by the Institute. Through an exchange with the South Australian Museum in June 1964 a 7½ oz. piece of the Coonana stony meteorite was acquired. This 15 lb. meteorite had been found 3½ miles W. of the Coonana bore, E. of Lake Callabonna, South Australia, in 1962.

An exchange with Mr Joseph Urban of Tucson, Arizona, in 1965 resulted in the acquisition of several overseas minerals not previously represented in the Collection. These included gowerite, nobleite, beegerite, strunzite, laueite, ajoite and kornelite. In May of the same year a large specimen of inesite from Broken Hill was donated by Mr A. H. Chapman, the well-known Sydney collector, and a number of choice mineral specimens from overseas localities were acquired from him through an exchange.

Dr D. R. Chapman of the United States National Aeronautics and Space Administration donated representative collections of tektites from South Vietnam and Thailand in 1965, in appreciation of help given in his researches on australites. These donations considerably increased the Museum's collection of overseas tektites. Another noteworthy acquisition during 1965 was a suite of metamorphic rocks mostly from the NW. part of South Australia; they were donated by Mr J. E. Johnson of the South Australian Department of Mines.

The Wolf Creek meteorite crater in Western Australia, the world's second largest, was discovered in 1947 but it was not until 1965 that fragments of an iron meteorite were found near the crater. One of these fragments was donated by Professor S. R. Taylor of the Australian National University who described the material collected (Taylor 1965).

Dr F. H. Pough of the Santa Barbara Museum of Natural History in California visited the National Museum in 1965, and specimens of chambersite, danburite, eskolaite, milarite, simpsonite and tourmaline were obtained through an exchange with him. A further exchange was made in 1966 when idocrase crystals, crystallized rose quartz, witherite, clinoclase and other interesting minerals were received.

In October 1959 a small piece of fulgurite, found at Karnak in Western Victoria, was submitted for identification. This resulted in the excavation of a fulgurite approximately 5 feet long from a sandhill at Karnak and its presentation to the Museum by Mr H. A. Keys. Beasley (1964) has studied and described this unusual specimen, formed by a lightning discharge penetrating a sandhill and melting the quartz sand along its path.

Broken Hill Proprietary Ltd. made a worthwhile donation in 1960 when they presented part of their collection from the old Proprietary Mine at Broken Hill. It contained good specimens of embolite, marshite, iodyrite, stolzite, raspite and other rare secondary minerals. Another collection given to the Museum in 1960 was that of Mr T. S. Hart (1871-1960), a teacher and naturalist who for many years was Lecturer in Geology at the Ballarat School of Mines. An accompanying hand-written catalogue gave the locality for each of several hundred specimens, almost entirely from Victoria. The Museum benefited from exchanges with Mr D. L. Erling of Milwaukee, U.S.A., between 1960 and 1964, receiving choice specimens of North American, Scandinavian and Madagascar minerals including new and rare species which filled several gaps in the Collection.

For some time Dr G. Baker had been studying accretionary growths found in sediments outcropping along the S. coast of Western Victoria between Freetrader Point (SE. of Princetown) and a point several miles NW. of Peterborough. On completion of his research in 1960 on a very wide range of accretionary growth structures, he donated the material studied (Baker 1962) to the Museum.

An exchange with the United States National Museum (Smithsonian Institution) in 1961 resulted in a representative collection of tektites from the Philippine Islands coming to the Museum. In the same year pieces of three Argentine meteorites were donated by Dr G. Baker. They were the Vera, El Toba and San Carlos meteorites, none of which were previously represented in the Collection.

A number of Broken Hill mining men have built up extensive mineral collections from the mines there, one of the most outstanding being that of Mr A. R. Campbell. Following suggestions from his friend, Sir Maurice Mawby, in 1962 Campbell donated a number of his minerals including crystallized specimens of stolzite, raspite, bustamite, campylite and brochantite. Another valuable donation in the same year was a miscellaneous collection of minerals and rocks from Mr F. S. Colliver, the well-known naturalist, which included several specimens of unusually large size and special interest. Late in 1962 one hundred and fifty australites which constituted part of the ethnological collection of the late Mr H. R. Balfour of Melbourne were received. These australites, from Mulka in South Australia, were subsequently studied by Baker (1969).

Between 1957 and 1963 Dr Beasley contributed to an ecological survey of Port Phillip Bay by studying the bottom sediments (Beasley 1966). This research resulted in several hundred samples of bottom sediments being classified and added to the Collection. Sand fractions of these samples are at present being loaned to specialists who are studying the foraminifera and ostracoda in them.

A marked increase in the number of Canadian minerals in the Collection came through an exchange with the Geological Survey of Canada in 1963. Among the minerals received was a specimen of the new species niocalite from Oka in Quebec. Another important acquisition in 1963 was a collection of minerals from Mount Painter and other areas in South Australia. This was donated by Mr B. Flounders of Whyalla and included some outstanding specimens of crystallized gypsum from the Kimba Gap and Myall Creek areas near Whyalla. Because of their fragile nature some of the gypsum specimens were hand-carried to Melbourne by Mr M. J. Mooney of the Museum Mineralogy staff who assisted in collecting them.

The most important acquisition in 1963 was the S. R. Mitchell Collection,

Dr Pough was previously Curator of Minerals at the American Museum of Natural History in New York, and the quality of his specimens was outstanding. Another valuable acquisition in 1966 was a collection of metamorphic rocks from Finland, donated by Professor Kalervo Rankama of the University of Helsinki.

The largest individual donation during 1966 was a collection of 148 australites which had been found 16 miles NNE. of Morgan in South Australia. These specimens came from Mrs Doris Thamm of Morgan and have been described by Baker (1968b). The growing public interest in australites was reflected in two further important donations during 1966. One was a collection of australites from 6 miles N. of Princetown in Victoria, presented by Mr E. Franks of Coburg, Victoria, and described by Baker (1968a). The other was a collection from near Bulong in Western Australia, donated by Mr C. B. C. Jones of Hampton Hill, near Kalgoorlie.

During 1966 the Museum collection benefited through donations from and exchanges with Mr A. F. Eadie of the Eadie Mining Engineering Company in Taft, California. Large individual crystals of bloedite as well as thenardite crystal groups from the Soda Lake region in California, and specimens of the new minerals deerite, nowieite and zussmanite from northern California, were received.

Between 1966 and 1968 Dr Beasley carried out an investigation of the beach sands on the southern shore of Port Phillip Bay, Victoria (Beasley 1969). This research resulted in 23 beach sand samples, of which the textural and constituent composition had been described, being added to the Collection.

The most valuable acquisition during 1967 was a collection of rare minerals and gemstones obtained through an exchange with Mr M. L. Ehrmann, a mineralogist of Los Angeles, California. Particularly choice specimens of brazilianite and kunzite from Brazil were received. Another rare mineral known as doverite was donated by Professor A. J. Boucot of the California Institute of Technology in 1967; it came from Dover in New Jersey, U.S.A.

Early in 1968 a giant spherulite, with a diameter of 12 inches, from Doon Doon, N.S.W., was donated by Mr N. Franks of Albury. It is by far the largest spherulite in the Collection. The growing interest in meteorites throughout the world resulted in requests from various universities and research organizations for samples of them. Several requests came from Professor R. A. Binns of the University of New England in Armidale and, in appreciation of assistance given, he donated pieces of two Queensland meteorites in 1968. They were the Hamilton meteorite and the Wynella meteorite, neither of which were previously represented in the Collection.

A suite of nickel-bearing mineral specimens and the rocks associated with them from Kambalda in Western Australia was presented by Western Mining Corporation Limited in 1968, and further specimens from the same region were donated by Mr R. H. Gill of Melbourne. An outstanding specimen received during the same year was a large hexagonal crystal of aquamarine from Brazil. This beautiful crystal measuring 3 inches in height was obtained from Dr P. Bancroft of Livermore, California, U.S.A.

Gold crystals are rare, so the acquisition of a specimen containing four large crystals associated with limonite was of particular importance. This unique specimen had been found during the early days of gold mining in Victoria, and is thought to have come from the Wedderburn field. It was offered for sale to the Museum by Mr Frank Mitchell (son of the late S. R. Mitchell) and purchased for $14, but its value as a specimen is many times this sum.

The growth of interest in gemmology and lapidary was reflected in an increase in donations of gem minerals and ornamental stones. In 1968 Altmann and Cherny Pty. Ltd. of Melbourne donated a collection of gemstones which included

a particularly fine yellow cut sapphire from Ceylon. Another valuable donation in the same year came from Dr H. E. Millson of New Jersey, U.S.A.; it consisted of polished agates from Mexico, 'agatized coral' (chalcedony and agate replacing fossil coral) from Florida, and polished labradorite from Labrador. Cut and polished spherulites containing agate and chalcedony from Tamborine Mountain and Mount Hay in Queensland were also donated by lapidary enthusiasts anxious to help the Museum. During 1969 a faceted rock crystal (weight 86 carats) from Kingsgate, N.S.W., and a large faceted smoky quartz from Beechworth, Victoria, were presented by Mr A. Amess of Melbourne who cut and polished the specimens.

Conclusions

The most extensive collection of overseas minerals and rocks in an Australian museum has been assembled during the past 115 years. Efforts to build up the collections of Australian minerals and rocks during the past 20 years have resulted in considerable additions, but continued endeavour is needed to further enlarge them.

Service given by the staff and honorary associates has influenced many individuals, companies, and teaching and research organizations in presenting specimens to the Museum. Exchanges of certain duplicate material with other museums, universities and private individuals are valuable; gaps in the Collections may be filled and good specimens obtained. However, as the number of specimens available for exchange is limited, more purchases will be necessary in the future to acquire rare minerals and choice specimens from overseas countries.

During the 115-year period of growth of the Collection there have been some marked changes of interest in various minerals and in meteorites and tektites. During the nineteen fifties the number of uranium-bearing minerals in the Collection increased considerably following the advent of atomic energy and the search for uranium deposits. The importance of tektites in planetary science during the past 10 years has resulted in many more tektites being donated to the Museum than in previous decades.

As the Collections have grown they have been arranged more systematically, allowing greater use to be made of them. This applies to the part on display and to the reserve collections which are available for reference and research purposes. Series of teaching exhibits set up in recent years are used extensively by students, and other exhibits are attracting greater public interest. A larger number of specimens have been loaned to universities and other research organizations during the past 10 years than in previous decades, and research work on Museum specimens has added to scientific knowledge at an increased rate.

References

ATKINSON, J. A., 1896. A locality list of all the minerals hitherto recorded from Victoria. *Proc. Roy. Soc. Vict.* 9: 68-119.

BAKER, G., 1942. Sand stalagmites. *J. Geol.* 50: 662-667.

————, and FROSTICK, A. C., 1947. Pisoliths and ooliths from some Australian caves and mines. *J. sedim. Petrol.* 17: 39-67.

————, ————, 1951. Pisoliths, ooliths and calcareous growths in limestone caves at Port Campbell, Victoria. *J. sedim. Petrol.* 21: 85-104.

————, 1956. Nirranda strewnfield australites, south-east of Warrnambool, Western Victoria. *Mem. nat. Mus. Vict.* 20: 59-172.

————, 1962. Accretionary growth structures, south-west Victorian coast, Australia. *Mem. nat. Mus. Vict.* 25: 17-48.

————, GITTINS, A., and DONNELLY, T. H., 1964. Nickel-rich ataxite from Corowa, New South Wales. *Geochim. et Cosmochim. Acta.* 28: 1377-1388.

————, 1968a. Australites from Princetown, Victoria. *Mem. nat. Mus. Vict.* 28: 23-37.

————, 1968b. Australites from NNE. of Morgan, South Australia. *Mem. nat. Mus. Vict.* 28: 39-76.

———, 1969. Australites from Mulka, Lake Eyre Region, South Australia. *Mem. nat. Mus. Vict.* 29: 65-79.

Beasley, A. W., 1957. Heavy black sands from Phillip Island, Victoria. *Mem. nat. Mus. Vict.* 21: 101-116.

———, 1964. A fulgurite from Karnak, Western Victoria. *Mem. nat. Mus. Vict.* 26: 11-19.

———, 1966. Bottom sediments of Port Phillip Bay. *Mem. nat. Mus. Vict.* 27: 69-105.

———, 1969. Beach sands of the southern shore of Port Phillip Bay, Victoria, Australia. *Mem. nat. Mus. Vict.* 29: 1-21.

Chalmers, R. O., 1967. *Australian rocks, minerals and gemstones*. Angus & Robertson, Sydney.

Dunn, E. J., 1929. *Geology of gold*. Griffin, London.

Edwards, A. B., and Baker, G., 1943. The Koraleigh stony meteorite. *Mem. nat. Mus. Vict.* 13: 157-160.

———, ———, 1944. The Cranbourne meteorites. *Mem. nat. Mus. Vict.* 14: 23-35.

Gill, E. D., 1965. Quaternary geology, radiocarbon datings and the age of australites. *Spec. Pap. geol. Soc. Am.* 84: 416-432.

Liversidge, A., 1875. The minerals of New South Wales. *Trans. Roy. Soc. N.S. Wales* 9: 153-215.

Pescott, R. T. M., 1954. *Collections of a century*. Brown, Prior, Anderson, Melbourne.

Pelfrd, W. F., 1910. *Catalogue of the minerals of Tasmania*. Gov. Printer, Hobart.

Selwyn, A. R. C., and Ulrich, G. H. F., 1867. Notes on the physical geography, geology and mineralogy of Victoria. *Official Record of Intercolonial Exhibition of Australasia, Melbourne, 1866-67*: 145-236.

———, and others, 1868. *A descriptive catalogue of the rock specimens and minerals in the National Museum, collected by the Geological Survey of Victoria*. Gov. Printer, Melbourne.

Stillwell, F. L., 1941. The Caroline stony meteorite. *Mem. nat. Mus. Vict.* 12: 41-48.

Taylor, S. R., 1965. The Wolf Creek iron meteorite. *Nature, Lond.* 208: 944-945.

Ulrich, G. H. F., 1869. Observations on the 'Nuggety Reef', Mount Tarrengower gold-field. *Q. Jl. geol. Soc. Lond.* 25: 326-335.

———, 1870. *Contributions to the mineralogy of Victoria*. Gov. Printer, Melbourne.

Walcott, R. H., 1900. Additions and corrections to the census of Victorian minerals. *Proc. Roy. Soc. Vict.* 13: 253-272.

———, 1915. Description of the Victorian meteorites, with notes on obsidianites. *Mem. nat. Mus. Vict.* 6: 1-66.