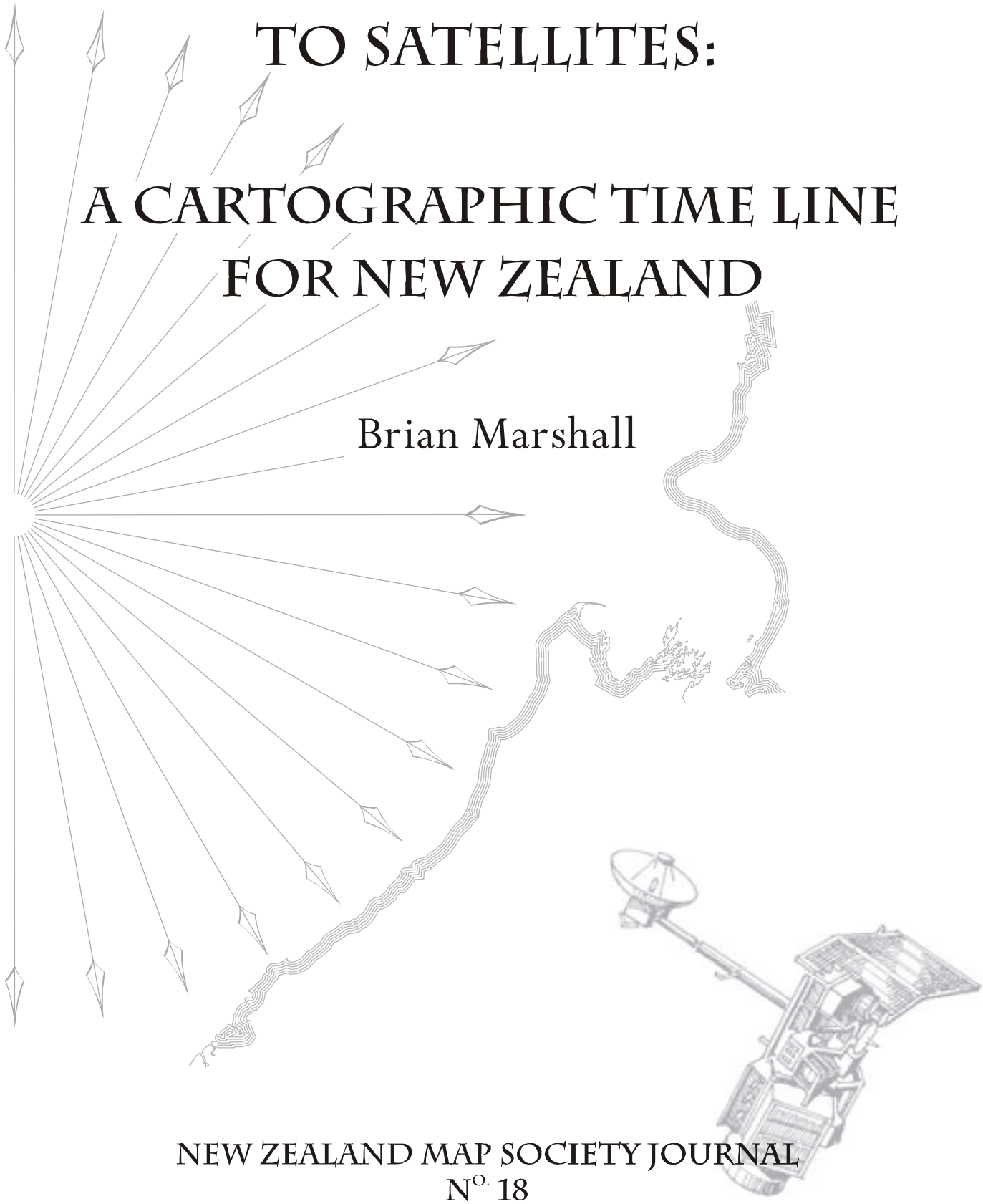
FROM SEXTANTS TO SATELLITES:

A CARTOGRAPHIC TIME LINE FOR NEW ZEALAND

Brian Marshall



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The New Zealand Map Society

The New Zealand Map Society brings together people and organisations with an interest in a wide range of subjects relating to cartographic materials. The Society publishes an annual journal, and an irregular newsletter, *Datum*. It hosts regular seminars. The Society maintains contact with fellow organisations in Australia, Europe and the United States of America.

New members are welcome. Current membership fees are $NZ15 for both New Zealand and overseas members. Individual and institutional membership fees are identical. Subscriptions should be sent to the Treasurer:

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"Trig Station, Maraetaua. L. Cussen and survey gear. 1883."

[Source: Cussen album, Hamilton City Libraries Image Number 412]

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FROM SEXTANTS TO SATELLITES:

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BRIAN MARSHALL

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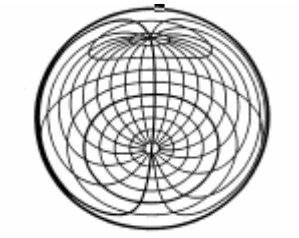

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INTRODUCTION

This time line records the main events in the surveying and mapping of New Zealand. Also included are events relating to map publishing, map keeping and map librarianship, the teaching of surveying and cartographic skills, the formation of societies and associations relating to surveying and cartography - in fact, to "cartography" in the broadest possible meaning of the word.

Maps are an essential tool for developing a nation, from its initial discovery right through to the creation of its modern economic and social infrastructure. Maps record what is known about a place, and at different points in time. Maps are a unique portrayal of place, displaying a wide range of phenomena in a way that is virtually impossible via any other medium.

This time line records the activities of people who clearly considered themselves to be surveyors, hydrographers or cartographers. Also included are many who conducted survey work and, often, constructed the resulting maps as well, but did not see themselves primarily as surveyors at all. These people were explorers, adventurers, exploiters of natural resources (whalers, sealers, timber and flax collectors, miners), engineers, geologists, soil scientists, environmental scientists, and the like. Many of these groups of people were assisted by Maori, who possessed a detailed "cartographic" knowledge of the shape and form of the land long before Europeans arrived, and were able to draw for Europeans maps of different parts of New Zealand when asked to do so.

Very important were the draughtsmen and many early surveyors were in fact draughtsmen turned surveyors. As Nola Easdale (1988, page 13) points out, "Charles Heaphy began his New Zealand career as a draughtsman and artist with the New Zealand Company, but was very soon exploring and surveying. Other surveyors came in from the cold and became draughtsmen. Some, depending on the work which was offering, were draughtsman for a time then returned to the field."

Within the time line will be found details of the introduction of new equipment and the development of new cartographic techniques. This in turn leads to changing roles for many of the major players in the surveying/mapping environment. The 1935 decision of the mapping subcommittee of the New Zealand Committee for Imperial Defence to initiate compilation of organised inch to the mile topographic coverage of the whole of the country marks one of the significant points in our cartographic history. Its associated decision, to use methods utilising aerial photographs, also signals the beginning of a

significant change in the mapping role of the land surveyor. The function of defining terrain details and contour lines began to shift from the survey team, with plane table, alidade, Abney level and "a good eye for country", to office-based staff using increasingly sophisticated equipment. By the 1960s the main contributions of surveyors to the national mapping process were the establishment of co-ordinates and elevations of identifiable points to be used by photogrammetrists as reference points and the 'field checking' of maps before their publication. By 1988, Professor Basil M. Jones, of the School of Surveying at Otago University, was acknowledging in his editorial in the centennial issue of *New Zealand Surveyor* that, "many of the tasks which were formerly carried out by professional surveyors are now carried out by technical staff using modern technology" (Vol.32, page 316). This transformation of course is not unique to the cartographic profession! These changes can be seen against a background of changing Government policies towards surveying and mapping, whether these policies relate to opening up and developing the country, ensuring the correct recording of title to land, responding to war, implementing cost-recovery policies, privatising state owned assets, accessibility of public information and the monitoring of environmental changes.

While an endeavour has been made to be as all-inclusive as possible, some restraints have had to be imposed. Discovery and exploration is limited to events where a substantial increase in the knowledge of the land was subsequently provided, and preferably where maps resulted as well. There were difficulties with "events" relating to European and Chinese (but pre-Tasman) discoveries of New Zealand, described by some writers but repudiated by most scholars. These have mostly been included, with an indication that they are not part of mainstream scholarship or thinking, but tales of visits by Arabs, Tamils, Phoenicians, and others (Wiseman, 1998, 2001) have been excluded until more substantial evidence for their veracity can be provided. Also excluded is a claim by Reinoud M. de Jonge (2005) that King Huni (2599-2575BC), the last King of the 3rd Dynasty of Egypt, discovered New Zealand. De Jonge bases his claim on petroglyphs at Dissignac, Brittany, France, which he believes are actually 'route pictograms', or very stylised maps.

No attempt has been made to ascribe any level of importance to events. This timeline is simply a listing of events, a kind of super-catalogue that puts everything in, and in order. Major events often take up only one or two lines, and receive the same emphasis as something like a local town survey. The timeline should be seen as a starting point for further research rather than some kind of final end product.

References cited in the Introduction:

De Jonge, R.M. personal communication 4.11.2005, and
http://migration.steinwender.co.uk/linguistics21.htm (accessed 4.11.2005).

Easdale, N. 1988. *Kairuri, the measurer of land.* Petone: Highgate / Price Milburn, for the New Zealand Institute of Surveyors.

Jones, B.M. 1988. "Editorial: Looking forward – the next 100 years". *New Zealand surveyor*, 32: 316-317.

Wiseman, R. 1998. *Pre-Tasman explorers.* Auckland, Discovery Press.

Wiseman, R. 2001. *New Zealand's hidden past.* Auckland, Discovery Press.

Both Mairi Clark, Chief Photogrammetrist at the Department of Lands and Survey from 1982 to 1984, and Tony Bevin, Surveyor-General from 1996 to 2004, assisted considerably with the writing of this introduction.

ACKNOWLEDGEMENTS

I would like to acknowledge Sonya Donoghue, Manager, Science Information Services, University of Auckland Library, who allowed me work time to construct the time line.

This time line is very much a cobbling together of work done by numerous other people. They are acknowledged in the list of works consulted, at the end of the time line. Much of the information about technical developments since the 1920s has come from *No Clouds Today* by Peter Stephens, Piet van Asch and Mairi Clark.

The section of the time line between 1535 and Tasman's arrival in 1642 is very much the input of Michael Ross.

I would like to thank those who read preliminary drafts of the text, and offered comments. These include helpful suggestions from Janet Bray, and careful readings of the whole or major parts of the text by Phil Barton, Jan Kelly, Elva Leaming, Michael Ross and Lyn Williams. Jan Kelly and Mairi Clark both asked probing questions about the purpose of the time line, and helped me to clarify my own thinking.

John Spittal, Chief Topographer/Hydrographer at Land Information New Zealand, while looking at an earlier draft of the time line, rightly pointed out the lack of information about the development of photogrammetry at the Department of Lands and Survey. He also noted that the huge amount of mapping activity undertaken by that Department did not really emerge in that early draft. Hopefully that shortcoming has been addressed. Tony Bevin, a former Surveyor-General, and Mairi Clark, a former Chief Photogrammetrist at Lands and Survey, greatly added to the detail in the post-World War II section of the time line. John Baldwin at the School of Surveying, University of Otago, also ran his eye over the contents. Larry Robbins provided useful details about matters hydrographic. Melinda Allen of the Department of Anthropology, University of Auckland, gave assistance with dates for the initial settlement of New Zealand.

Jan Kelly designed the cover.

Dave Small and Tarn McDonald at the Alexander Turnbull Library, Jo-Anne Smith at Canterbury Museum, Lyn at the Westport Information Centre, and Peter Crossley at the School of Geography and Environmental Science, University of Auckland all answered individual queries. Bevan Shortridge assiduously hunted down first names for a number of people mentioned in the time line. Lyn Williams, Darryl Pike, Michael Ross, Ian Snowdon and Karen Craw assisted with the illustrations. The overall support of the New Zealand Map Society is very much appreciated.

LIST OF ILLUSTRATIONS

THE TIME LINE

The exploits of the mythic figure, Maui, are well known throughout Polynesia. According to Maori mythology he fished up Te Ika a Maui – the fish of Maui – the land now known as the North Island of New Zealand. Maori were clearly aware of the fish-like shape of the North Island. According to the myth, the mouth of the fish is Wellington Harbour, the tail is Cape Reinga/North Cape and the fins are Cape Egmont and East Cape. Lake Taupo is its heart. The South Island is Maui's canoe (Te Waka a Maui), while Stewart Island is the anchor (Te Punga a Maui) that held his waka while the great fish was hauled in. In the context of this time line, the myth serves to illustrate that early on, from canoe voyages around the coastline and explorations of its interior, Maori had developed an acute awareness of the geographical shape of the North Island. The myth shows how well the Maori had "mapped" New Zealand before any Europeans arrived to put it on paper.

*If the date is preceded by an asterisk (e.g. *1421-1423) the events are disputed by most scholars.*

ca. 530BC

- Pythagoras postulates the idea of a large southern continent to balance the land mass of the Northern Hemisphere. The idea of a great southern continent receives support from Claudius Ptolemy (AD ca.85-ca.165) and appears on many world maps, in a variety of forms, until at least the seventeenth century.

ca. 50AD

- Richard N. Holdaway argues that radiocarbon ages of up to about 2,000 yr BP on bone gelatin from Pacific rats from both the North and South Islands imply a transient human contact with New Zealand more than 1,000 years before settlement. Optical dating has confirmed the radiocarbon dates. Holdaway argues that the Pacific rat is unlikely to have arrived without human assistance.

ca. 800-ca. 1200

- Eastern Polynesians are exploring the widely scattered islands of the Pacific, including New Zealand, and returning to their homes again.

ca.1200-ca.1300

- The settlement of New Zealand takes place. (Allen (2005) points out that settlement sites dating to this time period exist throughout New Zealand and there is little controversy over their dating. There is some evidence for pre-

1200 AD settlement in New Zealand, including a handful of sites where the dates are more controversial and there is some evidence for possibly human-induced vegetation changes, as seen in pollen cores. Some scholars are prepared to push New Zealand settlement back to AD 1000-1200).

- Maori oral history records the arrival of various canoes, including *Arawa*, which landed near East Cape and explored the coast north to Maketu in the Bay of Plenty; *Tainui*, which also made landfall near East Cape, and sailed north to Whitianga and the Waitemata Harbour, where she was dragged overland to the Manukau Harbour before sailing south to Kawhia; *Mataatua*, which landed at Whakatane and sailed north to Takou; *Aotea*, which made landfall in the Kermadec Islands before reaching Great Barrier Island and sailing north around the North Island and south to the Aotea Harbour; *Tokomaru*, which made landfall near Gisborne and sailed south to Cook Strait and up the west coast to Tongaporutu; *Kurahaupo*, which made landfalls at Parengarenga and Mahia Peninsula; *Horouta*, which made landfall at Gisborne; *Uruao*, which made landfall in the far north of the North Island and sailed south along the west coast to reach Nelson, Kaikoura and eventually South Canterbury; *Mahuhu*, which landed at Whangaroa Harbour in the far north, and later sailed down the west coast of the North Island to reach the Kaipara Harbour; *Takitimu*, which landed on the west coast of the far north at Awanui and sailed south to the Hokianga, before sailing down the east coast to Tauranga and on to the Mahia Peninsula; and *Ara I Te Uru*, which was wrecked near Moeraki in North Otago (see note 1).

- Maori oral tradition also records the journeys of exploration made by Kupe, where the strongest traditions relate to Hawkes Bay, Cook Strait and Tasman Bay, and Northland; Tohe, who journeyed from Hokianga to Kaipara; Kahupeka, who journeyed through the Waikato, King Country, and around Kawhia; Ngatoro I Rangi and Tia, who journeyed in the Bay of Plenty, Waikato and Taupo areas; Kahumatamoemoe and Ihenga, who explored the Bay of Plenty - Rotorua Lakes districts; Paikea, who journeyed in the Bay of Plenty – East Coast area; Turi, who travelled from Aotea Harbour south along the coast of the North Island to Patea; Tamatea Ure Haea, who journeyed extensively throughout the whole of New Zealand; and Rakaihautu, who traversed the southern lakes region of the South Island.

(Further explorations, particularly inland, continued long after these dates).

*1421-1423

- Zhou Man, a Chinese navigator, leads one of four fleets attempting to perform a circum-navigation of the globe. According to author Gavin Menzies, Zhou travels from South America westward across the Pacific into the Tasman Sea, landing at Ruapuke Beach on the west coast of the North Island. Menzies argues that a shipwreck found at Ruapuke Beach is the wreck of a Tamil junk attached to the Chinese fleet. (In fact, the Ruapuke wreck is part of the *Orpheus*, wrecked on the Manukau bar in the nineteenth century, while the reference to the Tamil junk alludes to the myth that Colenso's Tamil bell was found there, along with a supposed nameplate).

1507

- A world map compiled by Martin Waldseemüller is published in Strasbourg. The map is titled *Universalis cosmographia secundum Ptolemaei traditionem et Americi*

Vespucci aliorumque lustrations (A map of the whole world according to the teaching (or tradition) of Ptolemy and of Amerigo Vespucci and of other surveyors). This is the first known map to depict the Pacific Ocean. Whitfield (2001) argues that the Pacific is a symbolic statement of the separate identity of America, because the Brazil described by Vespucci (following a voyage downs its coastline in 1501-1502) was so totally different from what was already known of China and Japan.

*1522

- The Portuguese sailor &UWRQLR de Mendonca sails from the northern coast of Sumatra in search of the 'Island of Gold' (Ilha d'Ouro). Wiseman (1998) claims that Mendonca, on this voyage, explored the coastlines of New Zealand, and this information is later incorporated into the Dauphin map drawn in 1536. Hervé (1983) argues that Mendonca "simply sailed south of Sunda Strait or, at least, on an intermediate southern course between Ceylon and Sumatra, where 'Islands of gold' are shown on some Norman [Dieppe] atlases".

*1526-1527

- In June 1526 the caravel *San Lesmes,* captained by Alonso de Solis, part of Loaysa's fleet, is separated in a violent storm as they emerge from the Straits of Magellan. Roger Hervé (1983) claims that, after a journey across the Pacific, the *San Lesmes* makes a landfall south of East Cape on the North Island. He bases this on two literary texts: *Cosmographie* and *Les Voyages avantureux du Capitaine Ian Alfonce Sainctongeois*, both by Jean Alfonce, a French explorer and writer. A claim has also been made that a hydrographic survey of New Zealand's Northland peninsula) was made during this discovery and it appears under the name of a single island – La Joncade – in the manuscript atlases of Guillaume Le Testu and the French pilot Pasterot.

ca.1535-1542

- The first of the Dieppe Portolan maps, which show a coastline similar to the east coast of New Zealand's North Island, is completed. Contained in a manuscript atlas of 12 maps, it was drawn by Jean Rotz and presented to King Henry the VIII of England. The other maps from this school, all showing versions of this coastline, were:

Mallard World Map (Alfonse) c.1536-1543
Anonymous planishere known as the Harleian (Dauphin chart) c 1537-1543
La Valliere atlas - 14 maps c1548
Anonymous atlas – 18 maps including two world maps c.1540-1545
Deslien's planisphere I 1541
Anonymous atlas – 4 maps attributed to Desceliers c 1542 (known as the Pierpoint Morgan Atlas after its owner)
Brouscon planishere 1543
Jean Fonteneau (known as Alfonse de Saintonge's Cosmographie, sketches 1544
Desceliers' planisphere I (known as the Henry II chart) 1546
Vallard atlas – 15 maps 1547
Desceliers' planisphere II 1550
Desceliers' planisphere III 1553
Le Testu atlas – 56 maps including 6 world maps and graduated charts 1556
Le testu World Map 1566
Desliens' planishere II 1566
Desliens' planishere III 1567
Hamon planishere 1568
Cossin world map 1570
J. de Vaulx – his first work of 12 maps 1583
Thevet's Grand Insulaire et pilotage 141 graduated charts 1586
Pastouret atlas 78 maps 1587

*1576

- Juan Fernandez, a Spanish explorer, sails on a Spanish caravel into the Pacific from Chile. Wiseman (1998) claims that Fernandez sights the coast-line of the North Island near East Cape, and sails south to Banks Peninsula, sighting Wellington Harbour on the way. Wiseman also claims that Fernandez winters-over in the Marlborough Sounds.

1589

- *Typus Orbis Terrarum,* the first map engraved and published by Jodocus Hondius, shows an eastern coastline similar to part of the Dieppe School maps. In addition it includes an island chain and the text "In ab Hernando Gallego 1570", attributing the discovery to Hernando Gallego, the Portuguese chief pilot on Mendana'a voyage in 1567.

1594

- Petrus Plancius, who was appointed cartographer to the Dutch East India Company (Abel Tasman's employer) in 1602, publishes *Orbis terrarvm typvs de integro multis in locis emendatus.* While showing a similar 'East Cape' bulge to that shown in the Jean Rotz atlas (see ca.1535-1542), the land is connected to New Guinea and Cape Horn. However the "New Zealand" area contains the text: "Ha regions cuidam Hispano apparuerunt cum disiectus a classe in hoc Australis vagaretur Oceano". Translated, this text claims that the region was found by a Spanish (ship) which broke away from their fleet and sailed across the ocean to Australis. Arnold Floris van Langren in his *Typus Orbis Terrarum***,** which was published in the same year, has the same text but placed nearer Cape Horn.

1596

- Theodor De Bry & Girolamo Benzoni publish *America Sive Novus Orbis Respectu Europaeorum Inferior Globi Terrestris Pars*, which contains the same text as is found in Petrus Plancius' map (see 1594).

1598

- Fernando Quiros, who was Mendana's Chief Pilot in the 1595 Spanish expedition to found a settlement in the area of Mendana's earlier discoveries, prepares a manuscript map of the Pacific Ocean showing the same coastline in the area of the east coast of New Zealand's North Island (see 1594).

1602

- Jean le Clerc publishes *Orbis Terrae Novissima Decriptio,* which is engraved by Jodocus Hondius. This map shows a coastline in the "East Cape" region, and includes text that refers to a 1570 discovery by Gallego, in the Hondius manner.

1625

- William Grent, using engravers employed by Jodocus Hondius II publishes *A new and Accurate Map of the World Drawne According to the truest Descriptions, latest Discoveries, and best Observations, that have been made by English, or Strangers.* In a similar manner to Petrus Plancius, the map included the text: "This coast was first discovered by a Spanish ship sevrd from her fleet and driven here along in the southern sea".

1627

- John Speed publishes *A New and Accurat Map of the World*, engraved by

the same Hondius engravers as Grent used (see 1625), and using the similar text to Grent: “These coasts were first discovered by a Spanish ship separated from her fleet, and driven here along in the southern sea”

1635

- William Janszoon Blaeu publishes *Americae Nova Tabula* which includes the New Zealand “East Cape” bulge standing alone in the south-west Pacific. There are no references to discoverer, nor any explanation of the discovery.

1636

- Henricus Hondius publishes the first of four states of his *Polus Antarcticus*. This map shows the long island chain inheritied from his father Jodicus Hondius and the now-familiar tracing of the east coast of the North Island. Hondius also attributed the island chain to Hernando Gallego.

1642

- Abel Janszoon Tasman and his navigator Franz Jacobszoon Visscher, who planned the expedition in the *Heemskirk* and *Zeehaen,* explore and chart the western coastline of New Zealand, from Hokitika north to Cape Maria van Diemen. Their manuscript maps of the explored coastline have one key difference: Visscher’s map shows a gap where Cook Strait is, while Tasman’s does not. Recent research (Ross, 2002) has provided significant evidence that Visscher was using a version of Henricus Hondius’s *Polus Antarcticus* (1636) which showed the island chain and eastern coastline, and was in fact attempting to sail through Cook Strait to sail past the lower end of that coastline (at 40º south). At that time Hondius was official globe-maker to the Dutch East India Company, who had commissioned Tasman’s expedition.

1644

- According to Brian Hooker (2004), in this year the first representation of a part of New Zealand in a printed map occurred, and that the Amsterdam printer Jacob Colom was quite likely responsible.

1645

- Joan Blaeu updates Willem Janszoon Blaeu’s 1619 world map to incorporate Tasman’s charting of the New Zealand coastline.

1648

- Joan Blaeu publishes Tasman’s discoveries in a world map of 20 sheets showing two large hemispheres. Printed in Amsterdam, the map is titled *Nova Totius Terrarum Orbis Tabula*.

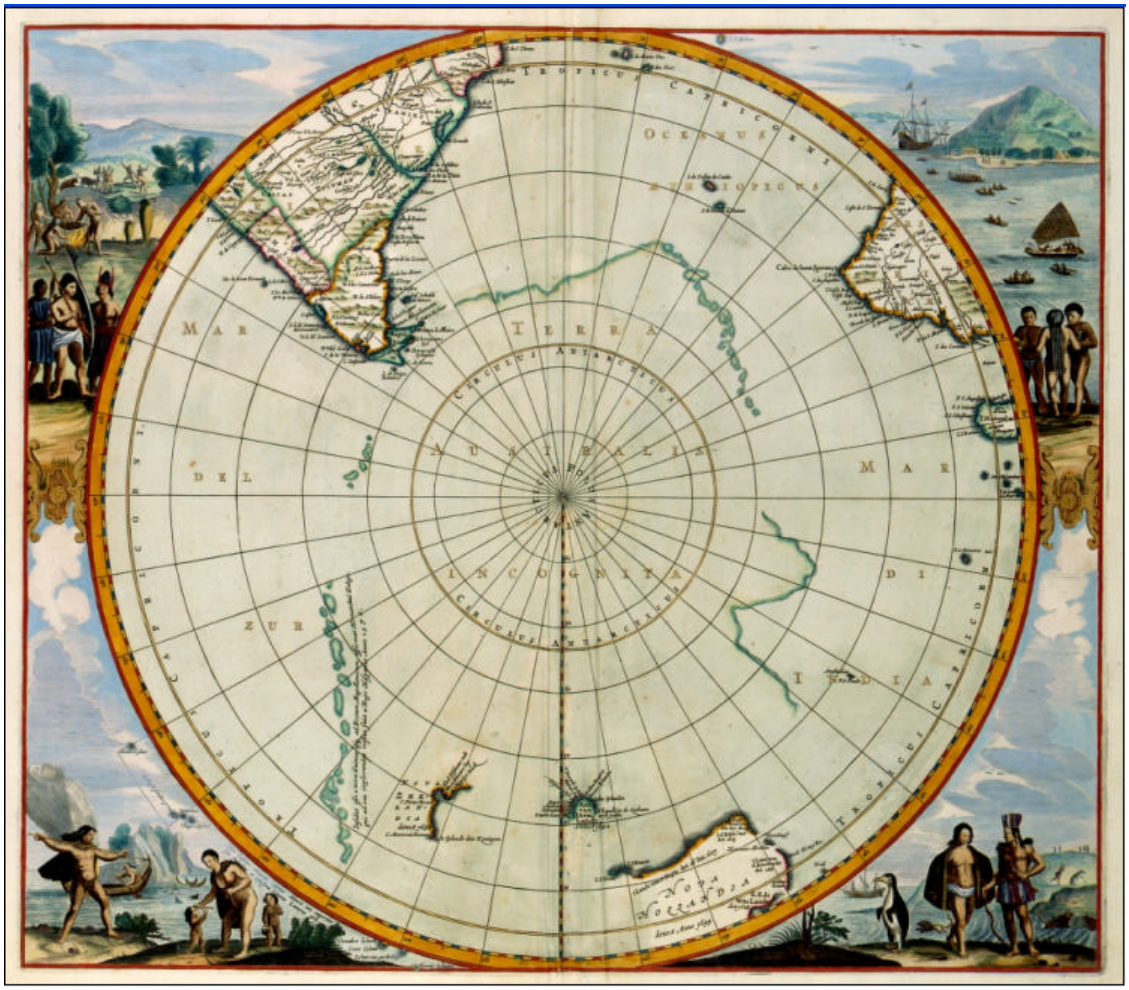
- Possible first use of the name Zeelandia Nova on a map, when Blaeu revises his terrestrial globe.

1663

- Melchisédec Thévenot publishes the first French chart to show Tasman’s discoveries. The chart appears in his *Relations de divers voyages curieux* published in Paris.

1691-1696

- Vincenzo Maria Coronelli publishes his *Atlante Veneto* in Venice, which includes a map showing New Zealand’s western coastline.



Polus Antarcticus (Fourth State) by Henricus Hondius

[Source: Szentirmay-Ross Map Collection - Digital Archive 2005]

1739

- Philippe Bauche, geographer to King Louis XV of France, publishes a map titled *Carte des Terres Australes*, on which Nouvelle Hollande is shown north of and separate from a great Antarctic land mass in two parts, on one of which New Zealand forms a cape.

1744-1748

- The British mercantilist John Campbell, in his *Navigantium atque Itinerantium Bibliotheca: or, a Compleat Collection of Voyages and Travels*, advocates a commercial empire in the South Pacific extending from Juan Fernandez in the east to New Holland in the west, and including the great southern continent Terra Australis Incognita.

1766

- Instructions from the British Admiralty to Captain Samuel Wallis note that "there is reason to believe that Lands, or Islands of great extent, hitherto unvisited by any European power may be found in the Southern hemisphere between Cape Horn and New Zeland, in latitudes convenient for navigation…". Wallis, on board the *Dolphin*, discovers Tahiti.

1769-1770

- James Cook circumnavigates New Zealand and makes a running survey of the coastline. He first makes landfall at Poverty Bay, and sails south to Cape Turnagain before heading north around East Cape, into the Bay of Plenty, and around Cape Colville into the Firth of Thames. He then sails around the northern part of the North Island, down its western coastline and through Cook Strait. Cook continues down the east coast of the South Island, passes south of Stewart Island, and sails up the west coast of the South Island and eastwards to D'Urville Island before heading towards Australia (New Holland).
- Toiawa, a Maori ariki, draws a map of either the northern part of the North Island or the whole of the North Island for James Cook, while the *Endeavour* is at Mercury Bay.

- Jean-François-Marie de Surville, on board the *St Jean-Baptiste*, charts the northern part of the North Island, from Hokianga to Doubtless Bay.

1772-1773

- Marc-Joseph Marion-Dufresne and Julien Crozet, on board *Le* Mascarin, survey the western coast of the North Island and the eastern coast south to the Bay of Islands.

1773

- John Hawkesworth publishes a three volume *Account of the voyages undertaken … for making discoveries in the Southern Hemisphere, and successively performed by Commodore Byron, Captain Wallis, Captain Cartaret, and Captain Cook … drawn up from the journals … Illustrated with cuts, and a great variety of charts and maps.* Although James Cook is unhappy with the publication, it proves to be a best-seller.

1773-1774

- From March through to May 1773 James Cook, on board the *Resolution*, explores and charts Dusky Sound on his second visit to New Zealand. He then sails up the west coast of the South Island to Queen Charlotte Sound to meet Tobias Furneaux on board the *Adventure*. Cook leaves the Sound in June 1773 and sails east and north to Tahiti and returns to Queen Charlotte Sound via the Cook Islands and Tonga. In November 1773 Cook again leaves

Queen Charlotte Sound and sails towards the Southern Ocean and Antarctica, dispelling the myth of the Great Southern Continent. Cook returns to Queen Charlotte Sound in November 1774 before sailing for home.

- Tobias Furneaux anchors at Tolaga Bay in November 1773 before sailing south to Queen Charlotte Sound to meet James Cook.

1777

- James Cook anchors in Queen Charlotte Sound during his third visit to New Zealand.

1778

- Antonio Zatta's atlas *Atlante Novissimo* (published in Venice 1775-1785) includes a plate "La Nuova Zealande", dated 1778, based on Cook's chart of New Zealand.

1781

- Jean-François-Marie de Surville's chart - *Plan de la Baye de Lauriston* - is published, "according to Act of Parliament Sepr. 20th 1781" by Alexander Dalrymple. See also 1804.

1788

- William Bligh discovers the sub-Antarctic Bounty Islands.

1791

- A British expedition under George Vancouver (on board the *Discovery*) surveys parts of Dusky Sound, Fiordland. Vancouver, and William Broughton on board the *Chatham,* both sight the Snares Islands. Broughton discovers Chatham Island and charts its northern coast.

1793

- James Hanson, on board the *Daedalus*, charts the Bay of Islands, while enroute from North America to New South Wales.

- Tuki draws a map of New Zealand in chalk on a floor for Lieutenant-Governor King, after Tuki is kidnapped by James Hanson and taken to Norfolk Island. Tuki later redraws his map on paper using a pencil, and King's clerk, William Chapman, annotates it in ink using comments made by Tuki at the time. The chart is titled *Chart of New Zealand drawn by Tooke-Titter-a-nui Ware-pedo – a priest of that country who resided on Norfolk Island 6 months.* The original is held by the Public Records Office, London.

- Felipe Bauza, a cartographer with a Spanish expedition led by Alessandro Malaspina, charts Doubtful Sound in Fiordland. The visit to Doubtful Sound is part of a scientific expedition into the Pacific, and only nine hours are spent in the Sound.

- Joseph-Antoine Bruny-D'Entrecasteaux surveys the northern coast of the North Island, from Cape Maria van Diemen to North Cape, including Three Kings Islands. The resulting chart is prepared by the hydrographer Charles-François Beautemps-Beaupré.

1795

- Robert Murry on board the sealer *Endeavour*, charts Dusky Bay in Fiordland. The chart has not survived.

1798

- Giovanni Maria Cassini's copy of Cook's chart of New Zealand is published in volume 3 of his *Nuovo Atlante Geografico Universale*.

1800

- Henry Waterhouse on HMS *Reliance* discovers the Antipodes Islands. He names them the Penantipodes Islands, but the name is later corrupted to Antipodes Islands.

1801

- William Wilson, on board the East India Company's Ship *Royal Admiral*, charts much of the Hauraki Gulf and Thames.

1803

- The British Admiralty publishes Chart 748 which includes a number of references to Portuguese discovery of the east coast of New Zealand's North Island. These include "…whose Eastern Coast was known to the Portuguese, about the year 1550"; "Gulf of the Portuguese 1550" – the eastern part of Cook Strait; and "Cabo Fermoso 1550" – East Cape.

1804

- Owen Folger Smith, an American sealer, is the first to chart Foveaux Strait. His discovery is not made public until 1809.

- The British Admiralty issues its first Admiralty chart of a part of New Zealand: *Plan of the Bay of Lauriston on New-Zeland*. The chart is derived from a survey by de Surville, and was earlier published in 1781 by Alexander Dalrymple.

1806

- The Auckland Islands are discovered by Abraham Bristow, on board the British whaling vessel *Ocean.* Bristow is a captain employed by the whaling firm Samuel Enderby and Sons.

1807

- Abraham Bristow, on board the *Sarah*, returns to the Auckland Islands, charts them, and claims them for the British Crown.

- Bruny-D'Entrecasteaux's charts are published by the Dépôt general des cartes et plans de la Marine in Paris, in Charles-François Beautemps-Beaupré's *Atlas du Voyage de Bruny-D'entre-casteaux*.

1809

- Eber Bunker, on board the sealer *Pegasus*, charts Foveaux Strait.

- William Stewart, on board the *Pegasus*, surveys Pegasus Harbour, Codfish Harbour and parts of Foveaux Strait. (This visit was subsequent to the one made by Bunker). Stewart then goes on to chart the Chatham Islands, and to affirm that Banks Peninsula is a peninsula and not an island as Cook had suggested.

1810

- Frederick Hasselburg (sometimes spelt Hasselbough, Hasselborough, or Hazelburgh), master of the *Perseverance*, discovers Campbell Island and names it after his employer, Robert Campbell and Company of Sydney.

1813

- Robert Williams, on board the brig *Perseverance*, charts Bluff Harbour, which he names Port Macquarie.

1814-1815

- John Liddiard Nicholas visits the Bay of Islands on board the *Active*, and meets a Maori ariki named Korra-korra

(Korokoro?) who draws for him on paper a map of the North Island.

1816

- In London a chart of the northern part of the North Island is published in the Church Missionary Society's *Missionary Register.*

- The *Oriental Navigator* (compiled by John Purdy) publishes William Stewart's chart of Port Pegasus, and assigns the name Stewart Island to the island.

1820

- Richard Skinner, master of the naval spar vessel *Dromedary*, charts the Hokianga Harbour.

- James Downie on board HMS *Coromandel* makes a chart of the Firth of Thames.

- George Fairfowl on board the *Dromedary* charts the northern part of the North Island from Doubtless Bay to Cape Brett, and Whangaroa Harbour.

- John Rodolphus Kent, captain of the schooner *Prince Regent*, explores various Northland harbours, as well as the Waitemata Harbour.

- William Gilbert Puckey charts the Kaipara Harbour.

1822

- James Herd surveys the Hokianga Harbour. His findings are later published by the French in the Duperrey Atlas, published between 1826 and 1830.

- William Lawrence Edwardson on board the *Snapper* charts Port William and Codfish Harbour (Stewart Island), Chalky Inlet (Fiordland), and draws a larger chart of the South Island which is included in Duperrey's Atlas.

1823

- John Rodolphus Kent, on board the *Mermaid*, visits a number of South Island harbours, sketching coastal profiles as an aid to navigation. Kent also visits and sketches North Cape on Stewart Island, and various islands in Foveaux Strait.

1824

- Louis-Isidore Duperrey, on board the *Coquille*, charts the Bay of Islands while making a 37 month circumnavigation of the world.

- Jules de Blosseville draws a map of the North Island, dated 1824 (but published 1827), based on information from missionaries and sea captains that shows a mythical Taranaki Bay (Port de Tarranarki) on the south Taranaki coastline. The map is titled *Carte de L'ile Ika-na-Mauwi (Nouvelle-Zélande)*. J.O'C. Ross has argued that de Blosseville, while at Port Jackson (Sydney), obtained a plan of Port Nicholson (Wellington), then known as 'Wanganui a Tara', but knowing only vague details of its location, inserted it in his map of the coastline at the entrance of the Wanganui River (Hooker, 1990). The existence of the bay was not disproved until 1840.

1825

- William White journeys overland from the Hauraki Gulf to the Waikato.

1826

- James Herd, on board the *Rosanna*, and Thomas Barnett, on board the *Lambton*, each separately chart Port Nicholson (Wellington). Both ships are

chartered by the first New Zealand Company.

- James Herd charts Port Otago.

1826-1830

- Louis-Isidore Duperrey's *Voyage autour de monde* is published in Paris by Arthus Bertrand as 9 volumes in 7 plus four atlas volumes.

1827

- The French navigator Jules Sebastien César Dumont d'Urville, on board the *Astrolabe*, surveys the western and northern coasts of the South Island and the eastern coast of the North Island. He also makes a survey of the Waitemata Harbour. Altogether, 13 charts result from this voyage.

- James Herd re-visits Hokianga Harbour, and revises his chart of the area.

1831

- Cyrille Pierre Théodore Laplace, on board the *Favorite*, takes soundings in the Bay of Islands, which are added to later published editions of Duperrey's chart.

- Two missionaries, Henry Williams and Thomas Chapman, journey overland from the Bay of Islands to Rotorua.

1834

- James Wyld in London publishes Thomas McDonnell's chart of New Zealand, with the title "*To the Right Honble. Thos. Spring Rice … This Chart of New Zealand*". A second edition appeared in 1837 and was revised in 1839. A third edition was issued in 1840, and revised the same year, and there were many subsequent reprintings and revisions of the map.

- Whangaroa Harbour is surveyed by Frank A. Cudlip on board HMS *Buffalo*, and by Thomas Woore on board HMS *Alligator*.

- Thomas Woore surveys Port Gore and Port Hardy.

- Missionaries Alfred Nesbit Brown and James Hamlin journey overland from the Kaipara Harbour to Kawhia, Ngaruawahia and the Firth of Thames.

- Thomas Florance, possibly the first professional surveyor to settle in New Zealand, makes a number of surveys of small blocks of land around the Bay of Islands that have been privately purchased from Maori.

1835

- Thomas Wing, on board the *Fanny*, charts Tauranga Harbour.

1836

- Thomas Wing, on board the *Fanny*, charts the approaches to the Manukau Harbour. He also charts Raglan (Whaingaroa), Kawhia and Kaipara Harbours.

- Frank A. Cudlip, on board HMS *Buffalo*, surveys Whangaroa Harbour and Mahurangi Harbour.

- James Lawreston and Thomas McDonnell make a running sketch of Kaipara Harbour.

1837

- Thomas Wing, on board the *Trent*, charts Port Ahuriri (Napier) and the coast as far north as Tolaga Bay.

- David Craigie, on board HMS *Pelorus*, produces the first plan of Pelorus Sound, Marlborough.

- George Johnson, on board HMS *Conway*, surveys Port Underwood, Marlborough.

- N.C. Phillips, on board HMS *Buffalo*, surveys Tutukaka Harbour.

- William Turner and William Veale on board the barque *Achilles* chart the Kaipara Harbour.

1837-1839

- Sometime between these two dates Tirarau draws a chart of the Kaipara for James Busby. The chart shows the main rivers and the location of kauri forests.

1838

- Surveys of Waitangi and Whangaroa Bay in the Chatham Islands are undertaken by the crew of the *Heroine*, captained by Jean-Baptiste Médée Cécille.

- Joseph Marie Martial Fournier, on board the *Heroine,* draws a chart of Lyttelton Harbour and Port Levy. He also charts Akaroa Harbour, Waitangi and Whangaroa Bays on Chatham Island, and the Bay of Islands before the *Heroine* leaves New Zealand waters.

- Urbain Dortet de l'Espigarie de Tessan, on board the *Vénus* (captained by Abel Aubert Dupetit-Thouars)**,** surveys the Bay of Islands. The chart is published in 1845.

- William Cornwallis Symonds makes a running survey of the Kaipara Harbour.

- The Society for the Diffusion of Useful Knowledge publishes a chart of "*The Islands of New Zealand*".

- While searching for new sealing grounds, John Balleny and Thomas Freeman discover the sub-Antarctic Balleny Islands.

1839

- William Mein Smith is appointed Surveyor-General to the New Zealand Company. At the time of his appointment Smith holds the position of Master of Plan Drawing at the Royal Military Academy, Woolwich.

- Edward Main Chaffers charts Port Nicholson and Tory Channel.

- C.E. Forsythe, on board *Pelorus*, completes a chart of the Bay of Islands.

- Henry Williams journeys overland from Otaki to Tauranga via the Rangitkei and Wanganui Rivers and Lakes Taupo and Rotorua.

- James Buller journeys from Kaipara to Port Nicholson.

- The botanist and explorer John Carne Bidwill journeys from Tauranga to Rotorua and on to Lake Taupo and Ngauruhoe, which he ascends.

- Raphael Clint, a lithographer in Sydney, publishes a map of Auckland titled *Plan of the SW side of the Firth of Thames.* This is a copy of a map published in London by J.W. Norrie in or before 1838, derived from a survey of the Waitemata Harbour carried out by John Rodolphus Kent on the *Prince Regent* in 1820.

1840

- A Royal Charter and its incorporated Instructions are forwarded by the Marquis of Normanby, Secretary of State for War and the Colonies, to Captain William Hobson, the Governor designate. Article 37 deals with the management of waste lands and with surveying, and authorises "a survey to be made"; for the land to be subdivided into counties, hundreds and parishes; and for the recording of all surveyed lands on charts for public inspection.

- Felton Mathew, of the Survey Department of New South Wales, is provided by Governor George Gipps to William Hobson as a provisional Surveyor-General for New Zealand. Mathew is accompanied by only one assistant surveyor when he arrives in New Zealand, J.J. Galloway. Galloway returns to Sydney after a few months because of ill health.

- Jules-Sébastien César Dumont d'Urville, on board the *Astrolabe*, surveys the eastern entrance to Foveaux Strait, and the eastern coastline of the South Island as far north as Cape Campbell. He also charts the harbour at Tauranga before returning to the Bay of Islands. The charts from this voyage are published in Dumont d'Urville's *Voyage au Pole Sud … Atlas Hydrographique*, published in Paris by the Dépôt-général de la Marine in 1847.

- Edward Main Chaffers surveys the Kaipara Harbour.

- Peter Fisher and Peter Bean, assisted by Thomas Bowen, on board the *Herald*, survey the Waitemata Harbour.

- Charles Robertson, on board the *Samuel Winter*, charts Cloudy Bay and Port Underwood, Marlborough.

- Frederic Alonzo Carrington is appointed chief surveyor by the Plymouth Company and is sent to New Zealand to find a suitable site for a settlement.

- Owen Stanley and J.S. Hill, on board HMS *Britomart*, survey Akaroa Harbour and Pigeon Bay in the South Island, and Waitemata Harbour in the North Island.

- Octavius Hadfield walks from Otaki to Cape Egmont.

- Edward Jerningham Wakefield journeys from Port Nicholson to Patea (mostly overland but by canoe at sea from Waikanae to the mouth of the Whangaehu River).

- A party led by Robert Park and including the surveyor Robert Stokes, Edward Jerningham Wakefield (an agent and explorer for the New Zealand Company), William Deans (an agricultural expert and a surveyor's labourer), and the artist Charles Heaphy, surveys the Porirua-Taranaki coastal region.

- Wellington Carrington lays out part of the township of Petre (Wanganui).

- William Mein Smith commences to lay out Britannia on the site of the present Petone, but floods cause him to move to the present site of Wellington.

- Robert Stokes begins the survey of the Hutt Valley.

- Felton Mathew, on board the cutter *Ranger*, examines various harbours and inlets between the Bay of Islands and the Firth of Thames while searching for a suitable site to locate the capital of New Zealand.

- Felton Mathew submits his plan for the laying out of Auckland. Mathew is forced to work alone, with no survey assistants, draughtsman or clerk, and with inferior instruments.

- Robert Kearsley Dawson's *Report on surveying; considered with reference to New Zealand, and applicable to the colonies generally*, is published in London by Her Majesty's Stationery Office. (Dawson had earlier been employed by the New Zealand Company as an adviser on surveying methods, and he advocated a running survey methodology. One of his detractors was William Mein Smith, the Surveyor-General of the New Zealand Company).

- The British Antarctic Expedition, led by Sir James Clark Ross, visits various

sub-Antarctic islands. Ross charts Rendezvous Harbour (later renamed Port Ross) on Auckland Island. John Edward Davis, second master on H.M.S. *Terror*, charts Preservation Harbour on Campbell Island.

1840-41

- Johann Karl Ernst Dieffenbach surveys the Chatham Islands, and the resulting map is published by the Royal Geographical Society in London. While at the Chatham Islands, a Maori named E Mare draws an accurate chart of the island for him.

- William Colenso journeys through the Urewera country to Rotorua, then on to Matamata and through the Waikato to the Manukau Harbour and on to the Kaipara Harbour before reaching the Bay of Islands.

- The first use in New Zealand of triangulation for surveying purposes is made by Felton Mathew, around Auckland.

1841

- Charles Waybrow Ligar is Surveyor General from February 1841 until the duties he performs are taken over by the Provincial Chief Surveyors under the Constitution Act of 1853.

- The Land Registration Ordinance 1841 states that "there shall be deposited in the Register Office of every county or district maps of all the lands which shall from time to time be surveyed…which maps shall be signed by the Surveyor-general of the Colony, and by the Registrar", thus establishing the Lands and Deeds Register.

- Felton Mathew lays out the town of Russell in the Bay of Islands, and Auckland. His plan for Auckland largely fails to come to fruition, although his vision for Queen Street does.

- William Mein Smith surveys the site of Wellington.

- Samuel Charles Brees replaces William Mein Smith as the chief surveyor for the New Zealand Company, although Smith continues to do some survey work for the Company. Whereas Smith carried the title "Surveyor-General", Brees is given the title "Principal Surveyor and Engineer at the New Zealand Company Settlement of Wellington".

- James Wyld publishes a map titled *The Islands of New Zealand, from the Admiralty Surveys…* Revised editions are published in 1841, 1842, 1843, and subsequently.

- Frederick Tuckett is appointed the principal surveyor and civil engineer of the New Zealand Company settlement at Nelson.

- Charles Heaphy and Frederick Tuckett explore the banks of the Waimea River.

- Frederick Alonzo Carrington is appointed Chief Surveyor, Taranaki, and holds this position until 1844. He lays out the town of New Plymouth.

- Robert Stokes, New Zealand Company surveyor, and a party of five, cross from the Hutt Valley over the Rimutaka Range into the Wairarapa.

- A map of the South Island and Stewart Island is drawn by a small group of Otago Maori for Edmund Storr Halswell, Commissioner of Native Reserves for the New Zealand Company. The map was later published in the *Appendix to the Journals of the House of Representatives*, C-1, 1894.

- William Cornwallis Symonds, Ensign Abel Doffin William Best and Johann Karl Ernst Dieffenbach travel from

Auckland to Onehunga and down the west coast to Raglan and Kawhia, on to Te Awamutu, Mangakino and Taupo. The surveyor Joseph Merrett accompanies the party from Te Awamutu to Taupo. Symonds maps and records the land as they travel.

- Robert Park resigns from his position with the New Zealand Company to become the first Town Surveyor at Wellington.

- Johann Karl Ernst Dieffenbach's contract with the New Zealand Company expires, and although he offers to complete a thorough survey of the North Island his offer is rejected. Dieffenbach therefore returns to England.

- William Mein Smith, accompanied by F.A. Molesworth and Samuel Revans, undertakes an exploratory survey of the lower Manawatu River.

1841-1842

- Frederick Tuckett surveys the town site for Nelson, and explores the coastline as far as the Whanganui Inlet.

1842

- The Surveyor-General's office at Auckland is destroyed by fire, with the loss of all the plans and documents that it contains.

- Jules-Sébastien-César Dumont d'Urville's *Carte générale de la Nouvelle Zélande* is published in Paris.

- Charles Heaphy charts Nelson Harbour for the New Zealand Company.

- Charles Henry Kettle, Alfred Wills and five survey hands travel through the Manawatu Gorge, proceed south to explore the southern Wairarapa, and cross the Rimutaka Range to reach Wellington.

- William Mein Smith surveys the Chatham Islands, and the eastern ports of Stewart Island and the South Island. Most of his charts subsequently are lost when the cutter *Brothers*, on which he is a passenger, capsizes at Akaroa.

- Joseph Thomas and Frederick A. Sheppard survey and lay out the town of Wanganui.

- The surveyor John Sylvanus Cotterell, accompanied by Richard Peanter, journeys up the Motueka River to Tophouse and continues on to Lake Rotoiti.

- The first Deeds Registry Office, in Auckland, is established, as authorised by the Deeds Registration Ordinance of 1841.

1843

- Auguste Bérard on board the *Rhin* charts Banks Peninsula.

- The surveyors R. J. Harrison (see note 2) and Robinson travel up the Wanganui River to Taupo and cross over to Kawhia. The trip is made without any surveying instruments,

- The "Wairau Massacre" occurs after Te Rauparaha and Rangihaeata remove surveyors' pegs in the Wairau Valley. The surveyor John Sylvanus Cotterell loses his life during the incident.

- Frederick Tuckett makes a reconnaissance survey of eastern Otago.

- Alcide D'Orbigny's *Voyage dans l'Amerique Méridionale*, published by Pitois-Levrault in Paris, includes a geological map of the South Pacific, including New Zealand, and is probably the first geological map of New Zealand to appear.

- Te Heuheu Tukino II draws for Bishop George Augustus Selwyn a map on the

ground, showing the southern North Island.

- Hone Tuhawaiki draws maps of parts of Fiordland for Edward Shortland. These maps are later published in Shortland's *The Southern Districts of New Zealand* (London, 1851).

- Samuel Charles Brees, the New Zealand Company's chief surveyor, crosses the Rimutaka Range to make a reconnaissance survey of the lower Wairarapa before returning along the coastline to Wellington.

- Henry Stokes Tiffen surveys the Lake Wairarapa area for the New Zealand Company. While there, an unnamed Maori draws a sketch map of the area which Tiffen copies into his field book.

- Charles Heaphy, J.S. Spooner, and a small party, explore the country between Lake Rotoiti and the West Coast.

- The British Admiralty appoints Alexander Burns Usborne as Marine Surveyor in New Zealand. Usborne sails to New Zealand, but returns almost immediately because of the pain associated with a severe wound received in 1838.

- Lord Stanley, British Secretary of State for the Colonies, advises the Admiralty of the need to station a naval vessel in New Zealand waters, and of the need to conduct a coastal survey.

1843-1844

- William Colenso, a printer, missionary, naturalist and explorer, makes the longest of his journies when he travels from Hicks Bay south to Castlepoint and then walks north to Ahuriri in Hawkes Bay, to select a site for a mission station. He moves to Wairoa before travelling overland to Lake Waikaremoana and through the Urewera country to Tauranga and on to Otahuhu and the Kaipara.

1844

- Frederick Tuckett resigns as principal surveyor for the Nelson settlement, and decides to return to England. He accepts a position as principal surveyor and agent to select a site for the projected New Edinburgh settlement. As a consequence, Tuckett and a party comprising two assistant surveyors and five boatmen and survey hands sail from Port Nicholson (Wellington) to Banks Peninsula. Tuckett crosses the plains as far as the Waimakariri River before returning to his schooner and sailing south to Otago. From the mouth of the Taieri River Tuckett walks overland to the Clutha River before rejoining his ship and travelling as far as Stewart Island. On the return journey Tuckett and others walk overland from the mouth of the Clutha to Otago Harbour. Tuckett decides that the Otago Harbour is the best site for New Edinburgh.

- Thomas Wing, accompanied by Frederick Tuckett, surveys Bluff and the New River. Wing also surveys the coast from the Catlins to the eastern approaches to Foveaux Strait, and produces a complete chart of Stewart Island.

- Edward Shortland, Protector of the Aborigines, in the course of walking from Waikouaiti to Akaroa, meets Huruhuru and six other Maoris on the bank of the Waitaki River. Huruhuru draws a map for Shortland to show the route to the interior of Otago, sketching for the first time access to Lakes Hawea, Wanaka and Wakatipu, and the route to the West Coast. Shortland included Huruhuru's map in his *The Southern Districts of New Zealand*, published in London in 1851.

- Thomas Henry Fitzgerald is appointed by the Government Survey Office to be Assistant-Surveyor at Wellington. His first task is to survey all the pa, cultivations and other sites around Port Nicholson reserved to the Maori.

- William Spain, the Land Commissioner, authorises New Zealand Company and Crown surveyors together to cut an external boundary around Wellington enclosing the 68,000 acres of the Company's land. When completed, the boundary is found to enclose 209, 372 acres.

- Alfred Laurence Halloran, on board HMS *Osprey*, surveys Whangaroa and Mangonui Harbours.

- Augustus Octavius Croker Carrington is appointed Chief Surveyor in Taranaki. He becomes Provincial Surveyor in 1853 and holds this position until 1870.

- William Heaphy commences his overland journey from Otago to Nelson, reaching Riccarton before being thwarted in his attempt.

- John Wallis Barnicoat surveys the Motueka and Takaka districts.

- The surveyor Joseph Thomas, accompanied by settler Henry Shafto Harrison travels overland from Wellington via the Wairarapa and Hawkes Bay to the whaling station at Mahia Peninsula. The resulting map is attached to the *New Zealand Journal* of 5 November 1845. Henry Shafto Harrison makes an exploration down the Manawatu River in the same year.

1845

- J.G. Nops surveys Whangaruru Harbour.

- George Owen Ormsby surveys Manukau Harbour.

- William Davison makes a detailed survey of Otago Harbour for the New Zealand Company.

- Donald McLean journeys overland from New Plymouth to Kawhia and Taupo before returning via the Wanganui River.

- Charles Henry Kettle returns to New Zealand to head the survey for the new Otago settlement.

- Samuel Charles Brees, Principal Surveyor for the New Zealand Company, departs from Wellington for England, after an acrimonious exchange with William Hayward Wakefield and other Company officials. (Wakefield had earlier quarrelled with William Mein Smith.) Brees is replaced by Alfred Wills, one of the survey cadets brought out to New Zealand by Brees in 1842, who becomes "Officer in Charge of the Survey Office".

1846

- The New Zealand Government Act divides New Zealand into two provinces. The Surveyor-General in Auckland regulates the surveys of New Ulster, and the Chief Surveyor of the New Zealand Company, located in Wellington, regulates the surveys of New Munster. The Act makes provision for the establishment of a Land Registry for the purpose of registering title and a Land Court to investigate titles to land. The Act also makes provision for the regulating of land surveys.

- In February and March Thomas Brunner, William Fox, Charles Heaphy and the Maori guide E Kehu, travel from Nelson to Lake Roto-iti and on to the Buller valley near Murchison.

- In March Brunner, Heaphy and E Kehu journey from Nelson by sea to the Aorere, then cross overland to the West Haven Inlet and on to the mouth of the

Arahura River before returning to Nelson.

- Charles Heaphy surveys the coastline from Hokitika to Nelson.

- The Surveyor-General Charles Waybrow Ligar and the surveyor William Bertram White travel by foot from Wellington to Auckland.

- William Colenso journeys overland from Wellington to the Manawatu, and passes through the Manawatu Gorge to the Seventy Mile Bush.

- Charles Henry Kettle travels from Port Chalmers to Nuggets via Taieri and the Tokomairiro Plains. His surveys represent the first extensive use of trigonometrical work in New Zealand.

- David Lewis replaces Alfred Wills as Principal Surveyor for the New Zealand Company.

1846-1848

- Thomas Brunner and the Maori guides E Kehu and Epikiwati journey from Nelson via Lake Rotoroa down the Buller River and south to Okarito and Tititira Point. They return via the Grey, Inangahua and Buller River valleys to the Motueka Plains.

1847

- William Colenso and his Maori guides cross the Ruahine Ranges. (Colenso had previously attempted the crossing in 1845, but on that occasion was not successful).

- The Colonial Secretary and Charles Waybrow Ligar, Surveyor-General, decide that in future official surveys in the Colony will be conducted by means of a trigonometrical system. These are to be detached minor triangulations, rather than a comprehensive colony-wide triangulation, but with a hope that the minor triangulations can be brought within a regulatory set of major triangles at some future date.

1848

- Walter Baldock Durrant Mantell journeys inland from Kaiapoi to Dunedin. In his sketchbook are maps drawn in pencil by Te Ware Korari.

- Charles Henry Kettle surveys the town of Dunedin. The main streets are laid out at a bearing of 21° 39' 42", (magnetic north at the time of settlement).

- Joseph Thomas is appointed Chief Surveyor for the Canterbury Association. Thomas, Charles Obins Torlesse and Thomas Cass land at Port Cooper to select a site for the Canterbury settlement.

- Arthur Whitehead's *A Treatise on practical surveying, as particularly applicable to New Zealand and other colonies* is published in London by Longman and Co. Patterson (1984) notes that Whitehead's *Treatise* becomes "required reading for surveyors contemplating a removal to the New Zealand settlements".

- William Budge makes a survey of the delta of the Wairau River, where Blenheim is now situated.

- Donald McLean, with the surveyors Alfred Wills and John White, survey the boundaries of Maori and European land around Wanganui.

1848-1855

- *Acheron* and *Pandora* hydrographic survey of the New Zealand coastline. More than 45 charts are published following this survey. *Acheron*, under the command of John Lort Stokes, arrives in New Zealand waters in 1848, and her crew chart the Waitemata

Harbour and Hauraki Gulf before sailing south to Wellington, Akaroa and Otago. A survey of Cook Strait follows. In early 1850 *Acheron* is surveying around the southern South Island, then in Cook Strait again before heading north along the west coast of the North Island. Later in 1850 she returns to Foveaux Strait and Fiordland, before returning to Wellington in May 1851. Stokes surveys 4300 miles of the New Zealand coastline. *Pandora*, under the command of Byron Drury, arrives in New Zealand waters in September 1851 to replace *Acheron*, and surveys the Hokianga, Kaipara and Manukau Harbours. By 1855, when her survey work is complete, the west and north coast of the North Island, from New Plymouth to Doubtless Bay, as well as Pelorus Sound in Marlborough, have been charted by her crew.

1849

- William John Warburton Hamilton surveys inland Canterbury.

- Joseph Thomas, Alfred Wills and Walter Baldock Durrant Mantell complete a topographical survey of the Canterbury Plains westward of Lake Ellesmere and southwards to the Ashburton River.

- A base line of 20,469 links is measured on the Canterbury Plains near Riccarton, and a small triangulation of 2 to 3 miles is carried out northwards towards Oxford and southwards towards the Rakaia River.

- Joseph Thomas is appointed Chief Surveyor for Canterbury, and holds this position until 1851.

- Charles Obins Torlesse explores the Canterbury Plain, as far south as the Waihao River, looking for coal deposits and timber. Towards the end of the year Torlesse makes a survey of the Mandeville district, the coastal area of Canterbury between the Ashley and Waimakariri Rivers.

- Robert Park is appointed "Principal Surveyor to the Wellington Settlement" by the New Zealand Company.

- Felix Wakefield's C*olonial surveying: with a view to disposal of waste lands*, is published by John W. Parker, London, as a report to the New Zealand Company. Wakefield's ideas are accepted by the New Zealand Company as a remedy for the sad state of the surveys in most of the Company's settlements. Wakefield's ideas are opposed by Robert Park (see above), and they come to nothing.

1849-1850

- Joseph Thomas and Edward Jollie lay out the town of Christchurch.

1850

- The Colonial Government assumes control of the New Zealand Company's surveying operations.

- Frederick Aloysius Weld and C. Wilkinson journey up the Awatere River, and across the Barefell Pass to the Acheron River.

- William M. Mitchell and Edwin Dashwood journey into northern Canterbury via the Waihopai, Awatere, Acheron and Clarence Rivers. They fail to make a sketch of the country they pass through.

- William John Warburton Hamilton, and Lieutenant Richard Spencer of HMS *Acheron,* journey overland from Bluff to Dunedin.

- Charles Obins Torlesse and John Cowell Boys survey the Ashley and Oxford districts of Canterbury.

- Thomas Cass surveys the Lincoln and Ellesmere districts of Canterbury.

- Towards the end of the year the surveying activities of the Canterbury Association are suspended because of financial difficulties.

1851

- Thomas Brunner is appointed Surveyor of Crown Lands in Nelson.

- Charles Henry Kettle makes a reconnaissance survey from Waikouaiti to the Strath Taieri Plains.

- Thomas Cass is appointed Chief Surveyor for Canterbury and holds this position until 1867.

- Robert Park surveys land at Ahuriri, Hawke's Bay, prior to its purchase for settlement purposes.

- Mark Pringle Stoddart explores the Upper Rakaia and Lake Coleridge region.

- Edward Shortland's *Southern Districts of New Zealand* is published. It includes maps of some of the southern portions of the South Island and Stewart Island drawn by Hone Tuhawaiki, a Ngai Tahu ariki, and by Huruhuru.

- Charles James Nairn and Charles Johnson Pharazyn journey from Clutha to Tuturau in Otago.

1851-1852

- Walter Baldock Durrant Mantell journeys overland from Dunedin to the site of the future city of Invercargill. He and W.H. Stephen journey on to Riverton.

1852

- As a consequence of the introduction of provincial governments, six provincial survey departments are established - Auckland, New Plymouth (renamed Taranaki in 1858), Wellington, Nelson, Canterbury and Otago. The specific powers of the Surveyor-General are vested in a District Land Registrar, a Commissioner of Crown Lands, and a Chief Surveyor for each province. The New Munster Survey Office legally ceases to exist.

- Charles James Nairn and W.H. Stephen journey from Invercargill to Lakes Te Anau and Manapouri.

- Charles Henry Kettle is appointed Chief Surveyor, Otago. He holds this position until his resignation in1854. He makes a survey of the "native reserves" in Southland, at Tuturau, Oue, Omaui, Riverton, Colac Bay, Wakaputaputa and Pahi.

1853

- Michael Fitzgerald replaces Thomas Henry Fitzgerald as Surveyor in Charge of the Survey Office, Wellington.

- Augustus Octavius Croker Carrington is appointed Provincial Surveyor for New Plymouth Province.

- William Mein Smith is appointed "Surveyor in Charge at Wairarapa".

- Nathaniel Chalmers journeys up the Mataura River to central Otago and then goes on to Wanaka and Hawea via the Clutha River.

- Thomas Fitzgerald plans the town of Napier, under the supervision of Alfred Domett, Commissioner of Crown Lands at Napier.

1853-1876

- The design and construction of roads in New Zealand is the responsibility of the survey departments of the individual provinces.

1854

- William Bedlington lays out a settlement for the Nova Scotians at Waipu.

- Thomas Cass selects the town site for Timaru. The site is surveyed by Samuel Hewlings, who lays out the southern part of the town in 1856. At the same time the northern part of the town is laid out by Edwin Lough.

- Walter Baldock Durrant Mantell and a party of run-seekers travel overland from Dunedin to Bluff.

- Michael Fitzgerald resurveys and extends the town of Napier.

- Henry Mangles Denham, on board H.M.S. *Herald*, makes a survey of Raoul Island in the Kermadec group.

- George Swainson commences surveying work in the Rangitikei district of the southern North Island.

1854-1855

- William Mein Smith surveys parts of the Wairarapa, including the Small Farm settlements, a full coastal survey from Lake Ferry to Castle Point, a survey of the township of Featherston for the Provincial Council, the Wharekaka Plains east of Lake Wairarapa, and the block between the Turanganui, Lake Onoke and the coast.

- William Mein Smith establishes the boundaries for the settlement of Greytown in the Wairarapa, and a chain and prismatic survey of the site is made by William Corbett. The survey is completed by James Hughes in 1855.

1855

- Peter Proudfoot is appointed Chief Surveyor, Otago Province, and holds this position until 1856.

- Theophilus Heale is appointed Chief Surveyor, Southland Province. He holds this position until 1863.

- Cormac Patrick O'Rafferty is appointed Provincial Surveyor for Auckland.

- Charles Edward Douglas and Gerhard Mueller explore the Arawata River.

- Walter Henry Pearson, James and William Saunders, and Peter M. Napier explore the Maniototo Plains.

- Frederick Aloysius Weld is commissioned by the Nelson Provincial Government to find a more direct route between Nelson and Christchurch. Weld does this, finding a connection via Tophouse and the Acheron track to Canterbury, discovering Lake Tennyson and exploring the headwaters of the Waiau River.

- Thomas Cass, Cyrus Davie and John Cowell Boys lay out the township of Kaiapoi.

- A major earthquake hits Wellington, destroying the building in which the Survey Office is housed and badly damaging the Province's plan records system.

1856

- John Turnbull Thomson is appointed Chief Surveyor, Otago Province, and holds this position until 1873. He introduces a number of meridional circuits for the control of surveys in Otago.

- John Turnbull Thomson travels overland from Dunedin to the present site of Invercargill.

- Peter Proudfoot and Alexander Garvie initiate the laying out of the towns of Bluff and Invercargill. The work is completed by J.T. Thomson because of Proudfoot's ill health.

Kaipara Harbour, surveyed by Comr. B. Drury, and the officers of H.M.S. Pandora, 1852. London: Hydrographic Office of the Admiralty, 1858.

[Source: Auckland City Libraries, NZ Map No. 2560]

- The township of Blenheim is laid out by Alfred Dobson.

- The British Admiralty publishes the first edition of the *New Zealand Pilot.* The *Pilot* is edited by George Henry Richards and Frederick John Evans, and is based on the *Acheron* and *Pandora* surveys.

- Alexander Garvie journeys to the upper end of the Dunstan Gorge in central Otago.

- The Ngai Tahu ariki, Reko, draws for John Chubbin a map in the sand showing the course of the Matuara River, with streams being represented by hollows and mountains by little mounds of sand. Later in the year Chubbin and his party travel up the Mataura Valley to the Kingston Arm of Lake Wakatipu. Reko also draws a map for John Turnbull Thomson of the southern South Island. This map is of the route which Reko walked in 1831 from Kaiapoi pa (following Te Rauparaha's raid) and Tuturau. It was sketched on the floor and included identification of the pass that Thomson later named Lindis.

- Robert Park is appointed Chief Surveyor for Wellington Province.

- Thomas Brunner is appointed Chief Surveyor for Nelson Province.

- Charles Heaphy is appointed Chief Surveyor for Auckland Province.

- Colonel Thomas R. Mould, officer in command of the Royal Engineer Contingent at Auckland, and a veteran of the Ordnance Survey of Ireland, proposes to Governor Gore-Browne that a primary triangulation of New Zealand be undertaken under the supervision of the General Government. Although the Governor supports the proposal, central government is less enthusiastic, and the provincial governments are likewise unenthused.

1857

- Charles Waybrow Ligar resigns as Surveyor-General. Cormac Patrick O'Rafferty possibly acts in this capacity for a short while.

- Edward Dobson, accompanied by the settlers Henry Taylor and George Mason, journeys up the Hurunui River and over Harper Pass to the upper Taramakau River.

- Gerhard Mueller explores the Landsborough tributary of the Haast River.

- John Turnbull Thomson makes a reconnaissance survey of Southland, and establishes a base-line for his triangulation survey of Southland.

- John Tiffen Stewart maps the Manawatu River from the sea to the Manawatu Gorge, and the tributary rivers that flow into the Manawatu River.

1857-1858

- John Turnbull Thomson makes a reconnaissance survey of central and northern Otago using information given to him by Reko. Thomson explores the Waiau, Aparima, Oreti, and Mataura Rivers to their sources, as well as following the Waitaki River to its source and discovering the Lindis Pass, which he traverses. He also comes upon the sources of the Clutha in Lakes Wanaka and Hawea.

- Alexander Garvie makes a reconnaissance survey of the southeastern parts of Otago.

1858

- Ferdinand Hochstetter and Julius Haast arrive in New Zealand.

- Charles Heaphy is appointed Chief Surveyor for Auckland Province.

- Alexander Garvie is sent by John Turnbull Thomson to make a reconnaissance survey of parts of central Otago.

- Robert Torrens travels to New Zealand to advocate the adoption of his system of land registration.

- Stephenson Percy Smith, accompanied by Arthur Standish, Fred Murray and J.S. McKellor, walks from Mokau to Taupo and on to the Rotorua lakes, thence back to Taupo and south to Wanganui before returning to New Plymouth.

- John Tiffen Stewart surveys blocks of land in the Manawatu, as a prelude to their purchase by the Government.

1858-1859

- Edward Jollie and William Spearman Young plot the boundary between Otago and Canterbury.

1858-1862

- Samuel Hewlings, at times assisted by Edward Jollie, Charles Shaw and Robert Townsend, conducts a survey for settlement purposes in south Canterbury, and carries out triangulation and topographical surveys to define grazing runs.

1859

- The New Zealand Government requests the loan of a geologist from a visiting Austrian scientific expedition on board the *Novara*, to investigate coal deposits at Drury south of Auckland. Ferdinand Hochstetter undertakes the work, and is persuaded to stay on after the expedition leaves New Zealand. He and Julius Haast travel up the Waikato and Waipa Rivers, visit Raglan and the Aotea and Kawhia Harbours and journey across to Lake Taupo, Rotorua, Maketu, Tauranga, Hamilton and back to Auckland. Hochstetter and Haast then travel to Nelson to examine various mineral and coal deposits.

- Ferdinand Hochstetter and Charles Heaphy make a geological survey of the area adjacent to Auckland and the North Island thermal areas.

- John Turnbull Thomson introduces into Otago a survey system for title purposes based on Section, Block and District.

- William Gilbert Rees and his party journey from Oamaru to Wanaka and Queenstown.

- John Rochfort surveys the boundary between the provinces of Nelson and Canterbury.

- An “exploring committee” determines that coal deposits at Drury, south of Auckland, are abundant, and that no serious engineering difficulties exist to prevent the construction of a railway or tramway from Drury to Auckland.

- Cyrus Goulter is appointed Chief Surveyor, Marlborough Province.

1859-1860

- James Mackay seeks a direct route from Nelson to the Grey River mouth, and from Lake Rotoroa travels down the Buller to the Maruia Springs Junction before crossing to the Grey River and continuing south to Okarito and Bruce Bay. His return journey is via the Heaphy River and the Aorere River to Collingwood.

1859-1864

- Stephenson Percy Smith makes eight journeys in the Kaipara district, during which he is involved in surveying for land purchase by the Government. Notable surveys were those of the extensive Waioneke and Tauhoa blocks.

1860

- Christopher William Richmond, Native Minister, instructs Robert Parris, a land purchase agent, to survey land at Waitara so that the Government can complete the purchase of the Waitara Block. The survey is commenced by Augustus Octavius Croker Carrington, accompanied by Parris, but interrupted by a party of Maori who pull out the surveyor's pegs and jostle the survey party. This leads to the imposition of martial law, and becomes a stepping stone to the New Zealand Wars of the 1860s.

- Crown Grant Record Maps for Otago are prepared by John Reid of the Otago survey staff. The purpose of the maps is to provide an authentic groundwork of all titles to land, and to provide in the future for the preservation of land titles.

- Julius Haast makes a topographical and geological survey of the western parts of Nelson Province.

- William Thomas Locke Travers, Christopher Maling and Henry Lewis become the first Europeans to travel through the Lewis Pass.

- Alfred Dobson is appointed Chief Surveyor, Marlborough Province, and holds this position until 1862.

- Alphonse J. Barrington leads a party of gold prospectors on an expedition in South Westland between the Hollyford and Arawata Rivers.

- Samuel Butler explores the headwaters of the major Canterbury Rivers and sights, but does not cross, what is later known as Arthur's Pass.

- James Mackay explores and opens a direct route between Nelson and Greymouth.

- William Gilbert Rees and Paul von Tunzelmann reach Lake Wakatipu.

- Arthur Dudley Dobson makes a survey of Lyttelton Harbour.

- Arthur Dudley Dobson and John Henry Whitcombe survey the upper waters of the Hurunui River and Lake Sumner. They also lay out roads through the Weka Pass, over the Waikari Plains and up the Blyth and Greta Rivers to the Omihi Valley.

- Edwin Fairburn lays out the township of Oamaru.

- The Land Registry Act is passed, but proves to be a failure.

- Robert Park is dismissed as Chief Surveyor, Wellington Province, and is replaced by George Swainson.

1861

- John Holland Baker and E. Owen explore central Otago, around Lakes Tekapo, Ohau and Wanaka.

- John Rochfort journeys up the Grey, Ahaura and Waiheke Rivers and crosses the divide to reach a tributary of the Waiau River.

- Julius Haast is appointed provincial geologist in Canterbury. His first task is to explore the mineral potential of Canterbury, and he begins a geological survey of Canterbury's rivers.

- Julius Haast surveys and maps the geology of the Clent Hills and Mount Somers districts in Canterbury. He conducts further surveys in 1864 and 1873 before publishing his findings in the *Reports of Geological Explorations during 1873-4* (published 1877).

- William Skeet explores a route from Whangapeka to Karamea.

- James Hector is appointed as Provincial Geologist by the Otago Provincial Government, on the

Watercolour showing John Turnbull Thomson taking observations from the summit of Mid Dome. Behind Thomson is his assistant, Lindsay, feeling the cold.

[Source: Hocken Library]

recommendation of Roderick Murchison, Director of the British Geological Survey. The appointment is for three years. He takes up the position in 1862, and is given the task of drawing a geological map of the whole province.

- Samuel Butler and John Holland Baker cross the Whitcombe Pass, Southern Alps.

- The Survey Correction Act is passed, to deal with discrepancies between true measurements and the descriptions on the Crown Grants.

- John Turnbull Thomson's *An Outline of the principles and details connected with the colonial survey of the Province of Otago* is published in Dunedin.

1861-1862

- James McKerrow makes a reconnaissance survey to Lake Wakatipu and to Mt. York, from where he obtains views of Lakes Te Anau and Manapouri.

1862

- Henry Stokes Tiffen is appointed Chief Surveyor, Hawkes Bay Province, and holds this position until 1863.

- Henry Gostling Clark is appointed Chief Surveyor, Marlborough Province, and holds this position until 1873.

- George Swainson resigns as Chief Surveyor, Wellington Province, to become Surveyor of Native Reserves at Wellington. Not until 1865 is a new Chief Surveyor appointed.

- Julius Haast and Arthur Dudley Dobson explore the Mackenzie country, and Dobson runs compass and chain traverses up the Tekapo, Pukaki and Ohau Rivers. The two men explore the glaciers around Mount Cook, journey up the upper Waitaki River and past Lakes Tekapo and Pukaki, and attempt to cross to Westland via the Sealy Pass.

- James McKerrow surveys the area around Lakes Hawea and Wanaka, the latter lake being surveyed by him from a whaleboat. He also completes a survey of the Matukituki Valley.

- John Rochfort and James Burnett survey the Greymouth coalfields.

- Thomas Brunner lays out the towns of Westport and Greymouth.

- The township of Palmerston in North Otago is surveyed by Alexander Dundas.

- James Stewart and Samuel Harding survey a railway route from Auckland to Drury.

1862-1863

- James McKerrow travels overland from Dunedin to Bluff, thence into the Waiau area before making surveys of Lakes Wanaka, Te Anau and Manapouri from boats.

1863

- Ferdinand Hochstetter's and Augustus Hermann Petermann's *Geologisch-topographischer Atlas von Neu-Seeland* is published at Gotha. This is a 20 page atlas containing six maps. In 1864 an English version is published by T. Delattre, Auckland.

- Johann Franz Julius Haast, assisted by William Spearman Young, starts his search for a practical route from Wanaka into Westland, and crosses the Haast Pass into Westland.

- John Henry Whitcombe and Jacob Lauper cross from Canterbury to Westland via the Whitcombe Pass.

- Arthur Dudley Dobson surveys the Nelson/Canterbury provincial boundary, commencing in the Hurunui valley and crossing over to the Grey valley and down to the Tasman Sea. The whole boundary is traversed with chain and compass.

- The West Coast survey begins. The section from the Grey River to Abut Head is under the control of Arthur Dudley Dobson, the section from Abut Head to Jacksons Bay is allocated to Robert Preston Bain. Dobson commences his survey of the West Coast in December 1863, and completes it the following year. Bain's reconnaissance survey is largely a disaster.

- Patrick Quirk Caples surveys and maps the Hollyford – Greenstone – Wakatipu area.

- James Hector crosses from Martins Bay via the Greenstone Valley to Queenstown. On board a yacht he explores the Fiordland coastline as well.

- John Rochfort and James Burnett survey the Whangapeka coalfields.

- John Holland Baker carries out the triangulation of western and central Southland.

- J. Aitken Connell, of the firm of Connell and Moodie, surveyors, Dunedin, surveys the township of Cromwell.

- The township of Kaikoura is surveyed by Joseph Ward.

- Samuel Hewlings and Edward Jollie lay out the town of Arowhenua, later named Temuka.

- Charles Herman Weber is appointed Provincial Surveyor in Hawkes Bay.

1863-1864

- Samuel Harding surveys a route for a railway line between Riverhead and Helensville, northwest of Auckland. (Construction of the railway line is carried out between 1871 and 1875).

1863-1865

- C. Hunter Brown traverses the Urewera country and produces a map sufficiently reliable for use by Colonel George Stoddart Whitmore when subduing Tuhoe and attempting to capture Te Kooti in 1869.

1864

- Robert Park surveys the town site for Ashburton.

- The township of Hamilton East is surveyed by William Australia Graham; the township of Hamilton West is surveyed by William Blackburn.

- Theophilus Heale explores Stewart Island to ascertain its possibilities for settlement.

- John Rochfort surveys the coastline of southern Westland, completing Robert Preston Bain's surveying contract.

- Alphonse J. Barrington, James Farrell and Antoine Simonin explore the area north of Lake Wakatipu and around Lake Alabaster.

1864-1865

- Charles Heaphy, chief surveyor to the central government, surveys the confiscated Maori land in the Waikato. This work severely stretches Heaphy's capabilities, and is severely criticised by Henry Spencer Palmer in his 1875 report on the state of New Zealand surveys.

1864-1867

- Theophilus Heale supervises the surveying of the Tauranga area for settlement purposes. Heale leaves Tauranga (Te Papa) in mid 1865, and in 1866 his work is taken over by Frederic James Utting, who completes the town survey and extends the rural surveys to the full extent of the local confiscated land. The rural surveys are completed by Horatio Nelson Warner in 1866 and Henry Lufkin Skeet in 1867.

1865

- The New Zealand Geological Survey is established, as part of the Colonial Secretary's Department, under the direction of James Hector.

- The Surveyors' Association of the Province of Auckland is established, and publishes its *Rules and regulations*. The Association functions on a voluntary basis and lacks formal recognition.

- James Hector produces his *Sketch Map of the Geology of New Zealand* at a scale of 1:2,000,000, a coloured map that shows the general geological boundaries with reasonable accuracy.

- Charles Heaphy surveys the towns of Hamilton and Cambridge.

- Julius Haast journeys from Canterbury to the West Coast via the Hurunui and Lake Sumner, and later in the year makes a similar journey via Arthur's Pass, returning via Brownings Pass.

- Gerhard Mueller makes extensive surveys of the valleys of the western Southern Alps, and travels to Bruce Bay to define Maori reserves in south Westland. He also lays out the town of Okarito.

- Henry Jackson is appointed Chief Surveyor, Wellington Province.

- John Holland Baker is appointed Chief Surveyor, Southland Province, and holds this position until 1870, when he becomes inspector of surveys in Southland following the amalgamation of Otago and Southland provinces.

- Stephenson Percy Smith and Charles Wilson Hursthouse conduct surveys for military settlement around New Plymouth.

- Alfred Domett surveys the town site of Napier.

- John Rochfort and Captain Frederick Gibson travel through southern Westland as far as Mahitahi examining river mouths as possible port locations.

- John Rochfort lays out the town of Greymouth.

- John Holland Baker surveys a route for a railway line in Otago from Winton to Kingston.

- Clause XXV of the Native Lands Act requires that applications and dealings coming before the Native Land Court be accompanied by a survey plan correctly defining the land concerned, and that the survey be made by a surveyor licenced to do so under the Act.

- The town of Wairoa, northern Hawkes Bay, is surveyed by Michael Fitzgerald and George Burton.

- W.J. Gundry surveys five acre lots around Pukekohe, prior to its settlement.

- Two charts of the Auckland Islands, based on survey work by Thomas Musgrave conducted in 1865, are published. One appears in Norman, W.H. and Musgrave, T., *Journals of the Voyage and proceedings of HMCS "Victoria" in search of ship-wrecked people at the Auckland and other islands* (Government Printer, Wellington); the other in Musgrave's

Castaways of the Auckland Islands, edited by J.J. Shillinglan (Lockwood, London). Another map of the Auckland Islands is drawn by John Holland Baker.

1866

- Julius Haast makes a detailed survey of the headwaters of the Rakaia River.

- Andrew Sinclair, who becomes Chief Surveyor to the Native Department, drafts regulations governing the survey of "Native Lands".

- John Tiffin Stewart lays out the town of Palmerston North.

1866-1867

- Stephenson Percy Smith, George Watkin Williams, Charles Allen Wray and F. Wilson survey the Patea – Waitotara district.

1866-1870

- Henry Jackson undertakes a systematic triangulation of the Wairarapa and western part of Wellington Province.

- Edward Percy Sealy explores a number of glaciers in the Mt Cook region, and takes photographs. In 1866 he travels up the Ashburton and Rangitata valleys; in 1867 he is on the Mueller and Hooker Glaciers; in 1868-70 he visits the Mueller Glacier again as well as the Tasman Glacier.

1867

- The Marine Department appoints George Austin Woods as Chief Marine Surveyor, and the schooner *St. Kilda* is obtained as a survey vessel. At the end of 1867 the *St. Kilda* commences a survey near Kaikoura Peninsula.

- The Native Lands Amendment Act creates an Inspector of Surveys' Department. The Department is established in connection with the Native Land Court Office in Auckland, where the majority of Native land claims are going on. The functions of the Department are the custody and recording of the original survey maps of Native land claims, collating these maps into general maps and registers, and the extension of triangulation over all the North Island. Theophilus Heale is appointed Inspector of Surveys, and holds this position until 1873.

- Theophilus Heale measures a base line to conduct a triangulation between the Bay of Islands and the Hokianga.

- In the absence of any Surveyor-General, Heale acts as an adviser to the Government in Wellington on survey matters until 1875.

- Thomas Cass resigns as Provincial Surveyor for Canterbury because of ill-health. He is replaced by Cyrus Davie, who holds this position until 1871.

- Edwin Fairburn experiments with the use of metal tape for distance measurement, while surveying the Thames goldfields.

- Arthur Dudley Dobson explores and reports on various routes from Motueka to Karamea.

- Johann Franz Julius Haast makes a journey to the source of the Waimakariri River.

- Frederick Wollaston Hutton surveys and maps the Waikato coalfields. He also surveys and maps the Thames goldfield, and the geology of Great Barrier Island.

- The Lithographic Branch is established by Government, working under the supervision of the Government Printer, but under the control of the Survey Department. The Branch is responsible for printing plans, maps and charts, together with a variety of other printed works.

1867-1868

- Henry Wrigg makes a preliminary survey of a railway route between Nelson and Cobden (across the Grey River from Greymouth).

1868

- The Deeds Registration Act is enacted to consolidate and amend laws relating to the registration of deeds affecting real property.

- Theophilus Heale commences an extensive triangulation scheme for the control of Maori land surveys, in the North Island. The scheme consists primarily of two networks, one with a base near the Kaipara Harbour, the other rests on a base line at Maraekakaho in Hawkes Bay. Two million acres are triangulated in the Taupo – Bay of Plenty region as well.

- Thomas Humphries conducts a small triangulation in Taranaki.

- The Marine Department's *St. Kilda* completes surveys around Cape Campbell, the anchorage off the Flaxbourne River and at Kaikoura Peninsula before commencing survey work on the West Coast of the South Island.

- Malcolm Fraser is appointed Chief Surveyor, Westland Province. He commences the first quasi-triangulation of Westland as far south as Bruce Bay.

- Johann Franz Julius Haast, assisted by Charles Edward Douglas and William Docherty, makes a geological survey of south Westland.

- James Hector maps the geology of Kawau Island.

- Edward Henry Bold is commissioned by the Government to survey and negotiate a telegraph line route from Napier to Tauranga via Taupo.

- James Dundas defines and surveys the northern boundary of Southland Province.

1868-1869

- Stephenson Percy Smith makes a trigonometrical survey of the Chatham Islands.

- Adam Johnston surveys Preservation Inlet, Otago.

1869

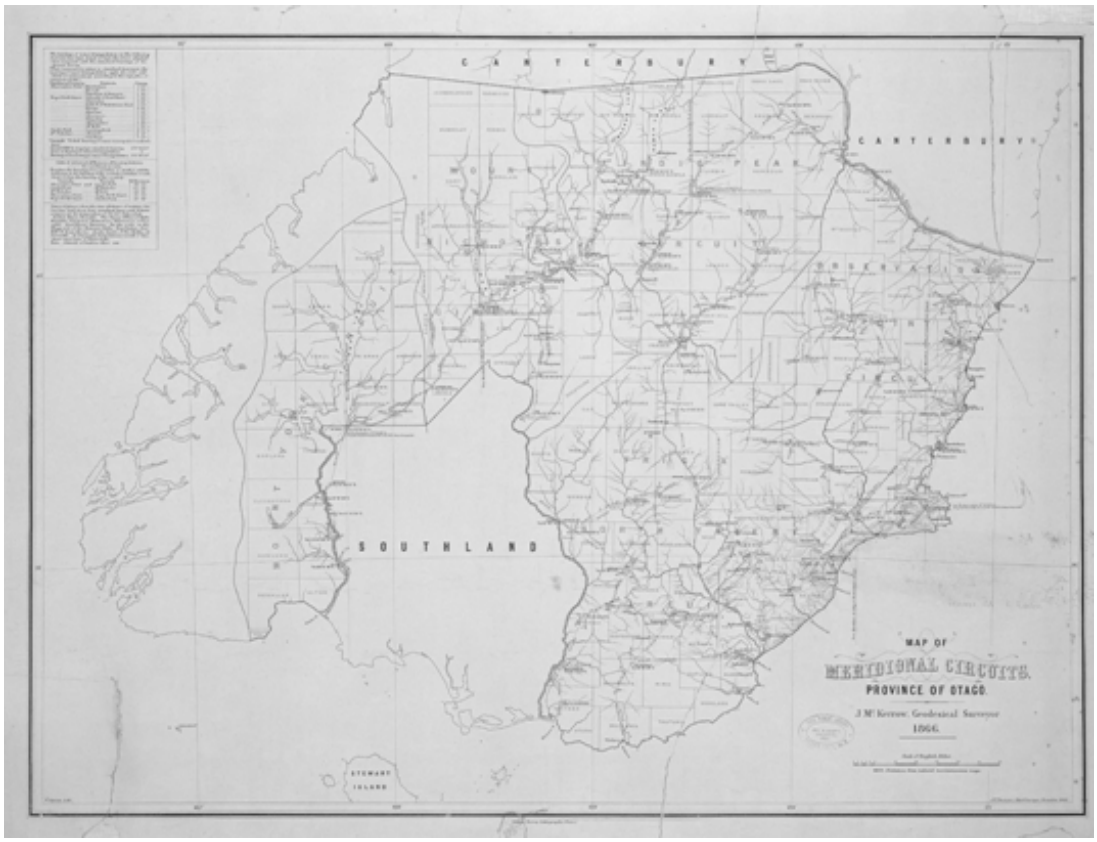
- The *St. Kilda* surveys the entrance of Otago Harbour.

- The Marine Department conducts astronomical measurements and coastline observations which reveal considerable errors in the British Admiralty charts of the South Island's West Coast.

- James Hector, Director of the Geological Survey of New Zealand, publishes a geological map of New Zealand at a scale of 1:2,000,000.

- Theophilus Heale inspects the state of Native land surveys in Wellington and Hawkes Bay Provinces.

- In response to a request from New Zealand that half the cost of hydrographic surveys be paid by New Zealand, the other half by Great Britain (as was happening in Canada and the various Australian colonies), the British Government decrees that, because of



Map of meridional circuits, Province of Otago. Dunedin: Otago Survey Office, 1866.

[Source: Auckland City Libraries. NZ Map No. 3818]

the recently completed *Acheron – Pandora* surveys, New Zealand would have to bear the total cost, and that any surveying would be limited to sheltered anchorages and harbours. The British are prepared, however, to lend surveyors and to engrave the results at home.

1869-1870

- The Marine Department replaces the *St. Kilda* with the *Edith,* and surveys of parts of the coastline of Auckland Province are conducted. In May 1870 the services of George Austin Woods, Chief Marine Surveyor, are dispensed with, and the hydrographic survey is abandoned.

1870

- Mount Eden becomes the chief triangulation station for the survey of Auckland province.

- Stephenson Percy Smith is appointed Geodetic Surveyor on the staff of Theophilus Heale, Inspector of Surveys in Auckland.

- John Holland Baker becomes Inspector of Surveys in Southland following the amalgamation of Otago and Southland provinces.

- Tauranga Harbour is surveyed by J.R. Palmer (see note 4) on board the *Rosario,* a ship of the Sydney-based Australian Squadron.

- The coastline from Cape Foulwind to Cascade Point (Westland) is surveyed by Mr Woods, a local surveyor.

- Thomas Humphries is appointed Chief Surveyor, Taranaki Province.

- James Hector maps the geology of the Colville district, Coromandel, and the Ohinemuri district.

- The township of Gisborne is surveyed and laid out.

- Henry Jackson surveys Papaioea, which becomes known as Palmerston North.

- Charles Allen Wray lays out the township of Hawera.

- Johann Franz Julius Haast's map of Canterbury is published.

- The Railways Act authorises the survey of several railway routes in both the North and South Islands.

- Charles Herman Weber explores three possible road and railway routes between Waipukurau and the Manawatu Gorge.

- William Brunton surveys possible railway routes between Invercargill and the Mataura River.

- The Torrens system of land registration is introduced when the Land Transfer Act is passed. The Act provides for the appointment of a Registrar-General of Lands, as well as District Land Registrars, Assistant Land Registrars and Deputy Officers. Sections 107 and 108 of the Act sets out requirements for accurate maps.

- John Edwards, Navigating-Lieutenant on HMS *Blanche*, charts the Auckland Islands.

- The Public Works Department is established. Many of the Department's staff are engineers and surveyors.

- Henry Wrigg is commissioned by the newly established Public Works Department to survey a railway route from Auckland to Tuakau, with a branch line to Onehunga.

- James Stewart maps Mortimer's Lava Cave, Three Kings, Auckland. This is the first cave survey to be published.

1870-1873

- Various routes for a railway line from Wellington across the Rimutaka Range to the Wairarapa are surveyed by Charles O'Neill and John Rochfort.

1871

- Stephenson Percy Smith, Theophilus Heale and Horace Baker measure a base-line at Maraekakaho in the Hawkes Bay with a 20m steel tape and straining apparatus. This is the first time that a long steel band is used for such a purpose, and gives results superior to those obtained formerly by the use of a Gunter's chain and similar measuring devices.

- The Registrar-General of Lands, appointed under the provisions of the Land Transfer Act 1870, recommends in a report to the Colonial Secretary that Government promote legislation to create a system of survey which will operate over the whole colony.

- Gerhard Mueller is appointed Chief Surveyor, Westland Province.

- Samuel Hewlings is appointed Chief Surveyor, Canterbury Province, and holds this position until 1876.

- Arthur Dudley Dobson is appointed Chief Surveyor for the Nelson Province.

- John Holland Baker conducts surveys to connect Stewart Island to the South Island trigonometrically.

- Frederick Wollaston Hutton surveys and maps the Collingwood coal mine.

- The standard survey of the central area of Dunedin is completed by J. Aitken Connell.

- Charles Wilson Hursthouse commences a survey of a railway route from Wanganui to New Plymouth.

- Theophilus Heale's *Principles and practice of surveying, to be adopted by officers employed in the field in connection with the Inspector of Surveys' Department* is published by the Government Printer, Wellington.

- The first in an annual series of "New Zealand wreck charts" is published as part of the annual report of the Marine Department. The series continues until 1922. The reports appear in the *Appendix to the Journals of the House of Representatives*, G-6 1871, G-30 1872, H-19A 1873, H-22 1874, H-12A 1875, H-29 1876, H-12 1878, H-10 1879, H-13 1880, H-27 1881, H-15 1883, H-6 1884, H-24 1886, H-4 1887, H-19 1888, H-31 1889, H-18 1890, H-30 1891, H-29 1892, H-31 1893, H-18 1894, H-29 1895, H-15 1896-1922.

1872

- Frederick Wollaston Hutton surveys and maps the geology of Southland.

- Johann Franz Julius Haast maps the geology of the Shag Point district, Otago.

- The Post Office fire in Shortland Street, Auckland, results in the serious loss of Auckland Provincial Council maps and plans.

- A.C. Turner surveys the site of the township of Taupo.

1872-1873

- Frederick Wollaston Hutton surveys and maps the geology of the northeast of the South Island, from Cook Strait south to the Rakaia River.

1873

- Daniel Austin Tole is appointed Chief Surveyor for Auckland Province.

- James McKerrow is appointed Chief Surveyor, Otago Province, and holds this position until 1876.

- Gerhard Mueller initiates triangulation survey of southern Westland to connect and adjust earlier surveys. Most of the fieldwork is done by George John Roberts.

- James Hector publishes a geological map of New Zealand at a scale of 1:2,000,000, based on official surveys and the explorations of Hochstetter, Haast, and others.

- W. Ellison surveys lands owned by Francis Hicks and James Boyle, which together constitute the site where the township of Hastings is laid out.

- A conference is held in Wellington of Chief Surveyors to discuss the condition of existing surveys, and steps that might be taken for improvement. Resolutions and detailed minutes of proceedings (published in the *Appendix to the Journals of the House of Representatives*, H-1, 1873) call for an accurate system of triangulation; a system of main and circuit traverses connected to selected meridians and the triangulation; uniform rules and regulations to be made applicable to all surveys carried out by General and Provincial Governments; the provision of record maps based on the triangulation and that no land be bought under the Land Transfer Act until delineated on such record maps; and the setting up of a board to be responsible for the qualification of surveyors.

- Horace Baker commences a survey of the Seventy Mile Bush, southern Hawkes Bay.

- The Photolithographic Branch of the Government Printing Office is established. Most of its early work consists of making copies of plans for railways and roads, for the Public Works Department. It also prints a large number of geological maps and drawings.

- Daniel Manders Beere surveys the route for a railway line between Palmerston North and Wanganui.

1873-1874

- J. Jacquemart on board the *Vire* makes a survey of Campbell Island prior to the island being used by the French in 1874 as a point from which to observe the transit of Venus. The leader of the 1874 expedition is A. Bouquet de la Grye of the Hydrographic Office of the Ministry of Marine, and a subsequent report by the scientist H. Filhol includes a map resulting from a survey of the island. The map forms the basis of all subsequent British Admiralty charts of the island.

1874

- James Hector makes a geological survey of the area between Poverty Bay and East Cape.

- John Holland Baker makes a standard survey of the town of Invercargill.

- George Frederick Richardson lays out the townships of Gore and Mataura.

- John Carruthers, Engineer in Chief of the Public Works Department, and James Mackay, General Government Agent, explore a route for a railway line between Cambridge in the Waikato and the Manawatu. Their route largely follows the Waikato River to Lake Taupo, around its eastern shore, and southwards. Carruthers also comments that a line west of Lake Taupo might be a possibility.

- John Spence Browning surveys Jackson Bay in southern Westland as a site for possible settlement.

- HMS *Challenger,* under the command of Captain George S. Nares, surveys a route for an undersea telegraph cable between Sydney and Wellington. This is part of a scientific circumnavigation of the world undertaken by *Challenger*, lasting nearly four years.

1875

- Henry Spencer Palmer of the Ordnance Survey of Great Britain visits New Zealand to observe the transit of Venus, and is asked to report on the state of the surveys. His report is presented to Parliament in 1875. Palmer comments that of the section surveys, some had been good but others inaccurately done and next to valueless for the purposes of "a cadastral map on the correctness of which all men may agree, and which will give safety and value to Crown grants, and protect individuals from litigation, and Government from the risk involved in the issue of land titles under the Land Transfer Act". He recommends that all surveying be put under central control; that a principal triangulation be extended over the whole country, a secondary triangulation over those parts likely to be settled within 20 years, and a tertiary triangulation over all settled areas; that a uniform system of map projection be laid down and map sheets compiled for record purposes; and that a test be prescribed by the Surveyor-General for the qualification of surveyor. Palmer notes that 30% of New Zealand "has been covered with triangles trustworthily observed".

- Morgan James Cooper Carkeek produces the first partial map of the Tararua Range (from Mount Hector north to Mount Dundas), in his field notebook.

- Alexander McKay surveys and maps the geology of the coastal part of Hawkes Bay, from Cape Kidnappers to the southern boundary of the province. He also maps the geology around the northern margins of Raglan (Whaingaroa) Harbour.

- S. Herbert Cox explores the drainage patterns around Mt Cook, determining that the principal drainage from Mount Cook is to the southeast by the Tasman and Hooker Glaciers.

- John Turnbull Thomson's *An Exposition of processes and results of the survey system of Otago* is published by Henry Wise, Dunedin.

- Thomas Meddick Foy makes a reconnaissance survey of various possible railway routes from Canterbury to the West Coast, via the Hurunui, Amuri and Hope Passes. He also surveys possible railway routes to connect Nelson and Picton with north Canterbury.

- Edward Holroyd Beere surveys a railway route between Wanganui and Hawera.

1875-1876

- S. Herbert Cox and Alexander McKay survey and map the geology of Westland.

1876

- The Surveyor-General's Department established.

- John Turnbull Thomson is appointed Surveyor-General. His main task is to implement a triangulation system which will coordinate and control the accuracy and correctness of all future surveys.

- The provincial Chief Surveyors become the statutory Chief Surveyors of the various land districts, the boundaries of which generally follow the old provincial boundaries.

- Surveys of “Native land” are placed under the control of the Surveyor-General.

- John Spence Browning is appointed Chief Surveyor for Nelson, and holds this position until 1896.

- The Department of Lands is established.

- John Turnbull Thomson’s *Instructions for Settlement Surveyors on Demesne Lands of the Crown* is published. These instructions deal with minor triangulations, settlement surveys, office records, and the qualification for entry into and promotion within the Survey Department.

- S. Herbert Cox surveys and maps the geology of the area between Poverty Bay and Napier. He also maps the Buller coalfield.

- Alexander McKay surveys and maps the geology of Kaikoura Peninsula and Amuri Bluff. He also maps the geology of the Cape Campbell district, Marlborough.

1876-1877

- S. Herbert Cox surveys and maps the geology of parts of the Waikato.

- D. MacFarlane surveys and maps the geology of the Jackson and Cascade Valleys, southern Westland.

1877

- A meridional circuit system of triangulation is introduced to New Zealand, with 28 meridional circuits being established (9 in the North Island, 19 in the South Island). Each meridional circuit is subdivided into survey districts, nominally 1,000 chains square and based on the meridian of the initial station of the circuit.. Each survey district is further subdivided into blocks. The first cadastral mapping (usually at a scale of 80 chains to an inch) is commenced on a district by district basis and is continued generally in this form until 1960, when the cadastral NZMS 177 series (equivalent to the NZMS1 topo series) is progressively introduced. These cadastral maps showed all the land parcels and there descriptions, roads, trig stations and some basic topography.

- Stephenson Percy Smith is appointed first geodesical surveyor and chief surveyor of Auckland Province.

- Horace Baker is appointed Chief Surveyor, Hawkes Bay District.

- John Holland Baker becomes the Chief Surveyor, Canterbury District.

- William Arthur is appointed Chief Surveyor for Otago, and holds this position until 1885.

- John Spence is appointed Chief Surveyor for Southland.

- Alexander McKay surveys and maps the geology of the country between Masterton and Napier.

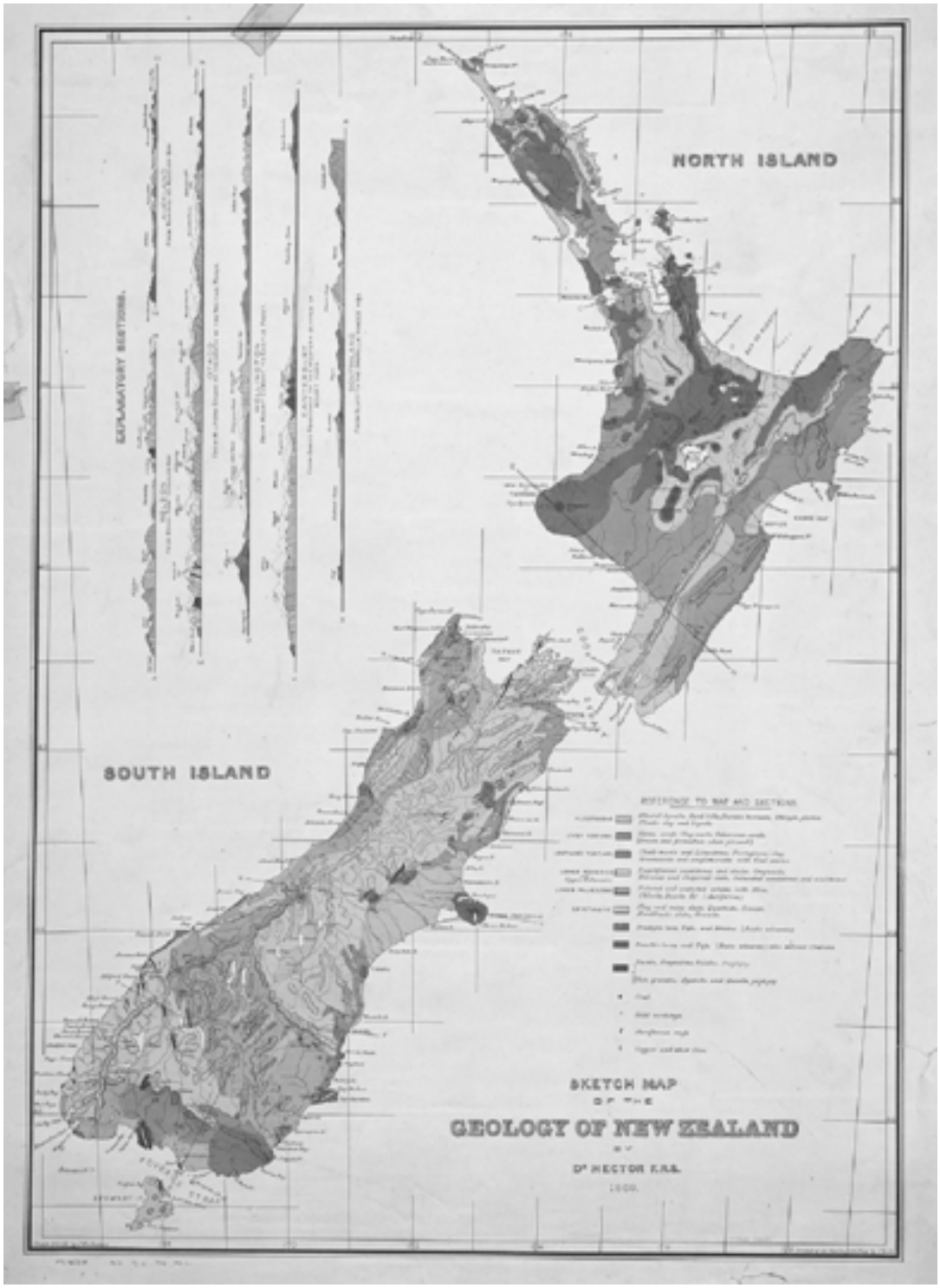
- S. Herbert Cox surveys and maps the geology of the area around Whangarei, the area between Opotiki and East Cape, and the southeastern Wairarapa.

- Robert Blair Denniston surveys and maps coalfields in the Waikato, near Whangarei and Kawakawa, and in Otago.

- William Henry Skinner lays out the northern part of the township of Stratford in Taranaki.

1878

- The Surveyor-General, in his capacity as Secretary for Crown Lands, becomes the permanent head of the Department of Lands, combining the titles of Secre-



Sketch map of the geology of New Zealand by James Hector. Wellington, 1869.

[Source: Auckland City Libraries. NZ Map No. 470]

tary for Crown Lands and Surveyor-General. This remains the case until 1906.

- The photo-lithographic printing office is transferred from the Public Works Department to the Survey Department.

- Charles Brown commences a survey of the Waimate Plains, Taranaki. The survey continues through to 1881, in the face of opposition from local Maori. The opposition culminates in the occupation of Parihaka by colonial forces in November 1881.

- S. Herbert Cox surveys and maps the geology of the Hokanui Ranges, Southland, and the Te Anau district, Fiordland. He also surveys and maps the geology of the Wairoa and Dun Mountain districts, Nelson.

- James Hector surveys and maps the topography and geology of the Mokau River area, North Island west coast.

- C.B. Knorpp surveys possible railway routes in the southern North Island, between Waikanae and the Manawatu.

- Thomas Meddick Foy reports on a survey of a variety of possible railway routes in the northern South Island.

1878-1879

- The Public Works Department surveys various routes for a railway from Wellington north to Waikanae. The route surveyed by James Daniel Climie and Henry Westcott Climie is eventually selected.

1879

- The Surveyor-General's Department is named the Survey Department of New Zealand (until 1891).

- John Turnbull Thomson retires as Surveyor-General. James McKerrow is appointed in his place.

- John William Allman Marchant lays down a standard chain length at Government Buildings, Wellington and, by means of steel tapes standardised to this distance, the standards at Auckland, Nelson, Christchurch and Dunedin are compared.

- Charles W. Adams completes a standard survey of Christchurch city.

- Alexander McKay surveys and maps the geology of the Baton River and Wangapeka districts, Nelson, the Mount Arthur Range and the Riwaka Range.

- William Newsham Blair and Charles Yelverton O'Connor survey four possible railway routes between Canterbury and the West Coast, via Cannibal Gorge, Hurunui Saddle, Arthur's Pass, and the Lake Lyndon route. Blair's report is published in 1884.

1879-1880

- S. Herbert Cox and James Park survey and map the geology of lower Northland (Auckland to just north of Dargaville/Whangarei).

1879-1881

- Possible railway routes between Helensville and Whangarei, Whangarei and Kawakawa, Hamilton and Te Aroha, Westport and Inangahua, and Tapanui and Waikaka, are surveyed.

1880

- Surveying and laying out of the township of Rotorua is commenced by R.B. Morrow.

- The 1873 geological map of New Zealand is revised and produced on the occasion of the Melbourne Exhibition. The map is accompanied by James Hector's *Handbook of New Zealand*.

- The civil engineering firm of Thornton and Brown surveys a railway route from Canterbury to Westland via Cannibal and Ada's Pass. Construction of the Midland Railway commences only in 1887.

- Ernest Henry Wilmot explores the valleys of the Routeburn and Hollyford Rivers, with a view to extending the Otago triangulation survey to the settlement at Martins Bay.

- A Commission is appointed to investigate the workings of the civil service. It finds that the Survey Department "is very costly, involving £150,000 last year. Being regarded from a scientific rather than a practical point of view, and being left almost in the hands of specialists uncontrolled, Commissioners have formed a low opinion of the real utility of a large proportion of the work done".

- Alexander McKay surveys and maps the geology of the area west and north of Lake Wakatipu.

- U.T. Hughes, on board the sloop *Cormorant*, surveys Lyttelton Harbour.

- Hickson conducts a standard survey of Auckland city.

1881

- George John Roberts observes a chain of triangles across the Southern Alps, connecting the triangulations of Canterbury and Westland. He extends the triangulation down the West Coast past Mt Cook, and as a result the height of Mt Cook is computed by Gerhard Mueller to be 12,349 feet.

- Thomas Noel Brodrick surveys the country north of Lake Wanaka.

- Alexander McKay surveys and maps the geology of Waitaki County.

- S. Herbert Cox surveys and maps the geology of Manukau County, and the area between Auckland and Mercer. He also surveys and maps the geology of Collingwood County.

- An attempt is made to form a New Zealand Institute of Surveyors by means of the introduction of the New Zealand Institute of Surveyors Bill, but the legislation fails to pass through the House.

- James Daniel Climie completes a standard survey of the city of Wellington.

1882

- Survey Observatory is built at Mount Cook in Wellington.

- The Survey Department commences survey work to lay out reserves and hapu divisions in Taranaki for the West Coast Commission.

- S. Herbert Cox surveys and maps the geology of the Ohinemuri and Te Aroha district. He also surveys and maps the geology of Shag Valley (between Palmerston and Waihemo, north Otago), and of Collingwood County (between Collingwood and Big River).

- Alexander McKay surveys and maps the geology of the Inangahua Valley.

- John Rochfort conducts a standard survey of Napier.

- H. Maitland conducts a standard survey of Timaru.

- John Rochfort is employed by the Nelson Railway Committee to explore a

route linking Nelson Province with Canterbury.

- William Spotswood Green explores and maps the Mount Cook area, Southern Alps.

1882-1883

- John Hay, District Surveyor, Southland, undertakes a reconnaissance survey of the area west of Lake Hauroto.

1882-1884

- Anthony Dickson Wilson extends a network of triangles over Marlborough.

1882-1886

- James Baber conducts a major triangulation in the Urewera country.

1883

- Charles Wilson Hursthouse appraises a possible railway route between Te Awamutu and Stratford. During March he is held captive for two days by local Maori who oppose the surveying activities.

- S. Herbert Cox surveys and maps the geology of the area between the Maruia and Buller Rivers. He also surveys and maps the geology of Mount Somers and the Malvern Hills, Canterbury.

- Anthony Dickson Wilson undertakes a geodetic survey to connect the triangulation survey systems of the North and South Islands across Cook Strait.

- Charles W. Adams, Geodesical Surveyor, determines the difference of longitude between Sydney Observatory, New South Wales, and Mt Cook Observatory, Wellington.

- Alexander McKay surveys and maps the geology of northeastern Otago.

- Robert von Lendenfeld explores the Mount Cook Tasman Glacier area, and maps the watersheds and drainage patterns of the area.

- James Baber produces an accurate map of the Urewera, in spite of opposition from Tuhoe.

- James Henry Kerry-Nicholls maps the King Country, using “a system of barometrical measurements and topographical observations”.

- J.B. Grey, master of the New Zealand Government schooner *Kekeno*, surveys various inlets and coves on the Auckland Islands.

- Navigating Lieutenant Hallett, on board HMS *Cossack*, makes a map of Campbell Island.

1883-1884

- James William Blackett surveys the Lewis Pass for the proposed East-West Coast Railway.

- John Rochfort surveys a route for the North Island Main Trunk Railway between Te Awamutu and Marton. From Marton he explores a route up the Porewa, Rangitikei and Hautapu Rivers (previously surveyed by Henry August Field and J.F. Siceley), across the Waimarino Plateau and along the upper Wanganui Valley to Taumarunui. At Taumarunui the local Maori forbid further exploration by Rochfort, and he is forced to retreat to Tokaanu and then northwards around the western side of Lake Taupo to Kihikihi. The northern end of the route is surveyed from Te Awamutu southwards to Te Awamutu and the Ongarue Valley.

- Robert West Holmes and Morgan James Cooper Carkeek survey a

possible railway route from a point south of Te Kuiti down the Awakino River valley to its mouth and generally along the coast to Waitara.

1883-1886

- Laurence Cussen surveys the King Country, from Kihikihi south to Mt. Ruapehu. By August 1884 43 trigonometrical stations have been erected, covering two million acres. In the course of his survey Cussen makes ascents of Mounts Ngauruhoe, Tongariro and Ruapehu.

1884

- The Department of Surveys begins to issue inch to the mile topographical maps. These remain the standard topographical maps until 1939, and are used also as base maps by the Geological Survey of New Zealand.

- Gerhard Mueller surveys a road line from Jackson Bay to Martins Bay, and locates a line for a road from Jackson Bay to the Hollyford Valley.

- Frank Stephenson Smith completes the extension of triangles from Amuri District across the Alps to Taramakau in Westland.

- Charles William Adams is appointed Chief Surveyor for Otago, and holds this position until 1897.

- A route for a road from Fort Galatea to Lake Waikaremoana is traversed by J.C. Blythe.

1885-1886

- Thomas Noel Brodrick makes a triangulation in the Waimakariri area of Canterbury on the line of the projected Midland Railway.

- George Phipps Williams surveys a route for a suggested railway line from Te Awamutu to Hastings.
- Arthur Dudley Dobson is employed by the Public Works Department to survey a railway line from Waikari in Canterbury up the Hurunui valley and down the Taramakau.

- Alexander McKay surveys and maps the geology of the Kawhia district.

- John Langmuir conducts a standard survey of Port Chalmers.

1884-1885

- Alexander McKay surveys and maps the geology of the eastern part of Marlborough Province.

1885

- Gerhard Mueller and Charles Edward Douglas explore and survey the Haast-Arawata region.

- James Park surveys and maps the geology of parts of Waipa, Kawhia, Waikato and Raglan counties.

- The Land Transfer Amendment Act authorises the Surveyor-General to make regulations and to license surveyors to carry out land transfer surveys.

- James Park surveys and maps the geology of the western part of Wellington Province and eastern and northeastern Taranaki.

1886

- Stephenson Percy Smith makes a topographical survey of the Tarawera eruption.

- John Hay extends a network of triangles over the Takitimo Mountains in Southland.

- John Strauchon completes a reconnaissance survey of the Tautuku Forest, Otago.

- Laurence Cussen places the first trig on the Paretetaitonga Peak of Mount Ruapehu.

- Laurence Cussen makes a hydrographic survey of Lake Taupo. His map shows 436 soundings, taken at an average of 1.8 per square mile.

- New Zealand Geological Survey becomes part of the Mines Department.

- Alexander McKay surveys and maps the geology of northeastern Otago, from Kakanui to Waikouaiti.

- James Park surveys and maps the geology of the district between the Dart River and Big Bay, Lake and Westland counties.

- G.W. Williams conducts a standard survey of the suburbs of Auckland.

- A standard survey of the central area of New Plymouth is completed.

- John Fairchild, on board the *Hinemoa*, makes sketch surveys of the Bounty Islands and the Antipodes Islands.

- James McKerrow's *New Zealand system of survey* is published by the Government Printer, Wellington. (The seven page book was probably prepared for the 1886 London Indian and Colonial Exhibition).

- The *Rules and schedule of prices* of the Hawke's Bay Surveyors' Association are published.

- C.B. Knorpp reports on a reconnaissance survey of the Gisborne/ East Coast area to locate a railway route.

- James Hector maps the extent of the Tarawera eruption.

1886-1887

- Frank Stephenson Smith and Frederick Augustus Thompson complete a triangulation of the Amuri back-country.

- Triangulation work in the Waimarino is conducted.

1887

- Triangulation of Westland is completed.

- Gerhard Mueller and Charles Edward Douglas make a reconnaissance survey of the Landsborough and Clarke Valleys in southern Westland.

- Alexander McKay surveys and maps the geology of Wairarapa and Hutt counties

- James Park surveys and maps the geology of the Waipara and Weka Pass districts, Canterbury.

- Stephenson Percy Smith and Henry Douglas Morpeth Haszard make a topographical survey of Raoul Island in the Kermadec group. They are landed on the island by Captain John Fairchild on board the New Zealand Government steamer *Stella*. Fairchild makes a number of soundings in the Kermadec Islands. At the same time the islands are annexed to New Zealand.

- Fred Mace and Taane Tinarau (also spelt Tinorau) explore the Glowworm Cave at Waitomo on a flax raft, using two candles for light.

1887-1888

- Alexander McKay surveys and maps the geology of the northern part of Hawkes Bay Province, the Lake Waikaremoana area, and the Raukumara Peninsula.

1887-1891

- Thomas Noel Brodrick surveys the boundaries of many of the extensive pastoral runs in south Canterbury. In doing so he maps a large part of the eastern side of the Southern Alps.

1888

- The New Zealand Institute of Surveyors is established. James McKerrow is its first President, and Thomas Ward its first Secretary.

- William Henry Homer explores a saddle between the upper Hollyford and the Cleddau River leading into Milford Sound.

- James Park surveys and maps the geology of North Wairarapa County. He also surveys and maps the geology of Bluff Peninsula, Southland, and the area between West Wanganui Inlet and Big River, northwest Nelson.

- Alexander McKay surveys and maps the geology of mid-Northland.

- The dredging of an iron helmet from Wellington Harbour leads to speculation about an early Spanish discovery of New Zealand.

1888-1889

- Thomas Noel Brodrick surveys the Canterbury high country prior to the land being made available for pastoral leasing. He also surveys and maps the Godley Valley and glaciers, Southern Alps.

- Frank Stephenson Smith and Frederick Augustus Thompson complete a triangulation in the Waiau and Terako areas of Nelson District.

- A railway route from near Stratford to Ongarue (near Taumarunui) is surveyed by Dan Ross, Robert West Holmes and Morgan James Cooper Carkeek. Much of this route is followed when the railway line is constructed between 1901 and 1933.

- HM Surveying Vessel *Egeria,* under the command of Captain Pelham Aldrich, examines the ocean bed between New Zealand and Hawaii to identify submarine dangers along potential trade and cable routes between Australasia and Canada. Aldrich makes considerable improvements to the Lucas sounding machine that he has on board, which facilitates the taking of soundings at greater depths.

1889

- James McKerrow retires as Surveyor-General and becomes Chief Commissioner of Railways. Stephenson Percy Smith is appointed in his place. He holds this position until 1900.

- Charles Edward Douglas explores and maps many of the valleys of Westland, reporting his findings to the Department of Lands and Survey. In some official reports at this time he is referred to as “Mr Explorer Douglas”.

- Alexander McKay surveys and maps the geology of Stewart Island. He also surveys and maps the geology of Marlborough and the Amuri district of Nelson.

- James Park surveys and maps the geology of Collingwood County, Nelson.

- John Fairchild, on board the *Hinemoa*, surveys Herekino Harbour, and the entrance to Whangape Harbour, in Northland.

- Following a visit by a party led by the Auckland Chief Surveyor Thomas Humphries to the Waitomo Caves, a report with a map and photographs is published in the *Appendices to the*

Journals of the House of Representatives, H-18, 1889.

- A standard survey of Thames is undertaken.

1889-1894

The *Journal of the New Zealand Institute of Surveyors* is published. The first editor is Edward de R. Tregear. Charles William Adams takes over the editorship in 1892. The journal is renamed in 1894.

1890

- Alexander McKay surveys and maps the geology of part of the Waimea Plains, Southland. He also surveys and maps the geology of Mangonui County, Northland.

- Gerhard Mueller makes a reconnaissance survey of the headwaters of the Okuru, Actor and Burke Rivers, southern Westland.

- Thomas Noel Brodrick surveys and maps the route from Lake Ohau to the Landsborough via Huxley Pass.

- Charles Adnam Mountfort's *Surveyor's pocket-book for rapidly and accurately reducing in the field distances measured on the slope to their horizontal value…* is published by R.C. Harding in Napier.

- The Lithographic Branch of the Survey Department loses its lithographic and photographic plant when a fire destroys the Printing Office's old building (in which the Branch was still housed – most of the Printing Office having previously moved to new premises).

1891

- The Commission on Native Land Laws ucovers a number of defects and abuses in the laws relating to the surveying of Maori land. Few of the Commission's recommendations find favour with the Government, however.

- Peter Edward Cheal completes a triangulation in the Piako area.

- Laurence Cussen makes the first topographical survey of the volcanic peaks in the central North Island.

- Charles Edward Douglas explores the Waiatoto Valley in Westland.

- John Hay makes a reconnaissance survey of central Stewart Island.

- The New Zealand Alpine Club is formed. One of its objects is to "acquire orographical and topographical information regarding the New Zealand mountains".

- Gerhard Mueller is appointed Chief Surveyor, Auckland.

- John William Marchant is appointed Chief Surveyor for Canterbury.

- James Edward Pickett's *A Short comparison of the New Zealand and Victorian survey systems* is published by J.C. Stephens in Melbourne.

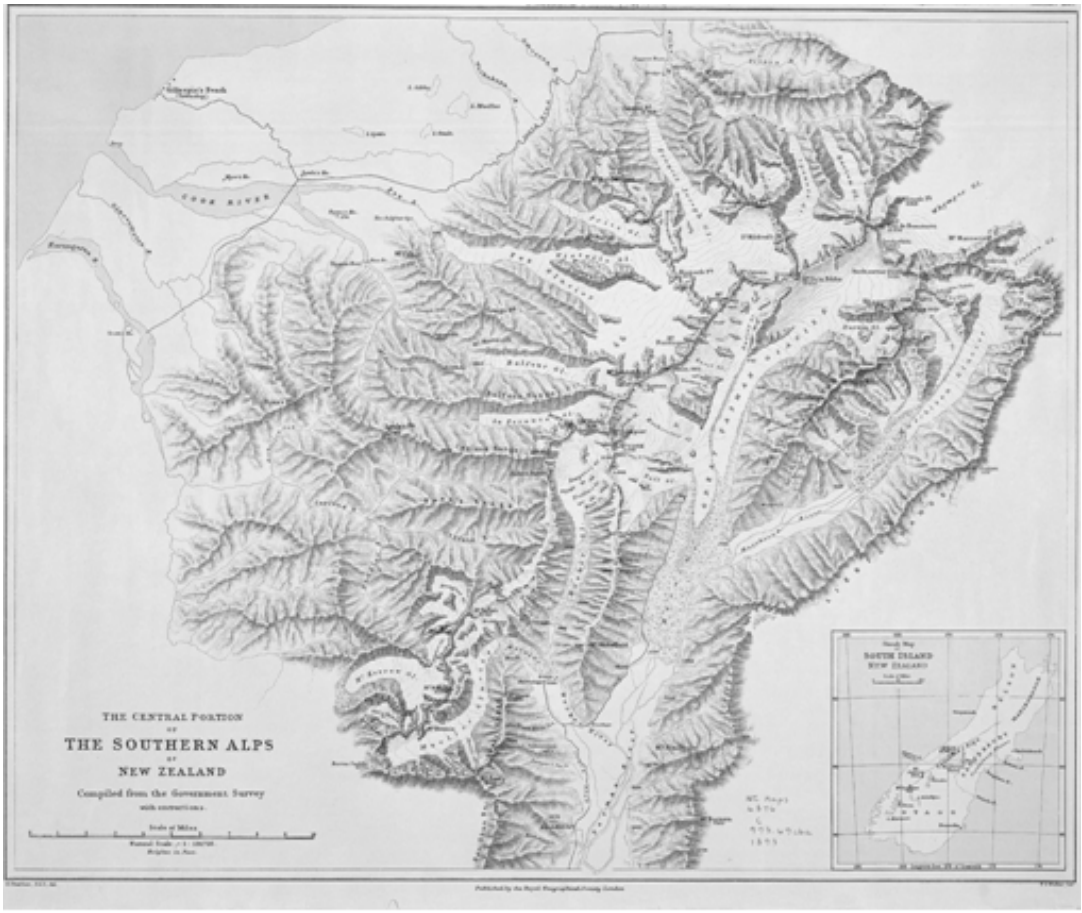
1892

- The Department of Lands and the Survey Department are amalgamated to become the Department of Lands and Survey.

- W. Wilson makes a topographical survey of the Wills and Macfarlane Valleys, Westland.

- Charles Edward Douglas makes a topographical and geological survey of the Copland Valley, Westland.

- A committee of inquiry which looks at the question of railway routes recommends that no further railway



The central portion of the Southern Alps of New Zealand compiled from the government survey with corrections. London: Royal Geographical Society, 1893.

[Source: Auckland City Libraries: NZ Map No. 4876]

construction should be carried out until more explorations and surveys are made.

- Alexander McKay surveys and maps the geology of the northern part of Westland County. He also surveys and maps the geology of the North Cape district, Mangonui County, and of the Hokianga, Whangaroa and southern Mangonui counties

- A standard survey of Westport is undertaken.

1893

- Charles Edward Douglas and Arthur Paul Harper complete a reconnaissance survey of the Upper Waiho area, Westland.

- W.S. Pillans and Thomas Mackenzie make a reconnaissance survey of the area west of Lake Manapouri.

- John William Allman Marchant oversees the surveying, including basic triangulation, of the Cheviot Estate, northern Canterbury.

- Robert West Holmes surveys an alternative route for the Ohakune-Waimarino descent on the North Island Main Trunk Railway.

1893-1894

- Alexander McKay surveys and maps the goldfields of Otago

1894

- A topographical survey of Cheviot Estate is completed by Gordon Hurrell Morland McClure and others.

- The *Journal of the New Zealand Institute of Surveyors* is renamed the *New Zealand Surveyor*. Charles William Adams is editor of the new journal, and remains editor until 1917.

- James Dwight Dana, in his 4th edition of the *Manual of Geology*, constructs a bathymetric chart of the oceans which, in the vicinity of New Zealand, shows the two main islands lying in an area enclosed by the 1,000 fathom contour, but excluding the Chatham, Bounty, Antipodes, Auckland, Campbell and Macquarie Islands. These islands are included within the 2,000 fathom iso-bath, but the Kermadecs and New Caledonia are not.

1894-1895

- Alexander McKay surveys and maps the geology of southwest Nelson and the northern part of Westland.

1894-1896

- H.R. Dundas makes a topographical and trigonometrical survey of the southern part of Stewart Island.

1895

- The triangulation of the East Cape area of the North Island is completed by Morgan James Cooper Carkeek.

- T.K. Thompson completes the triangulation of the area of the North Island from Rangaunu Harbour to North Cape. This completes a chain of triangles from North Cape to Stewart Island. Thompson also fixes the true position of the Three Kings Islands.

- Malcolm, Kenneth and Donald Ross, W.J. Hodgkins and T.C. Fyfe explore the area around McKinnon Pass in Fiordland and ascend Mt Tutoko.

- A standard survey of Westport is undertaken.

- Alexander McKay and Henry Andrew Gordon survey and map the geology of the Urewera country while looking for gold and other mineral deposits. They

also survey and map the gold mining reserves in northern Westland and southwest Nelson.

1895-1896

- One million acres of the Urewera country are triangulated by J.I. Phillips, C. Reay, C. Clayton, and A.L. Foster, under the supervision of Laurence Cussen.

1896

- Thomas Mackenzie makes a reconnaissance survey of the area between Dusky Sound and Lake Manapouri.

- James Daniel Climie completes a standard survey of Palmerston North, and another for Feilding.

- J.I. Phillips undertakes a standard survey of Rotorua.

- A sketch survey of the Antipodes Islands is made by W.R. Willis, HMS *Ringdove.*

- A Board of Examiners for the licensing of surveyors is appointed. The Board comprises the Surveyor-General, the Under-Secretary for Lands, the Assistant Surveyor-General, the Inspector of Mines and the Chief Surveyors Napier and Christchurch.

- Preliminary discussions take place between P. Baracchi, Government Astronomer for the Colony of Victoria and Clinton Coleridge Farr about the "great need … for a more complete knowledge of the magnetic elements generally in these southern latitudes".

1896-1897

- Alexander McKay surveys and maps the geology of the Cape Colville area, Coromandel.

1896-1905

- The New Zealand coastline is surveyed by HMS *Penguin*, under the command of Commanders Willoughby Pudsey Dawson and James W. Combe. In 1896 *Penguin* is surveying around Cape Maria van Diemen, in 1897 the Hauraki Gulf, and in 1898 the Three Kings – North Cape area. In 1900 she surveys the approaches to Auckland, and the vicinity of Mayor Island, and in 1901 the Firth of Thames, and Coromandel and Tauranga Harbours. In 1902 *Penguin* is working between Gable End Foreland and Poverty Bay, in 1903 between East Cape and Gable End, and in Cook Strait. In 1904 *Penguin* surveys the entrance to Wellington Harbour, and the east coast of the South Island south to Foveaux Strait, as well as Westport Harbour. In 1905 she concentrates on the harbours of Great Barrier and Kawau Islands, and the approaches to Auckland Harbour.

1897

- A topographical survey of the area between Dusky Sound and Lake Manapouri is made by Ernest Herbert Wilmot, building on the information gathered by Thomas Mackenzie.

- A trigonometrical survey of the Coromandel Peninsula, from Cape Colville to Te Aroha, is made by Laurence Cussen.

- Stephenson Percy Smith's *Regulations for conducting the survey of land in New Zealand; together with land transfer survey regulations*, is published by the Government Printer, Wellington. Later editions are published in 1908 and 1923-1925.

- Harry James Wylde's *Field tables, for surveyors, engineers, mine managers and others…* is published by H. Brett in Auckland.

1898

- James Daniel Climie extends the standard survey of Palmerston North.

1899

- James Stewart reports on reconnaissance surveys for possible railway routes between Gisborne and Rotorua, and Gisborne and Opotiki.

- The Lands and Survey Department commences the mapping for the Defence Department of 200 square miles surrounding the City of Dunedin.

- The Department of Lands and Survey issues the first two of its short series of four *Professional Papers*. These are *Directions for testing traverse bearing by observations on circumpolar stars with 5-in. theodolite*, by Thomas Humphries, and *The use of explosives … a short paper for the use of road inspectors on government roadworks* by George Francis Robinson.

1899-1909

- A systematic survey of the magnetic field is begun by the Department of Lands and Survey, using instruments lent by the Royal Society, London. Observations of the magnetic declination, inclination, and horizontal intensity are taken over the period from 1899 to 1909, at 334 magnetic stations throughout New Zealand. The work of observation is done initially by Clinton Coleridge Farr assisted by William Thomson Neill of the Survey Department, Dunedin. Neill is replaced by Henry Fawsit Skey from Otago University, and with the appointment of Farr to a position at Canterbury University College in 1904 Skey takes full responsibility for the work. Results from the 334 stations are published by Clinton Coleridge Farr in 1916 as at epoch 1903.5. Maps are prepared by Farr to show the irregularities in magnetic inclination and declination within New Zealand.

1900

- Stephenson Percy Smith retires as Surveyor-General and moves to New Plymouth. He becomes a recognised scholar on the Maori language and the history and traditions of the Maori people. Alexander Barron is appointed Acting Surveyor-General in his place.

- The New Zealand Institute of Surveyors and Board of Examiners Act is passed. The Act requires that any rules made by the Institute be approved by the Minister of Lands, and establishes a Board of Examiners of Surveyors.

1901

- A new secondary triangulation is started, to bring together the different nets of minor triangles which had spread inland from the coastal chain in Wellington and Taranaki provinces. The triangulation ceases in 1902, and is recommenced in 1909.

- Gordon Hurrell Morland McClure extends the 1896 standard survey of Christchurch.

- The Christchurch Magnetic Observatory is established in the Botanic Gardens as a base station for the magnetic survey of New Zealand.

- Alexander Barron retires as Acting Surveyor-General.

- The Lithographic Branch of the Department of Lands and Survey is amalgamated with the Government Printing Office.

- The Surveyors Board holds its first meeting.

1902

- John William Allman Marchant is appointed as Surveyor-General.

- Extensive traverse and topographical surveys of the Urewera country are completed. These are necessitated by the Urewera Reserve Act of 1896 and its amending act in 1900.

- Keith Lucas and G.L. Hodgkin make bathymetrical surveys of nine New Zealand lakes (Taupo, Wakatipu, Manapouri, Waikaremoana, Rotorua, Rotoiti, Waikare, Whangape and Roto Aira). The survey is designed to be "detailed enough to allow of the drawing of rough isobaths in all parts of the lakes, but that minor details of form should be neglected". The soundings are made using a Lucas sounding machine with a capacity of about 400 fathoms.

1903

- The Department of Lands and Survey purchases 12 steel bands from Chesterton and Company, Birmingham. The tapes are slightly over 100 feet in length, and each Chief Surveyor is supplied with one of the tapes, so as to provide a uniform and consistent standard for the surveys of the colony.

- William Thomson Neill's *The use of the barometer for the determination of heights* is published as Lands and Survey *Professional Paper* no.3.

- Charles William Adams's *The measurement of distances with long steel tapes,* a paper initially read before the Victorian Institute of Surveyors in September 1888, is published as Lands and Survey *Professional Paper* no.4. This is the final *Professional Paper* in this series to be published.

1905

- James Mackintosh Bell is appointed Director of the Geological Survey of New Zealand. He immediately reorganises the Survey, employs new staff, and institutes a new geological and topographical mapping programme.

1905-1906

- James Mackintosh Bell and Colin Fraser survey and map the geology of the Hokitika area. The maps are published in 1906 as part of the Geological Survey's *Bulletin* no.1.

- James Park surveys and maps the geology of the Alexandra area of central Otago. The maps are published in 1906 as part of the Geological Survey's *Bulletin* no.2.

1905-1907

- James Mackintosh Bell and Colin Fraser survey and map the geology of the Coromandel Subdivision, Hauraki Division. The maps are published in 1907 as part of the Geological Survey's *Bulletin* no.4.

1905-1908

- Percy Gates Morgan and others survey and map the geology of the Mikonui Subdivision, north Westland. The maps are published in 1908 as part of the Geological Survey's *Bulletin* no.6.

1906

- John William Allman Marchant retires as Surveyor-General. Thomas Humphries is appointed in his place. At this time the positions of Under-Secretary for Lands and Surveyor-General are separated.

- The Under-Secretary for Lands becomes the permanent head of the Department of Lands and Survey.

- James Mackintosh Bell announces the reorganisation of the Geological Survey Department, and outlines a scheme for the preparation of a detailed topographical and geological map of New Zealand. For this purpose the country is divided into divisions, each one of which represents a problem of particular interest. Each division contains a number of survey districts, and several survey districts comprise a subdivision. Bell states that the Geological Survey Department proposes to prepare full reports, accompanied by geological and topographical maps, on each subdivision as soon as the necessary field work is completed.

- The first Geological Survey of New Zealand *Bulletin* (covering the Hokitika area) is published. The maps that accompany the *Bulletin* are the first in the one inch to one mile geological maps introduced by the Director of the Geological Survey, James Mackintosh Bell.

- James Daniel Climie revises part of the 1880 standard survey of Wellington.

- In the *Queensland Geographical Journal* John Murray discusses various features of the southwest Pacific Ocean, and includes a chart that incorporates many deep soundings taken by HMS *Penguin, Egeria,* and *Waterwitch*, as well as those of the *Challenger*. This chart is the first to show the Chatham Islands bathymetrically linked to New Zealand, with the 500 fathom isobath around the Chatham islands defining the Chatham Rise.

1906-1907

- James Macintosh Bell, Ernest John Herbert Webb, and Edward de Courcy Clarke survey and map the geology of the Parapara Subdivision, Karamea, Nelson. The maps are published in 1907 as part of the Geological Survey's *Bulletin* no.3.

- James Park surveys and maps the geology of the Cromwell Subdivision, western Otago. The maps are published in 1908 as part of the Geological Survey's *Bulletin* no.5.

1907

- James Daniel Climie, Inspecting Surveyor, completes the extension and revision of the 1880 standard survey of the city of Wellington.

- A map showing the topography and vegetation of Tongariro National Park is published in the *Appendix to the Journals of the House of Representatives* (C-14). The topographical details are provided by E. Phillips Turner; the vegetation by Leonard Cockayne.

- J.W. Gregory produces a chart, prepared by Edward Stanford, titled *Australasia showing the Depth of the Sea*. The chart shows a much improved delineation of bathymetric features, and shows the Tasman Basin, the Tonga and Kermadec Trenches, Lord Howe Rise, Norfolk Ridge and the Kermadec Ridge. The 1,000 fathom contour to the south encloses Auckland and Macquarie Islands, but the Chatham Islands are cut off from New Zealand by a trough approximately 3450 fathoms deep.

1907-1908

- James Park surveys and maps the geology of the Queenstown Subdivision, western Otago. The maps are published in 1909 as part of the Geological Survey's *Bulletin* no.7.

- James Mackintosh Bell and Edward de Courcy Clarke survey and map the geology of the Whangaroa Subdivision, Hokianga Division. The maps are published in 1909 as part of the Geological Survey's *Bulletin* no.8.

1908

- James Mackintosh Bell begins a geographical survey of the Franz Josef Glacier.

- John Langmuir assisted by H.M. Kensington, completes the field work of the standard survey of the city of Auckland.

- The Surveyors' Institute and Board of Examiners Act is passed, consolidating previous legislation but continuing all the provisions relating to the affairs of the Institute.

- The New Zealand Institute of Surveyors endeavours unsuccessfully to obtain the establishment of a Department of Surveying, Geodesy and Municipal Engineering at Victoria College in Wellington.

- The Deeds Registration Act consolidates the Deeds Registration Act 1868, the Deeds and Instruments Registration Act 1886 and the Lands and Deeds Registration Districts Act 1902.

- Leonard Cockayne maps the vegetation of the Waipoua Kauri Forest and makes a report, which is published in the *Appendix to the Journals of the House of Representatives* (C-14).

1908-1909

- James Henry Adams surveys and maps the geology of the Whatatutu Subdivision, Raukumara Division. The maps are published in 1910 as part of the Geological Survey's *Bulletin* no.9.

- Colin Fraser surveys and maps the geology of the Thames Subdivision, Coromandel. The maps are published in 1910 as part of the Geological Survey's *Bulletin* no.10.

- Ernest John Herbert Webb surveys and maps the geology of the Mount Radiant Subdivision, Westport Division. The maps are published in 1910 as part of the Geological Survey's *Bulletin* no.11.

1908-1910

- Percy Gates Morgan and John Arthur Bartrum survey and map the geology of the Greymouth Subdivision, north Westland. The maps are published in 1911 as part of the Geological Survey's *Bulletin* no.13.

1908-1911

- James Mackintosh Bell and Colin Fraser survey and map the geology of the Waihi-Tairua Subdivision, Hauraki Division. The maps are published in 1912 as part of the Geological Survey's *Bulletin* no.15.

1909

- Thomas Humphries retires as Surveyor-General. John Strauchon is appointed in his place.

- George Leslie Adkin makes the first recorded European crossing of the Tararua Range from Levin to Masterton.

- The British Admiralty asks the Department of Lands and Survey to prepare tables of tide predictions for New Zealand ports.

- H.M. Kensington conducts a standard survey of Rotorua.

- Gordon Hurrell Morland McClure extends the standard survey of Timaru.

- Leonard Cockayne reports on and maps the vegetation of Stewart Island.

1909-1911

- Edward de Courcy Clarke surveys and maps the geology of the New Plymouth Subdivision, Taranaki. The maps are published in 1912 as part of the Geological Survey's *Bulletin* no.14.

1909-1914

- A geodetic survey of New Zealand is commenced, starting with the measurement of a southern base-line in Wairarapa and a northern base-line at Eltham. The southern base-line is selected by H.J. Lowe, and easurement of the base takes 47 days between March and May 1909. The Eltham base-line is first suggested by H.M. Skeet in 1897, and is approved in 1909. Measurement of this base takes 46 days, between April and June 1910. Subsequent base-lines to be measured are the Matamata base, measured in December 1910 and January 1911, the Waitemata base, measured from June to August 1911, and the Kaingaroa base, measured in January 1912 and from February to April 1913. Work ceases because of the First World War.

1910

- James Daniel Climie extends the standard survey of Palmerston North, and makes a standard survey of Wanganui.

1911

- The British Antarctic Research ship *Terra Nova* undertakes the first hydrographic survey of the Three Kings Islands.

- James Mackintosh Bell resigns as Director of the Geological Survey of New Zealand. Percy Gates Morgan is appointed in his place.

- Hubert Girdlestone produces his map of the Tararua Range showing the route between Levin and Masterton.

- The Department of Lands and Survey orders two Troughton and Simms 8-inch transit theodolites from England. The theodolites are delivered in New Zealand the following year.

- William Thomson Neill revises and extends the standard survey of Dunedin.

1911-1912

- John Henderson and John Arthur Bartrum survey and map the geology of the Aroha Subdivision, Hauraki Division. The maps are published in 1913 as part of the Geological Survey's *Bulletin* no.16.

- Percy Gates Morgan surveys and maps the geology of the Buller-Mokihinui Subdivision, Westport Division. The maps are published in 1915 as part of the Geological Survey's *Bulletin* no.17. Included with the maps is a four sheet map showing the Buller coalfield.

1912

- John Strauchon retires as Surveyor-General. James Mackenzie is appointed in his place.

- Charles Adnam Mountfort revises and extends the standard survey of Wanganui.

- Walter Francis Robinson's *The Survey cadet's manual, for cadets entering the New Zealand Lands and Survey Department and for beginners in surveying*, is published by the Government Printer, Wellington.

- John Murray and Johan Hjort publish a map in their *The Depths of the Ocean* (London, Macmillan) showing the Fiji basin connected to the Norfolk Basin, no depression south-west of the Chatham Islands, and no connection between Campbell Plateau and Macquarie Island. The map shows the connection at the 500 fathom level between New Zealand and the Chatham Islands, and a generalised Hikurangi Trench.

1912-1914

- John Henderson surveys and maps the geology of the Reefton Subdivision, Westland. The maps are published in 1917 as part of the Geological Survey's *Bulletin* no.18.

1913

- Charles Adnam Mountfort revises the standard survey of Nelson.

- The Dominion Section of the Imperial General Staff Headquarters produces a 5 sheet topographical map of Wellington and vicinity, at a scale of 1:31,680. A revision is made in 1924 and published by the Department of Lands and Survey in 1925.

1914

- James Mackenzie retires as Surveyor-General. Ernest Herbert Wilmot is appointed in his place.

- In a report to the First Lord, Winston Churchill, the Hydrographer of the British Admiralty, Sir Herbert E. Purey-Cust, advocates that surveying in New Zealand waters should be at the Admiralty's expense. This idea fails to come to fruition, as does a similar proposal floated in 1919-1920.

1914-1916

- John Henderson and Montague Ongley survey and map the geology of the Gisborne district. The maps are published in 1920 as part of the Geological Survey's *Bulletin* no.21.

- W. Gibson surveys and maps the geology of the Egmont Subdivision, Taranaki. The maps are eventually published in 1929 as part of the Geological Survey's *Bulletin* no.27.

1914-1918

- Following the 1912 Public Service Act, the newly-established Public Service Commission sets out Regulations detailing the syllabus for the examination of draughtsmen of the Lands and Survey Department for a certificate in competency. Subsequent modifications provide for 1st and 2nd grade certificates in draughting and computing; the first certificates are awarded in 1917. Completion of these examinations is prerequisite for advancement beyond a certain salary level.

1915

Charles Adnam Mountfort revises the standard survey of Napier.

1915-1916

- Patrick Marshall surveys and maps the geology of the Tuapeka District, central Otago. The maps are published in 1918 as part of the Geological Survey's *Bulletin* no.19.

- James Park surveys and maps the geology of the Oamaru District, north Otago. The maps are published in 1918 as part of the Geological Survey's *Bulletin* no.20.

1916

- W.C. Parkinson, of the Carnegie Institution, Washington, visits New Zealand and makes a number of magnetic observations.

- *The Magnetic Survey of New Zealand*, based on the work of C. Coleridge Farr, assisted by Henry Fawsit Skey and D.B. MacLeod, is published by the Department of Lands and Survey.

- In its *Annual Report on Surveys* for 1915-16, the Department of Lands and Survey publishes a *Map of Anzac and the Suvla Bay Area, Gallipoli Peninsula, to illustrate operations carried out during the campaign of 1915.* The map is prepared from information supplied by Private Waldo Thompson of the Napier staff of the Department, who is present at the landing on 25 April 1915 and sees four months service in the ensuing operations.

1917-1919

- John Henderson and Montague Ongley survey and map the geology of the Mokau Subdivision and the area around Te Kuiti. The maps are published in 1923 as part of the Geological Survey's *Bulletin* no.24.

- John Henderson maps the geology of the Cheviot district, north Canterbury.

1918

- D. Macpherson surveys and maps the area between Lake Te Anau and Gaer Arm, Fiordland.

- The settlement on the land of returned servicemen sees an intensification of survey activities by the Department of Lands and Survey.

- Cecil M. Hill and J.L. Sleeman, flying in a Caudron bi-plane, take a number of aerial photographs of the Christchurch area. These are believed to be the first oblique aerial photographs taken in the South Island.

1918-1921

- John Henderson and Leslie Isott Grange survey and map the geology of the Huntly – Kawhia Subdivision. The maps are published in 1926 as part of the Geological Survey's *Bulletin* no.28.

1919

- George B. Bolt takes G. Bourne, chief photographer for the *Auckland Weekly News*, on a flight over Auckland, during which Bourne takes a number of oblique photographs of Auckland.

1919-1920

- James Park surveys and maps the geology of Western Southland. The maps are published in 1921 as part of the Geological Survey's *Bulletin* no.23.

- Montague Ongley and Eric Ogilvy Macpherson survey and map the geology of the Collingwood area. The maps are published in 1923 as part of the Geological Survey's *Bulletin* no.25.

- Admiral Sir John Parry submits a memorandum to the British Admiralty concerning the measures to be taken to survey the waters of the colonies of the Empire. New Zealand requests that the task be carried out by the Admiralty and suggests that half the cost of surveying New Zealand waters be borne by the New Zealand Government. The plan comes to nothing because of severe retrenchment within the British Admiralty due to post-war economic pressures.

1919-1921

- Hartley Travers Ferrar surveys and maps the geology of the Whangarei – Bay of Islands area. The maps are published in 1925 as part of the Geological Survey's *Bulletin* no.27.

1920

- Publication of a two miles to one inch topographical series commences, designed to cover all of New Zealand. Sheet boundaries are based on geographical lines, each sheet comprising 1° in longitude and ½° in latitude, rather than on survey district boundaries.

- The Lands and Survey Department publishes two sheets in a contoured, coloured topographical series of New Zealand at a scale of 1:125,000. The maps are largely the work of Kenneth Graham, are based on existing triangulation, and conform to the scheme of the 1:1,000,000 International Map of the World. The two maps are for the Auckland and Wellington regions.

- Ernest Herbert Wilmot resigns as Surveyor-General after being prosecuted for a lapse of propriety. Thomas Noel Brodrick, Under-Secretary for Lands, is Surveyor-General from April to October. William Thomson Neill is appointed to the position in October.

- The first Samoan trainee passes his preliminary surveying orientation course in New Zealand before returning to Samoa.

- The standard survey of Dunedin is revised.

- Charles Adnam Mountfort revises the standard survey of Palmerston North.

- H.M. Kensington conducts a standard survey of Gisborne.

1920-1923

- Montague Ongley and Eric Ogilvy Macpherson survey and map the geology of the Waiapu Subdivision, Raukumara Division. The maps are published in 1928 as part of the Geological Survey's *Bulletin* no.30.

- Leslie Isott Grange surveys and maps the geology of the Tongaporutu - Ohura Subdivision, northern Taranaki. The maps are published in 1927 as part of the Geological Survey's *Bulletin* no.31.

1921

- D. Macpherson and S. Turner explore the Milford Sound and Hollyford River area.

- John Henderson and Leslie Isott Grange make a geological reconn-aissance of the Marakopa district, south of Kawhia, and map its geology.

1921-1922

- Percy Gates Morgan and H.A. Ellis survey and map the geology of the Waihi area. The maps are published in 1924 as part of the Geological Survey's *Bulletin* no.26.

1921-1938

- The North Island geodetic triangulation is made, observations beginning at the Kaingaroa base.

1922

- Maurice Crompton-Smith (son of Stephenson Percy Smith) briefly holds the position of Surveyor-General.

- The Surveyors' Institute and Board of Examiners Amendment Act is passed.

- The Lands and Survey Department publishes a 2 sheet topographical map of Dunedin and vicinity, at a scale of 1:31,680. The map is based on survey work carried out by William Thomson Neill.

1923

- The first New Zealand postage stamp to feature a map as its design is issued. The stamp commemorates the re-introduction of penny postage, which had been suspended because of the First World War.

- C. Otway revises and extends the standard survey of Invercargill.

- A.C. Haase revises and extends the standard survey of New Plymouth.

- John Henderson surveys and maps the geology of the Mount Arthur district, northwest Nelson.

1923-1926

- John Henderson, Leslie Isott Grange and Eric Ogilvy Macpherson survey and map the geology of the Motueka Subdivision. Eleven maps are drawn in 1930 but not published until 1959, when they appear as a belated *New Zealand Geological Survey Bulletin* no.35.

- Montague Ongley surveys and maps the geology of the Kaitangata-Green Island Subdivision, eastern Otago. The maps and accompanying bulletin (number 38) are published in 1939.

1923-1928

The Department of Lands and Survey publishes its *Records of the Survey of New Zealand (Supplementary to Annual Report)*. The Record contains the "annual reports of parties and officers conducting basic surveys and scientific operations". Five volumes are published, covering the years 1923/24 (published 1925) through to 1927/28 (published 1928).

1924

- The Honorary Geographic Board, with no statutory authority, is formed after the Minister of Lands decides that a small board is needed to handle place naming concerns.

- The first Automobile Association map is produced.

- The Land Transfer (Compulsory Registration of Titles) Act is passed to ensure that as far as is practicable all land in the country is brought under the Torrens system.

- The Hollyford River valley in Fiordland is mapped by T.W. Preston.

1925

- The New Zealand Permanent Air Force purchases two aerial camera types, one for vertical photography and the other for oblique photography, and undertakes the first vertical photography in New Zealand.

- Hartley Travers Ferrar publishes a sketch map of New Zealand's bathymetry that indicates the south-western boundary of Campbell Plateau and the existence of the Hikurangi Trench. The map is published in volume 7 of the *New Zealand Journal of Science and Technology*.

1926

- George Leslie Adkin starts to describe and map hundreds of named Maori sites between the Manawatu and Otaki rivers.

- The first urban area aerial survey in New Zealand is made by James L. Findlay, Officer Commanding at the

Royal New Zealand Air Force base at Wigram. The survey is of the city of Christchurch.

- Leonard M. Isitt and W. Stan Simpson make the first vertical aerial survey involving line overlap photography. The survey is of the Waimakariri River, north of Wigram, hristchurch.

- The Department of Scientific and Industrial Research is established, under the leadership of Dr. Ernest Marsden. The new department brings together a number of existing scientific institutions (including the Geological Survey) and develops some new ones (such as the Soil Division).

- H.M. Kensington completes the field work for standard surveys of Whangarei and Gisborne.

- B.C. Aston maps and classifies the soils of Rotorua county.

1926-1927

A survey party led by T.W. Preston makes observations of latitude and longitude at a number of positions in the Fiordland sounds, to test the accuracy of the coastline as it is then charted. Topographical sketches of several of the sounds are made also.

1926-1928

- The soils of central Otago are mapped by Hartley Travers Ferrar. The maps and accompanying text are published as the New Zealand Geological Survey's *Bulletin* no.33 in 1929.

1926-1929

- Horace E. Fyfe, partially assisted by John Henderson, surveys and maps the geology of the Murchison and Maruia Subdivisions. The maps are drawn in 1935, and put into storage pending publication of an accompanying bulletin. The bulletin (*New Zealand Geological Survey Bulletin* no.36) is finally published in 1968.

1927

- Percy Gates Morgan, Director of the New Zealand Geological Survey, dies from a heart attack. John Henderson is appointed to replace Morgan, and holds the position until his retirement in 1945.

- A contour survey of Egmont National Park, on a scale of 20 chains to 1 inch, and with vertical contours of 100 feet, is commenced.

- A standard survey of Blenheim is completed by J.D. Clapperton.

- The first aerial forest survey in New Zealand is made, of the Hanmer Springs plantations, for the New Zealand Forest Service. The aerial photography is conducted by the New Zealand Permanent Air Force.

- Douglas Mill forms the Air Survey and Transport Company, based at Hobsonville. A limited amount of aerial surveying and photography is carried out by the Company.

- Hartley Travers Ferrar maps the geology of Kapiti Island.

- Geophysical survey methods are introduced into New Zealand when an attempt is made to study part of the New Plymouth oil field, and areas near Woodville and Weber in southern Hawkes Bay. Much of the information that is gathered is lost to New Zealand because the company is of foreign origin.

1927-1928

- Further reconnaissance survey work in Fiordland is carried out by T.W. Preston.

1928

- The Surveyors Registration Act is passed. The name of the Surveyors Board is changed to Survey Board (but the new legislation does not alter the Board's constitution or membership), and provision is made for the registration of surveyors. The Surveyors' Institute Amendment Act is also passed, repealing those parts of the 1908 Act dealing with the Surveyors' Board and amending the 1908 Act in relation to the constitution of the Institute's Council.

- The Department of Scientific and Industrial Research publishes an account by Robert Speight of the geology of the Malvern Hills, Canterbury. The report and an accompanying map is issued as *Geological Memoir* no.1.

- The Magnetic Observatory at Christchurch is moved 50 km north to Amberley, because of interference from the urban electric tramway system in Christchurch.

1928-1932

- Hartley Travers Ferrar and Norman Hargrave Taylor survey and map the geology and soils of the Te Kuiti Subdivision in the King Country. The maps are published in 1946 as part of the Geological Survey's *Bulletin* no.41.

1929

- William Thomson Neill retires as Surveyor-General. Harry Edward Walshe is appointed in his place.

- The Department of Lands and Survey purchases two of the new optical geodetic theodolites (Wild T3) for use on the geodetic triangulation. These replace the two 8 inch T&S transit theodolites obtained for this work in 1912. The use of the new theodolites results in a significant improvement in accuracy and progress. These T3 theodolites, together with later models, are then used extensively on all major triangulation projects for the next 60 years, being ultimately supplanted by GPS.

- The Department of Lands and Survey participates in an international longitude campaign by carrying out longitude observations at Kelburn in Wellington. Similar campaigns are carried out in 1933 , which contribute to the definition of the New Zealand Geodetic Datum 1949 , and later in 1957-58.

- An aerial mosaic of the city of Christchurch is completed, following the initial flight in 1926.

- The book *Maori witchery, native life in New Zealand*, by Charles Barton Browne, is published in London by J.M. Dent. The book takes the form of a novel, and describes experiences amongst the Maoris of a government surveyor engaged in the King Country on the construction of the Main Trunk railway. Browne worked with John Rochfort, and the main character of the book is possibly an amalgam of the author and Rochfort.

1929-1930

- Leslie Isott Grange surveys and maps the geology of the Tongariro Subdivision, central North Island. The maps are published by the Geological Survey in 1938 but the accompanying bulletin, number 40, is not published until 1960.

1930

- Leslie Isott Grange and Norman Hargrave Taylor, both geologists, map ash showers on the Volcanic Plateau of the North Island and show a correlation

between soil type and bush sickness amongst farm stock.

- Hartley Travers Ferrar makes the first use of aerial photographs for geological survey work during the course of work in the Te Kuiti subdivision. The photographs are taken at an altitude of 10,000 feet, by the Air Survey and Transport Company of Auckland.

- Les Adkin and H.R. Francis produce the first comprehensive map of the northern part of the Tararua Range.

- An aerial survey of Christchurch is completed by the New Zealand Permanent Air Force. The area covered includes the city of Christchurch, Riccarton, Lyttelton, Sumner and New Brighton boroughs, and Waimairi, Halswell, Heathcote and Paparoa counties. 67 2 feet by 2 feet mosaics are produced.

- The Surveyor General Harry Edward Walshe obtains on approval two aerial survey cameras, from Zeiss in Germany and Henry Wild in Switzerland, but because of spending restrictions is unable to go ahead and purchase either of them.

- The University of New Zealand offers a two-year Diploma in Surveying. The course is suspended because of changes to the regulations of the Survey Board, and there are concerns by the University that moves by the survey profession to reconstruct its own examinations might result in no candidates coming forward for the University examinations.

1931

- New Zealand's first topographical map to be produced using photogrammetric methods is compiled in the Lands and Survey Department by senior draughtsman Robert J. Crawford using a technique described in *Simple Methods of Surveying from Aerial* Photographs by British Army Lieutenant Martin Hotine. The area covered in this experimental project is part of Blocks V & IX, Wakapapa S.D. in the Nelson Land District.

- Most of the survey and land title records for the Hawke's Bay Land District are destroyed in the Napier Earthquake.

- The magnetic survey of New Zealand, started by the Department of Lands and Survey in 1899, is transferred to the Department of Scientific and Industrial Research.

- The standard survey of Invercargill is completed.

- The first New Zealand sheet (S.L.59 - Dunedin) in the Carte Internationale du Monde au 1,000,000 (International map of the World 1:1,000,000) series is published. (Two further sheets are compiled and drawn by the Lands and Survey Department: S.L.58 – Fiords, published in 1934, and S.K.59 – Christchurch, published in 1936).

- Harold Service maps the geology of the Goodwood district, northeast Otago.

1931-1936

- Re-establishment surveys, including triangulation and precise levelling and field work for standard surveys of Napier and Hastings, are undertaken following the Napier Earthquake of 1931.

1932-1934

- John Herbert Williamson surveys and maps the geology of the Naseby Subdivision, central Otago. The maps are published in 1939 as part of the Geological Survey's *Bulletin* no.39.

1933

- Special observations for the determination of longitude are made at the Dominion Observatory, Wellington, as part of a world-wide programme inaugurated by the Bureau des Longitudes, Paris. Wellington is chosen as one of the Southern Hemisphere stations, along with Capetown, Adelaide and Buenos Aires. The observations are made by R.C. Hayes and I.L. Thomsen.

- Leslie Isott Grange and Norman Hargrave Taylor make a rapid reconnaissance survey of the soils of western Taranaki. The map is published in the *Appendix to the Journals of the House of Representatives*, H34, 1933.

- Leslie Isott Grange is appointed Officer-in-Charge, Soil Survey Unit, Department of Scientific and Industrial Research.

1933-1935

- The soils of part of Waipa County are surveyed and mapped by staff of the Department of Scientific and Industrial Research. The maps and accompanying text are published as Department of Scientific and Industrial Research *Bulletin* no.76.

1933-1936

Most standard survey work by the Department of Lands and Survey is suspended because of the Depression, with the exception of survey work in Hawke's Bay following the 1931 earthquake.

1934

- Henry Piet Drury van Asch takes aerial photographs of the Hastings area for the Department of Scientific and Industrial Research in order to help them delineate soil types.

- Lester Charles King maps and describes the geology of the Lower Awatere district, Marlborough. King's work is published as Department of Scientific and Industrial Research *Geological Memoir* no.2.

- The Honorary Geographic Board of New Zealand issues its *Place-names in New Zealand, rules of nomenclature and list of names approved, or changed, or expunged*. The publication is compiled by Johannes Carl Andersen.

1935

- The Marine Department and the Navy propose a hydrographic survey of the New Zealand coastline, to update the surveys of Cook, Drury and Byron.

- The Department of Lands and Survey acquires a Barr and Stroud precision topographical stereoscope which enables elevations to be measured and contour lines to be drawn on pairs of photographs.

- The vegetation of the South Island is mapped at a scale of 1:1,000,000 by Frederick William Hilgendorf. The map is issued as part of DSIR *Bulletin* no.47.

- Leo White and F. Stewart establish the aerial survey firm of Stewart & White Limited. The partnership between Stewart and White ceases in 1942 when White joins the Royal New Zealand Air Force.

1935-1936

- The soils of the Plains area of Ashburton County are described and mapped by I.W. Weston.

- Leslie Isott Grange is appointed Director, Soil Survey Branch, Depart-

ment of Scientific and Industrial Research.

1935-1939

- The first meeting of the Mapping Subcommittee of the New Zealand Committee of Imperial Defence (later the Organisation for National Security) is held in December 1935, chaired by Surveyor-General Harry Edward Walshe and including, amongst others, representatives from Defence, Forestry, Mines, Public Works, Scientific and Industrial Research and Treasury. Its first interim report defines terms of reference covering the co-ordination of all mapping activities, with the ultimate object of compiling a topographical map of New Zealand at a scale of one inch to the mile. Methods involving the use of aerial photographs are recommended and areas in Hawkes Bay from Eskdale to Waipukarau and in Auckland from Kaipara Heads to Tuakau are given first priority. In later years this subcommittee evolves into the Interdepartmental Survey and Mapping Committee which continues to meet regularly until 1986.

1935-1940

- A soil survey of Northland is undertaken by Norman Hargrave Taylor assisted by C.F. Sutherland. In 1936-1937 the soils between Russell and Waipu are mapped, as are the soils around Kaitaia. The soils of Whangarei County are written up by 1938. During 1939-1940 the soils of Hobson and Otamatea counties are mapped. The sheet maps for the soils of Whangarei County are published in 1948, but the accompanying bulletin (Soil Bureau Bulletin no.4) is never published. Detailed text appears in the annual reports of the Department of Scientific and Industrial Research, and soil maps appear in the *Appendix to the Journals of the House of Representatives*, H-34, for 1936, 1937-38, and 1939.

1936

- An RNZAF aerial mapping unit begins an aerial topographical survey from the Esk Valley to Porangahau in Hawkes Bay. The survey is completed by New Zealand Aerial Mapping in 1938.

- New Zealand Aerial Mapping is formed in Hastings.

- The Computing Branch of the Department of Lands and Survey, under E.J. Williams, Senior Computer, is expanded. Arrears of harmonic analysis of the tidal survey are put in hand and, with adjustment of standard traverses in Hawke's Bay almost completed, work can proceed on the adjustment of geodetic triangulation data in hand and coming forward from the field.

- The Department of Lands and Survey sets up a small photogrammetric unit under the supervision of Robert (Bob) J. Crawford. In 1940 this unit is named the Aerial Mapping Branch.

- The preparation of "flying maps" is undertaken by the Department of Lands and Survey, in collaboration with the Aerodrome Branch of the Public Works Department. The first of these covers the flying route from Auckland to Palmerston North.

- The Soil Survey Division of the Department of Scientific and Industrial Research is established, with staff from the New Zealand Geological Survey. The Division's first Director is Leslie Isott Grange.

1936-1937

- The Blackburn Coalfield, Buller, is surveyed and mapped by Horace E. Fyfe and Harold William Wellman. The

maps and accompanying text are published in the *Appendix to the Journals of the House of Representatives*, H-34, 1937-38.

1936-1941

- Montague Ongley, Albert Mathieson Quennell, David Alexander Brown and Arnold Robert Lillie survey and map the geology of the Dannevirke Subdivision. The maps and accompanying bulletin are published in 1953.

1937

- New Zealand Aerial Mapping's first major aerial survey is undertaken; of the Richardson Range from Queenstown to the head of the Shotover River.

- J. Alan Henderson of the Department of Lands and Survey completes the ground control of aerial surveys of 1,000 square miles in Hawkes Bay.

- The National Historic Committee approaches the Department of Lands and Survey about a proposal for an historic atlas of New Zealand, to commemorate the 1940 Centennial. An atlas and gazetteer subcommittee, chaired by James Rutherford of the History Department at Auckland University College, is appointed. To make room for the eight extra draughtsmen transferred to Lands and Survey Head Office to work on the atlas, the computing and aerial staff, under F.H. Jennings and Robert J. Crawford, move to premises in Aitken Street (Wellington).

- Standard survey work by the Department of Lands and Survey recommences, in a very limited way, with maintenance of the existing survey in Auckland City, and revision work in Christchurch and Ashburton.

1937-1938

- The soils of the Westport district are described and mapped by Charles Sherwood Harris and A.C. Harris. The text and maps are published as Department of Scientific and Industrial Research *Bulletin* no.71.

- By arrangement with the Defence Department, the Department of Lands and Survey divides New Zealand into rectangular sheets each measuring 30,000 yards by 45,000 yards. This is for the purpose of systematically locating topographical surveys of the North and South Islands. An index map of the North Island, showing the sheet layout is published in the 1937-38 annual report of the Department of Lands and Survey.

1937-1939

- A survey of the northern coasts (Mayor Island to the Bay of Islands) is undertaken by Captain Arthur Guy Norris Wyatt on board HMS *Endeavour*. Ten new charts are produced as a result of *Endeavour*'s surveys. The survey is planned initially as a ten year programme, but the programme is curtailed by the advent of World War II.

1938

- The National Mapping Committee establishes a target of 3,000 square miles (about 8,000 square kilometers) to be aerially photographed each year, and the RNZAF purchases an Oxford aircraft specially adapted for aerial photography.

- Detail plotting and contouring of sheet N.134 in Hawkes Bay is completed at a working scale of 1:15840. The Department of Lands and Survey's mapping capability is increased by the arrival of an additional Bausch and Lomb precision stereoscope.

- The Surveyors Act brings all qualified surveyors together in one professional body – the New Zealand Institute of Surveyors. The Act requires the holding of Annual Practicing Certificates, and makes it compulsory for surveyors on the register to be members of the New Zealand Institute of Surveyors.

- The soils of Duvauchelle Bay – Wainui District, Banks Peninsula, are described and mapped by Charles Sherwood Harris and A.C. Harris. The maps and accompanying text are published by the Department of Scientific and Industrial Research as *Bulletin* no.65.

- The Department of Scientific and Industrial Research publishes an account by Robert Speight of the geology of the Mount Somers district, Canterbury, with a map, as *Geological Memoir* no.3.

- The Department of Scientific and Industrial Research publishes, as *Geological Memoir* number 4, an account of early experiments in geophysical survey in New Zealand. Thirty-two geophysical investigations are detailed, with a map of each investigation.

- Variations of magnetic force in the Rotorua area are measured and mapped by C.N. Watson-Munro of the Dominion Observatory, Department of Scientific and Industrial Research.

1938-1942

- South Island geodetic triangulation is made.

1938-1943

- Maxwell Gage, Horace E. Fyfe, and others, survey and map the Greymouth coalfields. The maps and accompanying bulletin are not published until 1952.

1939

- The first one inch to one mile topographic map in what becomes the NZMS 1 series is published. The sheet is N.134 which includes Napier and Hastings.

- After consultation with the Army Department, Government authorizes the Lands and Survey Department to start producing topographical maps at a scale of 1:25,000 for the Auckland, Wellington and Christchurch fortress areas, and for the Waiouru training area.

- The Lands and Survey Department orders two anaglyph projection plotters from Zeiss in Germany but as the outbreak of war prevents their delivery, a large proportion of the mapping is done by ground survey using plane tables in combination with aerial photographs.

- During the year many square miles of country are photographed for purposes of irrigation, drainage, river and erosion control, road location, forestry, and soil survey and mapping.

- A soil survey of the Heretaunga Plains, Hawkes Bay, begun in 1935, is completed by H.A. Hughes, L. Hodgson and A.C. Harris of the Soil Survey Division. The maps are published as part of DSIR Bulletin no.70, *Land utilization report of the Heretaunga Plains.*

- The soils of the Wairau Plains, Marlborough, are surveyed and mapped by Charles Sherwood Harris. The maps and accompanying text are published by the Department of Scientific and Industrial Research as *Bulletin* no.72.

- A soil survey of mid Hawkes Bay is completed by Ivan Joseph Pohlen, Charles Sherwood Harris, Harry Stephen Gibbs and James Dickie Raeside. Because of the War the maps

and accompanying bulletin are not published until 1947.

- The New Zealand Railway Group is established at the request of the British Secretary of State for Dominion Affairs. The Railway Group includes the 9th Railway Survey Company. The Group conducts survey work for railway construction in the Western Desert of Egypt and Libya from 1940 through to 1941, in the Nile Valley in 1942, and in Palestine and Lebanon in 1943. The Group also surveys landing sites and potential airfields in southern Greece in 1940-1941, surveys routes from the Persian Gulf across Iraq to Russia in 1942, and in the same year surveys possible railway routes north of Baghdad.

- The British hydrographic survey of the New Zealand coastline is terminated because of the outbreak of war with Germany.

- The grasslands of the North Island are mapped at a scale of 1:1,000,000 by E.A. Madden. The map is issued as part of the Department of Scientific and Industrial Research's *Bulletin* no.79.

- Land use maps of the North and South Islands are published as part of the annual report of the Department of Agriculture (*Appendix to the Journals of the House of Representatives*, H.29, 1939).

1939-1960

- The geology of the Tuatapere Subdivision, Southland, is surveyed and mapped by Richard Wright Willett (1939-41), by R.W. Willett and John Marwick (1942), by R.W. Willett and Bryce Leslie Wood (1947), by A.C. Beck, B.L. Wood, Athol J. Waddick and Frederick Ernest Bowen (1948-49), by B.L. Wood, I.C. McKellar and Alexander Russell Mutch (1950-51) and by Charles Alexander Fleming, Norcott de Bisson Hornibrook and B.L. Wood (1960). The maps and accompanying bulletin are published in 1969.

1940

- With the outbreak of war photogrammetric and ground survey work commences on maps at a scale of 1:25,000, for military training purposes and progress on the Hawkes Bay inch to the mile sheets is suspended.

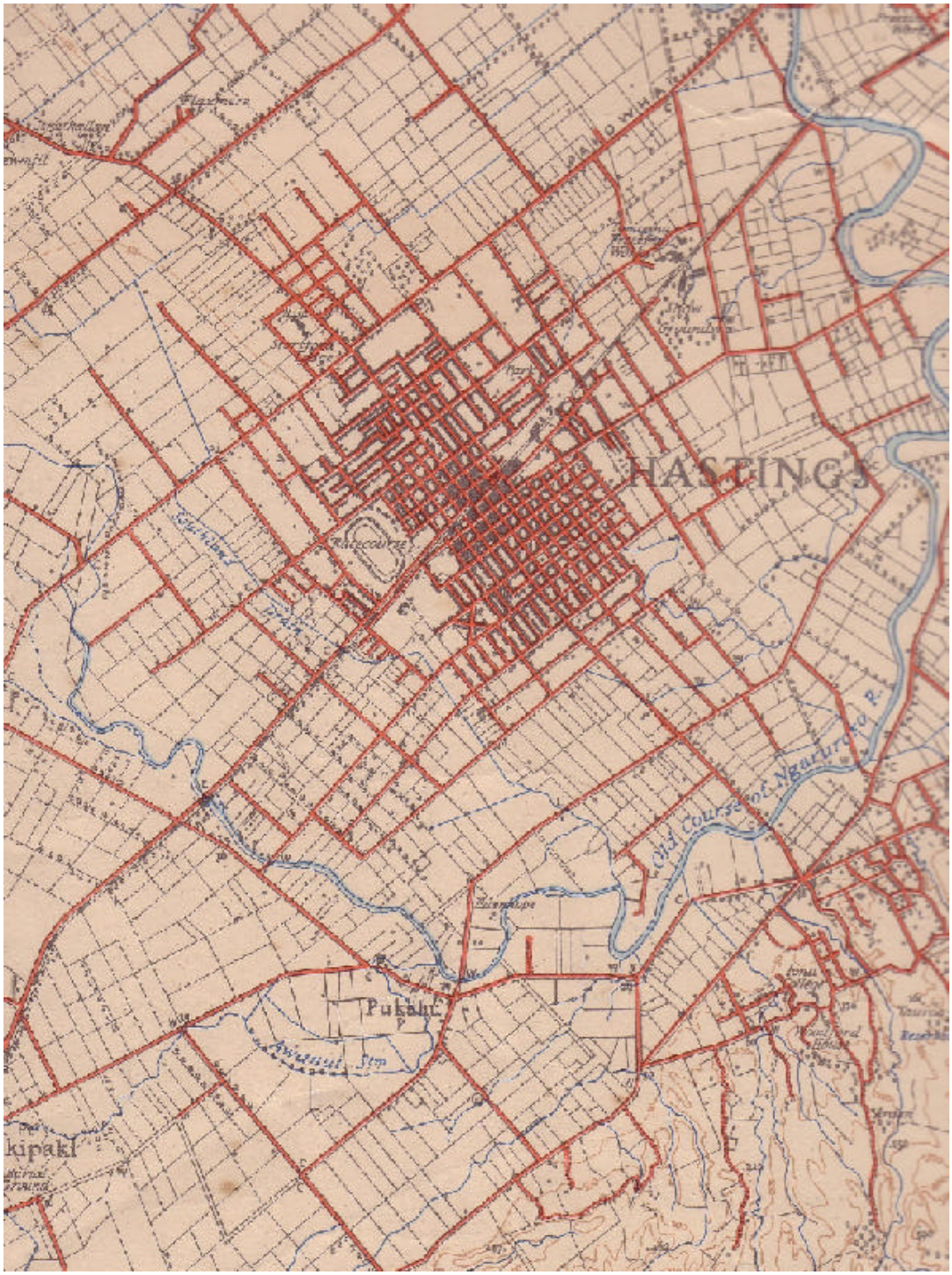
- Robert J. Crawford, Draughtsman in Charge of the Land & Survey Department's Aerial Mapping Branch retires and is succeeded by George T. Railton who, before the war, had made a private visits to the United Kingdom and Germany to familiarise himself with photogrammetric techniques and equipment.

- The Mapping subcommittee of the Organisation for National Security approves the construction of an aerial film storage vault on the property of Piet van Asch, of New Zealand Aerial Mapping Ltd, and this was completed in 1941.

- Systematic indexing of all aerial surveys carried out throughout the country is commenced. This is the first step towards the establishment of a national photo library under the supervision of the Department of Lands and Survey.

- Harry Stephen Gibbs makes a soil survey of Matakaoa County, East Coast, North Island. A brief revision of the survey is made in 1952. The map and accompanying bulletin are published in 1954.

- The Department of Scientific and Industrial Research publishes an account by C. Osbourne Hutton, of the metamorphism of the Lake Wakatipu



Portion of *New Zealand 1:63,360 Napier and Hastings Topographical 1 Mile Series. Sheet N.134.* (The first sheet in the NZMS 1 series to be published, in 1939).

[Source: University of Auckland Library Map Collection. Crown Copyright acknowledged.]

1941

- After consultation with the Army Department, the Lands and Survey Department undertakes the preparation of a military transport map series at a scale of 1:253,440. The data are assembled from field cruises of all roads by engineers of the Public Works Department, local body engineers, and the field staff of the Lands and Survey Department. The series is completed by the end of 1941.

- The Physics and Engineering Laboratory of the Department of Scientific and Industrial Research undertakes the task of designing and constructing an anaglyph stereoplotter. Difficulties are encountered in perfecting the optical elements and it is not completed until 1947.
- As part of the war effort, the Soil Survey Division makes surveys of the potential linen-flax soils around Balclutha and Clydevale; of the potential sugar-beet soils around Christchurch-Ellesmere; and of the soils of aerodromes to facilitate the Grassland Division's policy of producing chewings-fescue-brown-top swards on airfields.

- The Royal New Zealand Air Force commences aerial photography in Fiji for military and defence purposes, in particular to assist in the construction of a defence base.

- The Cawthron Institute, Nelson, maps the tobacco lands around Motueka and the Takaka Valley, and at the request of the Controller of Employment a soil map of 1,000 acres of mudflat at Nelson Haven is compiled.

- Harold William Wellman and Richard Wright Willett investigate a potential mica occurrence in southern Westland. While doing so they make a reconnaissance geological map of the area, and in so doing map the Alpine Fault, showing that there is a single major fault along the western edge of the Southern Alps.

- Eric Ogilvy Macpherson maps the phosphate occurrences at Clarendon, and the talc deposits and serpentine on D'Urville Island.

1941-1942

- L. Clifton completes a trigonometrical and topographical survey of Campbell Island.

1941-1948

- Field observations for a magnetic resurvey of New Zealand are taken from 1941 to 1948. Preliminary results are published in 1950, and final results in 1952 as at epoch 1st July 1945. Field observations are made between May 1941 and June 1942 by J. W. Beagley, accompanied by Hamilton Fellowes Baird, who makes all the subsequent observations. All field observations are made with Earth Inductor-Magnetometer-Theodolite No. 27, loaned to the New Zealand Government by the Carnegie Institution, Washington. Seven isomagnetic charts for declination and inclination, and for horizontal, vertical, total, northerly, and easterly forces are appended to the report.

1941-1951

- From 1948 the Magnetic Survey makes observations at repeat stations for secular variation and establishes new stations to improve the geographical distribution of the observations. Additional stations are established in connection with airborne magnetometer surveys carried out by the Magnetic Survey. Using the improved rates of secular change, the observations at 230 stations from May 1941 to May 1951 are reduced to Epoch 1950.5. The observations are made by

Hamilton Fellowes Baird, J.W. Beagley, Albert Leon Burrows, W.A. Carpinter and H.E. Garlick. The seven isomagnetic charts for declination and inclination, and for horizontal, vertical, total, northerly, and easterly forces are drawn by H.E. Garlick.

1941-1961

- From 1951 to 1961 magnetic resurvey work consists mainly of repeat observations on selected stations for secular variation throughout New Zealand. All measurements since 1941 are reduced to Epoch 1960.5. The observations are made by Albert Leon Burrows, H.E. Garlick, V.B. Gerard and W. Ian Reilly. Seven isomagnetic charts for declination and inclination, and for horizontal, vertical, total, northerly, and easterly forces are published. The charts are drawn by H.E. Garlick.

1941-1970

- Observations of the magnetic vector between 1940 and 1970 are used in the least-squares determination of the geomagnetic normal field for the New Zealand region. The observational data is comprised of a total of 708 vector determinations at 211 magnetic stations in New Zealand and outlying islands, at 269 points on 'Project Magnet' survey flight lines over the surrounding oceans, and at the Amberley, Apia, Toolangi, and Macquarie Island Observatories. The results are given in the form of contour maps of the seven normal field elements at epoch 1970.5. As compared with previously published charts of New Zealand, the scale is reduced from approximately 1:3,000,000 to 1:4,000,000, and the area extended to include the Chatham Islands and Campbell Island, thus taking in the extensive shallow water areas of the Chatham Rise and Campbell Plateau. Observational control for this extension of coverage depends to a large extent on the U.S. Naval Oceanographic Office's 'Project Magnet' data over the oceans.

1942

- A map showing areas prone to erosion in the South Island high country is completed by the Soil Survey Division. The map and accompanying text are published by the Department of Scientific and Industrial Research in 1945 as *Bulletin* no.92.

1942-1943

- The Navy obtains on free loan from Sir Ernest H. Davis the *Morewa* to carry out surveys from Whangaroa (North Auckland) south, of depths and tidal streams that would affect the planned laying of mines. Potential fleet anchorages at various harbours between Whangaroa and Akaroa are also surveyed.

- The Navy charters from Albert L. Cropp the *Elaine* to survey a proposed Queen Charlotte Sound fleet anchorage.

1942-1944

- Most of the field staff of the Department of Lands and Survey, the New Zealand Geological Survey, and the Soil Survey Division, are involved in work relating to military surveys. The Geological Survey is involved also in a search for strategic minerals, locating radar stations, and finding water supplies for military camps.

1943

- Harry Edward Walshe retires as Surveyor-General.

- Charles Sherwood Harris surveys and maps the soils of Ellesmere County,

Canterbury. A provisional map of the soils is completed in 1945, but the task of compiling the bulletin to accompany the map does not begin until 1956. The map is published in 1957, the bulletin in 1964.

- The Government purchases a Beechcraft AT 11 aircraft and a Williamson Eagle IV aerial camera for aerial photography purposes, and makes it available to New Zealand Aerial Mapping on a rental basis.

- The first edition of *Whitcombe's map reading in geography*, written by Kenneth Brailey Cumberland, is published in Christchurch by Whitcombe and Tombs. An 8th edition is published in 1959, the 9th (and final) edition, co-authored by Cumberland and Christopher J. Sparrow and published in 1968, has the title *Map reading in geography.*

1943-1944

- The mapping of linen flax soils around Timaru and Geraldine continues.

- Soil maps of the tobacco lands in the Moutere Valley are completed.

- Allan William verifies the geographical position of Campbell Island and checks the degree of accuracy in the survey work conducted by L. Clifton in 1941-1942.

- Norbert Modriniak makes a preliminary geophysical survey of a part of the Whakatane district, Bay of Plenty, and the Puhipuhi mercury deposit, Northland. He also makes a geophysical investigation of the Rotorua area, and compiles a magnetic map
- New Zealand Aerial Mapping makes an aerial survey of Norfolk Island at the request of the Australian government.

- Harold William Wellman surveys and maps the geology of the Geraldine covering 16 square miles, including the urban area of Rotorua.

1943-1945

- Allan William Eden of the Ministry of Works, assisted by George Easton, is commissioned to make a complete survey of the Auckland Islands. He completes a triangulation network of the islands as a control for his topographical mapping.

1943-1946

- James Dickie Raeside makes a soil survey of the plains and downs of Geraldine County. The maps and accompanying bulletin are published in 1959.

1944

- Russell Gladstone Dick is appointed Surveyor General.
- The National Mapping Committee authorises the Surveyor-General to establish a national library of aerial photographs. The Department of Lands and Survey also assumes responsibility for indexing the earlier RNZAF surveys and storing the negatives. By the end of the War over 100,000 individual photographs have been numbered.

- The Royal New Zealand Air Force forms an Air Intelligence Unit, attached to COMAIRSOPAC (Commander, Aircraft, South Pacific Area), to assess the effect of RNZAF bombing, to brief bombing crews, and to assess the serviceability and strength of Japanese airfields.

Subdivision, Canterbury. Because of the War the map and accompanying bulletin are not published until 1953.

1944-1945

- New Zealand Aerial Mapping carries out the photography, and the Department of Lands and Survey does the ground control surveys, for mapping around Suva and Lautoka in Fiji.

1944-1950

- Harold William Wellman and Richard Patrick Suggate survey and map the geology of Reefton Subdivision. The maps and accompanying bulletin are published in 1957.

1945

- Whites Aviation, a company specializing in oblique photography, is established by Leo White. (The Company is purchased by GeoSmart (NZ) Ltd. in 1988).

- The ban on the sale of 1:25,000 and 1:63,360 topographical maps prepared for the Army Department is lifted.

- John Henderson retires as Director of the New Zealand Geological Survey. Montague Ongley is appointed in his place.

- The Soil Survey Division of the Department of Scientific and Industrial Research is reorganised and renamed the Soil Bureau.

- The Institute of Survey Draughtsmen is formed.

1945-1946

- A soil survey of the Lower Clutha Plains is made by Edmund John Butler Cutler. The soil map is printed in 1955, the accompanying bulletin is printed in 1957.

1945-1947

- Arrangements are made between the Department of Lands and Survey and the Commissioner of Works for the preparation of regional survey data for subsequent works and regional planning. It is decided that factors such as land slope, population densities, vegetation, communications and land use will be mapped and reproduced as transparencies. Map overlays for the four metropolitan regions are completed by 1947, and are published as the NZMS 62 Metropolitan Planning Map Series.

1945-1948

- Charles Alexander Fleming surveys and maps the geology of the Wanganui Subdivision. The maps and accompanying bulletin are published in 1953.

- The coloured soil maps for the "General Survey of the Soils of the North Island" are published by the Soil Bureau. Most copies of sheets 1 to 5 of these maps are later destroyed in the Hope Gibbons fire of 1952, at the time that the accompanying bulletin was being printed. The sheets are amended for reprinting in 1953.

- A general survey of soil erosion in the North Island is undertaken by the Soil Bureau so as to map the various classes of erosion. The area east of the main divide, and Rangitikei, are surveyed in 1945; Taranaki and Manawatu in 1946; and the northern half of the North Island is completed in 1948. A soil erosion map is published in 1948.

1945-1950

- William Asher Watters, P. McLay, and Bryce Leslie Wood survey and map the

geology of the Gore Subdivision. The map and accompanying bulletin is published in 1956.

1945-1951

- Arnold Robert Lillie, D.L. Jenkins, A.E. Hill and Hilary James Harrington survey and map the Kaitangata coalfield. The maps and accompanying bulletin are published in 1958.

1945-1953

- Robert Findlay Hay and others survey and map the geology of the Mangakahia Subdivision, North Auckland. The maps and accompanying bulletin are published in 1960.

1945-1954

- The Department of Lands and Survey undertakes an extensive programme of providing preliminary schemes of subdivision, topographical data, and final land title surveys, for the Rotorua – Bay of Plenty – Taupo area. Topographical mapping for these purposes is extended into the King Country – Taumarunui region in 1952. Second and third order triangulation for the control of land settlement surveys is completed by 1954, and the mapping party operating in the area is disbanded at the end of 1954.

1945-1955

- A National Forest Survey of indigenous forest is undertaken by the New Zealand Forest Service, based on vertical aerial photography. The aerial photographic survey is undertaken by New Zealand Aerial Mapping under contract to the Department of Lands and Survey, and nearly 20,000 aerial photographs are used. Many maps, mostly at a scale of 1:15,840, are compiled directly from the aerial photography, and show broad tenure boundaries and areas of forest types representing timber-tree species associations and volumetric differences distinguishable on aerial photographs. The maps are not made available for general distribution.

1946

- The New Zealand Geographic Board is established by Act of Parliament. The Board is chaired by the Surveyor-General, and has responsibilities for matters relating to place names.

- The Department of Lands and Survey undertakes a number of detailed surveys of special areas, for the State Hydro-electric, Forestry, Public Works, and Mines Departments for special development purposes, and photogrammetric work is carried out for the Department of Scientific and Industrial Research, and the Forestry and Mines Departments. (Mapping work of this nature for a variety of government departments and agencies is conducted by Lands and Survey through to the mid-1980s (see note 3)).

- George T. Railton, the Draughtsman in Charge of the Lands and Survey Aerial Mapping Branch is redesignated as Chief Photogrammetrist. Senior Computer F.H. Jennings is redesignated Chief Computer and on his promotion to Supervising Draughtsman is succeeded by Ray J. Owen.

- The Wellington office of the Department of Lands and Survey investigates the map record system of the Valuation Department, and formulates proposals for the completion of an entirely new set of record maps for that department.

- The Lands and Survey Department publishes *Geodetic and Transverse Mercator Projection Tables*, giving values for every minute of latitude

covering New Zealand. The tables are initially computed, in the absence of tables for machine computation on the international spheroid, by Laurence Patrick Lee, J.H. Miller and F.H. Jennings of the Computing Branch, Head Office. The tables are used in computing geodetic positions and National Grid coordinates of all first-order stations.

- Alfred Charles Seymour Wright surveys and maps the soils of the Green Island -Kaitangata district. The map and accompanying bulletin are published in 1951.

- Alfred Charles Seymour Wright makes a reconnaissance soil survey of southwest Fiordland.

- The Department of Scientific and Industrial Research publishes an account by Robin Langford Oliver of the geological history of the Otaki Sandstone, lower North Island, with maps, as *Geological Memoir* no.7.

1946-1947

- In 1946 the New Zealand Geological Survey decides to produce a 1:1,000,000 geological map of New Zealand. The map, published on two sheets in 1947, is a compilation of work done by a variety of geologists, and incorporates revisions of Cretaceous and Tertiary stratigraphy and shows the full extent of the Alpine Fault for the first time. The cartography is done by Alfred W. Hampton, Chief Draughtsman for the Geological Survey.

- Maxwell Gage surveys and maps the geology of the Waitaki Subdivision, Otago. The maps and accompanying bulletin are published in 1957.

1946-1951

- A soil survey of the Canterbury Plains is made by parties led by Charles Sherwood Harris and John Dickie Raeside. The soil maps are printed in 1954, the accompanying bulletin is not printed until 1967.

- Geophysical surveys are made to map subsurface features at the sites of Waikato River hydro dams.

1947

- Following the attendance of the Surveyor General, Russell Gladstone Dick at the Military Mapping Conference in the United Kingdom, the New Zealand government approves the setting up of the Joint Services Mapping Committee, chaired by the Surveyor-General, to deal with the mapping and charting requirements of the three Armed Services including the preparation and distribution of topographical maps and aeronautical charts. Russell G. Dick also attends the Commonwealth Survey Officers' Conference and visits mapping organisations and manufacturers of survey and mapping equipment in the United Kingdom, Switzerland and the United States.

- The measurement of three base lines in the South Island (Riversdale on the Waimea Plain; Waitaki, near the mouth of the river; and Culverden in northern Canterbury), and the re-measurement of two old base lines in the North Island (Matamata and Waitemata), is completed by the Department of Lands and Survey using "Macca" base-line equipment borrowed from the Government of Tanganyika.

- The first issue of the New Zealand Institute of Draughtsmen's journal is published, and features an article by George T. Railton on "The Modern Scope of Mapping".

- A sketch survey of the Antipodes Islands is made by U.S.C.G.C. *Northwind*.

- The Technical Correspondence School, established by the Department of Education in 1946, offers courses in surveying subjects.

1947-1948

- George William Grindley surveys and maps the geology of the Eglinton Valley, Southland. The maps (which incorporate later material as well), and the accompanying bulletin, are published in 1958.

1948

- 12 Laplace stations (where both azimuth and longitude are observed so that a Laplace equation correcting the observed azimuth for the effects of deflection of the vertical) are selected by the Department of Lands and Survey and observed by D.R. Brenchley.

- A revised Land Act is passed which formalises the Surveyor-General's responsibility for triangulation, precise leveling and topographic mapping.

- A Wild A6 stereoplotter, ordered by the New Zealand Forest Service in 1947, is installed in 1948 in the Aerial Mapping Branch of the Department of Lands and Survey to provide base maps for Forest Service timber-type mapping and logging road planning. The most extensive of these covers Kaingaroa State Forest. for large scale survey work by the Aerial Mapping Branch.

- Harry Stephen Gibbs makes a soil survey of the Awatere-Kaikoura area and part of Marlborough County. The map with its accompanying bulletin is published in 1952.

- A new 1:1,000,000 geological map of New Zealand is published.

- New Zealand becomes a member of the International Civil Aviation Organisation; an organisation which produces comprehensive standards and recommendations for aeronautical charting.

- Cabinet approves the purchase of the Loch class frigate *Loch Craggie* for conversion to a survey ship. Plans change during 1948 and the purchase is never made.

- A new, two-stage, Public Service Draughting Examination replaces the separate certificates in draughting and computing.

1949

- With the completion of the first order triangulation, the New Zealand Geodetic Datum 1949 (NZGD49) using the Hayford (International) ellipsoid, is implemented.

- With the official recognition of the Department of Lands and Survey as the military and civil mapping agency in New Zealand, a Cartographic Branch is formed to carry out the drawing, preparation for printing and distribution of maps for both the Armed Services' and civil requirements, including topographical maps for the NZMS series and aeronautical charts. This programme necessitates an increase in staff and the provision of extra accommodation and arrangements are made to recruit staff in the United Kingdom. F L Rossiter, formerly Chief Survey Draughtsman of the department's head office, becomes the department's first Chief Cartographer. On his retirement in 1952, he is succeeded by Alf W. Hampton.

- In 1949 the Lands and Survey Department's Aerial Mapping Branch is renamed as the Photogrammetric

Branch. Its mapping capability is expanded by the arrival of three Zeiss Multiplex anaglyph projection plotters in 1949 and another two in 1951. A second Wild A6 stereoplotter is added in 1950 and a third in 1952, together with a Wild A5 Autograph. The latter is utilised mainly for aerial triangulation, a technique which markedly reduces the amount of field control required as a basis for mapping; but it can also be used for precise mapping at large scales.

- In order to make fuller use of existing photography, the Department of Lands and Survey engages New Zealand Aerial Mapping, under contract, to produce mosaic maps (NZMS 3 at a scale of 1:15,840 and NZMS 4 at 1:25,000). It is expected by the Department that these mosaics will assist in the study of lands for development purposes, particularly where topographical maps are not available, and priority is given to the need for investigations of timber resources, river control and soil conservation investigations in unmapped areas.

- HMNZS *Lachlan,* a River class frigate, is acquired by the Royal New Zealand Navy from the Australian Navy for surveying purposes. The first captain of the ship is Commander John Michael Sharpey-Schafer. Cook Strait and Wellington Harbour is the first area to be surveyed by HMNZS *Lachlan*.

- The Royal New Zealand Navy starts to accumulate soundings for bathymetrical charting purposes. The collection of echo soundings is initially carried out through Geophysics Division, Department of Scientific and Industrial Research, and after 1954 by the New Zealand Oceanographic Institute.

- Following the cataloguing and reclassification of all maps published by the Department of Lands and Survey, a provisional edition of the Department's *Catalogue of Maps* is published.

- The New Zealand American Fiordland Expedition includes a survey party from the Department of Lands and Survey. The party establishes control for the photogrammetric mapping of the area, primarily for State Hydro-electric Department requirements.

- Alfred Charles Seymour Wright surveys and maps the soils of Niue. The soil map is published in 1957; the accompanying bulletin in 1965.

- An *Atlas of Maps* is prepared by the Department of Agriculture to accompany the *Report of the Royal Commission to Inquire into and report upon the Sheep-Farming Industry in New Zealand*. The maps constitute pages 156-214 of the report, published in the *Appendix to the Journals of the House of Representatives*, H.46A, 1949, and include maps of each island as well as regional maps showing broad farming patterns.

- The New Zealand Speleological Society is formed, and systematic cave exploration and surveying in New Zealand begins.

1949-1955

- Jacobus Theodorus Kingma and David Alexander Brown survey and map the geology of the Te Aute Subdivision, central Hawkes Bay. The maps and accompanying bulletin are published in 1971.

1949-1958

- David Kear and James Cecil Schofield survey and map the geology of the Ngaruawahia Subdivision, northern Waikato. The maps and accompanying bulletin are published in 1978.

1950

- The first Lands and Survey street map in the NZMS 17 series is published, of Palmerston North.

- The Hydrographic Branch of the Royal New Zealand Navy acquires two motor launches for inshore coastal surveys and harbour surveys. The launches are renamed HMNZS Takapu and Tarapunga.

- After consultation with the Armed Services Mapping Committee and the Lands and Survey Department, the Government Printing and Stationery Department decides to extend its Photolitho and Process Engraving Branch in order to increase its offset lithography capacity to produce maps, charts and posters.

- The first Royal New Zealand Navy chart to be printed in New Zealand is produced by the Government Printing Office. Draughtsmen from the Department of Lands and Survey assist the Navy in the production of the sheet, and the chart is published by the Lands and Survey Department. The chart is NZ14, *Nugget Point to Centre Island including Foveaux Strait.*

- A mapping unit is established at the Forest Research Institute at Rotorua.

- The Conference of British Commonwealth and United States of America Survey Authorities takes place in Wellington.

- Leslie Isott Grange and John Patrick Fox make a reconnaissance soil survey of the lower Cook Islands. The maps and accompanying text are published as *Soil Bureau Bulletin* no.8 in 1953.

- James Dickie Raeside and Edmund John Balfour Cutler survey and map the soils of part of the Maniototo Plains, Otago. The maps are published in 1965, the accompanying bulletin in 1966.

1950-1951

- At the request of the Department of Agriculture, the Soil Bureau surveys and maps the sand country north of Foxton, Manawatu. The information is incorporated into Soil Bureau *Bulletin* no.16, published in 1958.

1951

- The Government gives permission to let a contract with a British yard for a new survey ship. Two years later Cabinet decides not to confirm the contract on account of rising costs and the project dies.
- Government decides to permit tenants to purchase State rental houses. The State Advances Corporation has the task of issuing individual titles to every purchaser within a period of seven years following the purchase. Although initially all subdivisions for State housing had been accurately surveyed and recorded on survey plans, the boundary fences on many allotments were not erected on the original survey lines, and the Department of Lands and Survey has the task of resurveying sites and preparing the necessary plans and documents for the issue of titles. By 1959 this task is brought up to date in all districts.

- The Geophysics Division of the Department of Scientific and Industrial Research is formed. The new Division includes the Geophysical Survey section of the Geological Survey, the geophysical observatories at Christchurch and Wellington, the Magnetic Survey, and the Seismological Observatory.

- A broad-scale aeromagnetic survey of the Rotorua volcanic region is flown for

the Department of Scientific and Industrial Research.

- The Public Service Survey Assistants' Examination is introduced for technician surveyors, and is intended primarily for the staff of government departments.

1951-1952

- Michael Lucas Leamy, M.A. Popplewell and Colin George Vucetich survey and map the soils of the Kaingaroa Plateau and Galatea Basin, central North Island. The maps are published in 1958, and the accompanying bulletin in 1960.

1951-1954

- D.D. Wilson surveys and maps the geology of the Waipara Subdivision, north Canterbury. The maps and accompanying bulletin are published in 1963.

1952

- Bruce H. Purser surveys and maps the geology of the Port Waikato area. The maps and accompanying bulletin are published in 1961.

- Montague Ongley retires as Director of the New Zealand Geological Survey. Leslie Isott Grange is appointed in his place.

- The Hope Gibbons Building fire results in the extensive destruction of New Zealand Geological Survey and Soil Bureau maps, bulletins, Lands and Survey files, and other records.

- The Department of Lands and Survey creates a Map Centre in Taranaki Street, Wellington, housing its stocks of maps and a map library.

- The Land Transfer Act is passed, providing for the convenient maintenance of the Register of Land Titles. The Chief Surveyor for each land district is required to approve any plan of survey before it can be deposited.

- J.W. Brodie provides a bathymetric interpretation of the Tasman Sea, in which he defines and describes the Tasman Basin, Lord Howe Rise, the New Caledonia Basin, Norfolk Ridge and Norfolk Basin. The description is published in volume 33B of the *New Zealand Journal of Science and Technology.*

- Colin Courtenay Lowry assumes command of HMNZS *Lachlan.*

- At the request of the Fijian Government, the Soil Bureau commences a reconnaissance soil survey of Fiji.

1952-1954

- John D. McCraw surveys and maps the soils of the Alexandra district, central Otago. The maps and accompanying bulletin are published in 1964.

1952-1956

- Alexander Russell Mutch, Athol J. Waddick and others, survey and map the geology of the Morley Subdivision, Southland. The maps and accompanying bulletin are published in 1972.

1953

- The Lands and Survey Department undertakes to produce detailed topographical mapping of Western Samoa. A five year plan of operation is decided upon.

- A Lands and Survey survey party completes 61 miles of coastal traverse of Upolu, Western Samoa.

- Staff from the New Zealand Geological Survey map the geology of Niue.

- The Lands and Survey Department conducts a survey to determine the length, alignment and level of the Rimutaka Tunnel project.

- Cabinet authorises the production of a national atlas of New Zealand, in substitution for the Centennial Atlas project.

- In Hastings, New Zealand Aerial Mapping sets up a photogrammetric mapping unit, initially with Multiplex equipment and later in the 1950s adding three Wild A8 stereoplotters.

- John Desmond Cowie surveys and maps the soils of part of Manawatu County. The maps and accompanying bulletin are published in 1958.

- The New Zealand Geological Survey publishes an account by Martin Theodore Te Punga of the geology of the Rangitikei Valley, with maps, as *Geological Memoir* no.8. The *Memoir* is first issued in 1952, but most copies are destroyed in the Hope Gibbons Building fire and the *Memoir* is reprinted.

- The Hydrographic Section is transferred from the Department of Lands and Survey to the Navy Office.

- The Royal New Zealand Air Force (Wigram) takes aerial photography of the Southern Alps between Harper Pass (Hurunui Saddle) and Fyfe Pass.

- The Plan Printing Branch of the Ministry of Works is transferred to the Government Printing and Staionery Department.

- C.R. Lyon from the Department of Lands and Survey spends six months in Ceylon training draughtsmen in mapping techniques.

1954

- George Stephen Ritchie assumes command of HMNZS *Lachlan*.

- The Lands and Survey Department assists the Fijian Government to produce topographical mapping of Fiji by doing the plotting and compilation work at the Photogrammetric Branch in Wellington.

- New Zealand Aerial Mapping makes an aerial survey of both Western and American Samoa.

- 86 miles of coastal traverse of Savai'i, Western Samoa, is completed by the Department of Lands and Survey.

- Responsibility for the field work required for the compilation of topographical mapping by the Department of Lands and Survey is decentralised to each Land District.

- The Lands and Survey Department undertakes the topographical mapping of approximately 200 square miles around Lake Tekapo, at a scale of 1:25,000, following the purchase of this land by the Army Department for military training purposes.

- 12,450 square miles in the North Island, and 28,800 square miles of the South Island, remain to be mapped at a scale of 1:63,360.

- Cabinet authorizes the production of a national atlas of New Zealand, in substitution for the never completed Centennial Atlas. A committee is set up to advise on the production of the atlas, and consists of the Surveyor-General (Chairman and executive officer in charge of the project), the Government Printer, the Parliamentary Historian, a representative of the New Zealand

Geographical Society, and the Assistant Under-Secretary of the Internal Affairs Department.

- The New Zealand Oceanographic Institute is established as a section of the Geophysics Division of the Department of Scientific and Industrial Research. It acquires full divisional status in 1958.

- William Alexander Pullar surveys and maps the soils of the Gisborne Plains. The maps are published in 1959, the accompanying bulletin is published in 1962.

- The United States Board on Geographic Names issues *New Zealand: official standard names approved by the United States Board on Geographic Names*. The 454 page gazetteer is prepared in the Division of Geography, Department of the Interior.

1954-1956

- Charles Alexander Fleming and David Kear survey and map the geology of the area around Kawhia Harbour. The maps are published in 1960 as part of the Geological Survey's *Bulletin* no.67.

1955

- The Lands and Survey Department sets up a Map and Chart Reproduction Committee to investigate and study cartographic and map printing methods, and to promote new ideas for this type of work.

- Alfred Charles Seymour Wright surveys and maps the soils of the Chatham Islands. The map and accompanying bulletin are published in 1959.

- The annual report of the Department of Scientific and Industrial Research notes that the Geological Survey occupies the same building that it did when it became part of the Department back in 1926. The accommodation is described as very inadequate.

- N.E. Odell and the Central Photographic Establishment of the Royal New Zealand Air Force conduct an extensive aerial survey of the Southern Alps.

1955-1957

- Ian Gordon Speden surveys and maps the geology of the Papatowai Subdivision, southeastern Otago. The maps and accompanying bulletin are published in 1971.

1956

- Alfred Charles Seymour Wright surveys and maps the soils of Western Samoa. The resulting soil and land classification maps are published in 1962. The accompanying bulletin is published in 1963.

- Leslie Isott Grange retires as Director of the New Zealand Geological Survey. Richard Wright Willett is appointed in his place.

- The compilation of a 1:250,000 geological map of New Zealand commences, using existing data and new survey information where necessary. This programme of geological mapping is planned to culminate in 1965 with the appearance of a Four Mile Geological Atlas of New Zealand.

- The Government purchases a Wild RC5A camera with interchangeable wide angle and normal angle lens cones. It is leased to New Zealand Aerial Mapping for use on both government and private surveys.

- An interdepartmental Survey and Mapping Committee, chaired by the Surveyor-General, is established.

- The Institute of Survey Draughtsmen is expanded to become the New Zealand Institute of Draughtsmen, catering to draughting personnel in a wider range of disciplines.

- Frank William Hunt assumes command of HMNZS *Lachlan*.

1956-1958

- The soils of the Manawatu-Rangitikei sand country are surveyed and mapped by John Desmond Cowie. The maps are published in 1966, and the accompanying bulletin in 1967.

1956-1967

- The New Zealand Forest Service undertakes an ecological survey of indigenous forests, with the aims of covering the non-merchantable forest not covered by the earlier National Forest Survey, and to establish a classification of forest with a nationwide and lasting application, and to map all the forest accordingly. The maps were to be available for general distribution. Most field work is completed by 1967, and maps subsequently are published at a scale of 1:250,000.

1957

- The Royal New Zealand Navy undertakes a survey of Lake Taupo. The chart is published as N.Z. 77, at a scale of 1:75,000, with six inset maps at scales of either 1:5,000 or 1:25,000.

- Robert Findlay Hay, Alexander Russell Mutch and William Asher Watters survey and map the geology of the Chatham Islands. The maps and accompanying bulletin are published in 1970.

- Staff from the New Zealand Geological Survey and the Australian Bureau of Mineral Resources, Geology and Geophysics, map the geology of Western Samoa.

1957-58

- Members of the Commonwealth Trans-Antarctic Expedition map the geology of part of Victoria Land, Ross Dependency, Antarctica.

1957-1960

- Joseph Edgar Cox surveys and maps the soils of Paparua County, Canterbury. The maps are published in 1971, the accompanying bulletin in 1978.

1957 & 1963

- Staff from the New Zealand Geological Survey map the geology of the Cook Islands. The maps are published in 1970 as part of the Geological Survey's *Bulletin* no.82.

1958

- A two-range Decca navigation system (2RD) is fitted to HMNZS *Lachlan*.

- The Lands and Survey Department purchases from Britain three Williamson wide-angle Multiplex plotters. These allow for the utilisation of photography from the new Wild RC5A aerial camera on mapping for the NZMS 1 series.

- The New Zealand Geographic Board issues a *Provisional Gazetteer of the Ross Dependency*, compiled by Arthur Stanley Helm. The 164 page gazetteer includes a bibliography and outline of the various expeditions which have contributed to place naming in the Dependency.

- The first Bouguer gravity anomaly map of New Zealand is published, by E.I.

Robertson and W.Ian Reilly, in the *New Zealand Journal of Geology and Geophysics*. The map represents abnormalities in the distribution of mass below sea-level.

1959

- Alexander H. McLintock's *A Descriptive Atlas of New Zealand* is published by the Government Printer, Wellington. The atlas consists of 48 pages of coloured maps and about 80 pages of text. 12,000 copies are printed initially, but they are all sold within a few hours of publication, and a further 20,000 copies are made available the following year.

- The first edition of the Department of Lands and Survey's *Catalogue of Maps* is published. (A provisional edition was published in 1949). The catalogue is based closely on the catalogue issued by the Geographical Section of the General Staff, War Office, London. The catalogue is divided into six parts – General and miscellaneous maps, cadastral maps, topographical maps, mosaic maps, aerial photographs, and precise levelling – bench mark lists.

- The first edition of the Hydrographic Branch of the New Zealand Navy Department's *Chart Catalogue & Index* is published.

- New Zealand becomes a member of the International Hydrographic Organization.

- A photographic survey of the entire New Zealand coastline is undertaken for defence purposes. The Royal New Zealand Air Force is assisted by a United States Navy detachment flown in from Guam. The resulting photography and mosaics are retained by the Americans on Guam, although New Zealand was able to obtain access to this material.

- The New Zealand Soil Bureau publishes a map and bulletin describing the soils of Raoul Island in the Kermadec Group, based on the work of Alfred Charles Seymour Wright.

-The Department of Lands and Survey places an order for three additional first-order photogrammetric plotters to meet the demands from the Ministry of Works for detailed topographical plans and maps for State highway, railway, and airport development. These precise plotters make it possible to produce maps showing contours with a two feet interval.

- The Department of Lands and Survey purchases the first electromagnetic distance measuring equipment for New Zealand, a MAR1 microwave Tellurometer, capable of measuring distances of up to 50 km. It is first used on a traverse of Northwest Nelson for hydrographic charting of that coast. The equipment is then extensively used, along with later models, for mapping survey control in New Zealand for the next three decades.

- The Land Use Division of the Department of Lands and Survey publishes a report and set of maps appraising the various classes of land on the West Coast of the South Island. A detailed mapping programme is carried out, handicapped to some extent by the only partial coverage of the area by topographical sheets. Maps showing land cover, land classification and land tenure are published (as NZMS 154).

- Aero Surveys is established by Tom A. Kenny and Brian A. Shrimpton, operating from Tauranga.

1959-1963

- Gerrit Neef surveys and maps the geology of the Eketahuna district in the Wairarapa. The map and

accompanying bulletin are published in 1984.

1959-1965

- John Gallagher Bruce and William Thomas Ward survey and map the soils of part of Raglan County. The map is published in 1976, the accompanying bulletin in 1978.

- A series of four cruises are undertaken by HMNZS *Endeavour* to investigate and map the morphology, sediments and structure of the New Zealand sub-Antarctic region. The first cruise, in October 1959, is led by Desmond Eugene Hurley; the second and third - led by E.W. Dawson – take place in April 1963 and January 1964; while the fourth, led by Ivan Neil Estcourt, occurs in January 1965.

1959-1968

- The New Zealand Geological Survey completes a geological map of New Zealand at a scale of 1:250,000 in 28 sheets (numbered 1, 2A, 2B, 3-27). The geology is shown in time units.

1960

- W.J.L. Smith assumes command of HMNZS *Lachlan*. Smith is the first New Zealander to captain the ship.

- The first sheet in the 1:20,000 topographical series covering Western Samoa is drawn at Head Office, Department of Lands and Survey, Wellington.

- The first digital electronic recording equipment is introduced to the Photogrammetric Branch of the Department of Lands and Survey. This enables the Department to intensify the completion of the production of the inch to the mile topographical series.

- The first sheets in the Department of Lands and Survey's NZMS 177 cadastral series, at a scale of 1:63,360, drawn on the same sheet lines as the topographical series, are published.

- The imminent arrival of a Wild A7 Autograph, a Wild A8 stereoplotter and a Thompson Watts plotter from the United Kingdom prompts the relocation of the Photogrammetric Branch of the Department of Lands and Survey from the State Fire Building in Lambton Quay to the Market Gardeners' Building in Wakefield Street. The A7 is fitted with digital data encoding recording which enables the recording of aerial triangulation information to be streamlined. Mapping continues on the NZMS1 series and for the New Zealand Forest Service and the amount of work for other departments increases dramatically. One of the first jobs carried out using the new equipment is at 1:480 with contours at 2' intervals for the Ministry of Works' Roading Division's planning of the Wellington motorway.

- The New Zealand Geographic Board issues a cyclostyled supplement to the *Provisional Gazetteer of the Ross Dependency*, compiled by Arthur Stanley Helm (see 1958). The supplement contains a list of 202 names approved by the Board. A further supplement is issued in 1963, containing an additional 322 approved names. Two supplements are issued in 1963, containing over 300 and 225 new names. A fourth supplement in 1965 lists over 250 newly approved names.

- As part of a Colombo Plan contribution, the Department of Lands and Survey's Chief Photogrammetrist, William (Bill) F. Cree, establishes a new photogrammetric branch for the Lands and Survey Department in Jesselton, British North Borneo.

- The New Zealand Primary Gravity network is published, giving values for

the 437 stations that have been established.

1960-1961

- The New Zealand Geological Survey undertakes a mapping programme in the Ross Sea Dependency. A Northern Party led by C.J. Matterson maps the geology of the area from the Byrd Glacier south to Mount Albert Markham; while a Southern Party, led by P.J. Hunt, maps the geology of the Nimrod Glacier area.

1960-1963

- The soils of Kairanga County, Manawatu, are mapped by John Desmond Cowie, B.S. Kear and Gary Edward Orbell. The map is published in 1972, the accompanying bulletin in 1978.

- A team of eight surveyors and four survey cadets leave New Zealand for Malaya, where they carry out survey work for a Malayan Government rural development programme. The Malayan project is part of a Colombo Plan assistance package.

1961

- Russell Gladstone Dick retires as Surveyor-General. Robert Phillip Gough is appointed in his place.

- The Department of Lands and Survey publishes a report and set of maps following a standard land utilisation survey of north east Taranaki. The maps show vegetative cover, land classification and land tenure, and are published as the NZMS 190 series.

- The Department of Lands and Survey purchases a photonymograph for use in its Cartographic Branch. This instrument supplies letterpress for maps and charts.

- A Thompson Watts plotter is installed at the Photogrammetric Branch, Department of Lands and Survey.

- George T. Railton retires as Chief Photogrammetrist at the Department of Lands and Survey, and is replaced by William (Bill) F. Cree.

- Alf W. Hampton retires as Chief Cartographer, Department of Lands and Survey, and is succeeded by Douglas G. Francis.

- The first sheets in the Department of Lands and Survey's NZMS 166 series for the Ross Dependency, Antarctica, are published at a scale of 1:250,000.

- The New Zealand Geological Survey publishes a 1:2,000,000 geological map of New Zealand as *NZGS Bulletin* no.66.

1961-1962

- The volume of cartographic work produced by the Department of Lands and Survey increases by about 20% over the previous year because of the introduction of new techniques and equipment; including new "cut-and-peel" masking methods, new stable based drawing materials, an extension of plastic scribing and of photomechanical methods.

- The New Zealand Geological Survey has two parties surveying and mapping in the Ross Dependency. The Northern Party, led by Richard Irving Walcott, maps an area of 11,000 square miles in the vicinity of the Miller Range; the Southern Party, led by W.W. Herbert, maps 16,000 square miles from the Queen Alexandra Range to the Axel Heiberg Glacier, and from the Polar Plateau to the Ross Ice Shelf.

- William H. Chapman, William C. Elder, and Ezekial R. Soza of the United States Geological Survey make an extensive tellurometer survey of the western coast of the Ross Sea, to provide accurate ground control for an area covering 87,000 square miles around Cape Adare.

1962

- W.J. Doole assumes command of HMNZS *Lachlan*.

- W.J.L. Smith is appointed Hydrographer, Royal New Zealand Navy, with the task of supervising all chart production and the day-to-day direction of the work of the Navy's three survey vessels. Until this time the commanding officer of the survey vessel had also been Hydrographer.

- The cartographic functions of the Town and Country Planning Branch of the Ministry of Works are taken over by the Department of Lands and Survey.

- The Joint Sarawak/Sabah Survey Training School is established in Kuching, Sarawak, by New Zealand as a Colombo Plan operation. The School provides a two-year course for an annual intake of 12 survey assistant trainees. (New Zealand continues to provide sponsorship and tutors until 1972, when local instructors take over).

- The University of Otago Press publishes the first of a series of New Zealand cartobibliographies prepared by Ray Hargreaves.

- It is decided to produce 1:250,000 gravity anomaly maps for the whole country, with stations some 3 km apart.

- The New Zealand Soil Bureau publishes an *Atlas of New Zealand Soils*. The Atlas consists of a number of single-factor maps which delineate the varieties occurring in certain properties in New Zealand soils.

- The United States Geological Survey undertakes electrotape traverses in the northwestern part of Victoria Land and southeast of the Beardmore Glacier.

1962-1963

- The New Zealand Geological Survey has two parties surveying and mapping in the Ross dependency. The Northern Party, led by H.S. Gair, surveys an area of approximately 10,000 square miles around the Rennick and Aviator Glaciers. The Southern Party, led by R.W. Hewson, establishes survey control over about 15,000 square miles of land in the Oates Piedmont, Mawson, Davis, David, and Priestley Glaciers and the Mount Nansen massif.

- A Federated Mountain Clubs of New Zealand Antarctic Party is organized by the Tararua Tramping Club, and the expedition, led by John Millen, maps about 3,500 square miles in the Tucker Glacier area.

1962-1964

- Iain Bruce Campbell surveys and maps the soils of Waikouaiti County, Otago. The map is published in 1971, the accompanying bulletin in 1977.

1963

- Under a Charting Agreement signed between the United Kingdom, Australia and New Zealand, the Hydrographic Branch, RNZN, becomes the sole authority for producing charts of the New Zealand coastline and surrounding Pacific Ocean.

- First students are enrolled in the Department of Surveying, which had been established in 1962 at the

University of Otago under the professorship of John B. Mackie. The first qualification to be offered is a Diploma in Land Surveying.

- The South Auckland Survey Office moves from Auckland to Hamilton.

- The New Zealand Oceanographic Institute commences publication of a 1:200,000 coastal bathymetry series for New Zealand.

- The Government purchases an Aero Commander 680F aircraft for aerial photography purposes and rents it to New Zealand Aerial Mapping. At the same time New Zealand Aerial Mapping purchases from the Government the Beechcraft AT 11 aircraft already in operation. The Aero Commander 680F allows for aerial photography of New Zealand's high country.

- Detailed mapping of the Kaingaroa State Forest is completed by the Department of Lands and Survey for the New Zealand Forest Service. This work has been in progress for 12 years, and covers an area of 538 square miles. Mapping of ten other state forests is completed at medium scale.

- A committee is set up for geodetic studies of crustal movement which result in a number of localised survey networks being established and surveyed by the Department of Lands and Survey, the New Zealand Geological Survey, and Professor John B. Mackie of Otago University over the next few years.

- Some of the Department of Lands and Survey's survey staff are involved in a joint exercise ("Project Quarterstaff") with two geodetic teams of the United States Army Map Service to record lunar occultations using modern electronic equipment. The project calls for the simultaneous observation of lunar occultations by parties in Australia and New Zealand in order to determine more precise geographical positions, and is part of a world-wide programme being conducted by the United States Army Map Service. (In 1964 the observations are carried out by Department of Lands and Survey staff only, but bad weather prevents any worth-while results being obtained).

- Aerial Surveys (Nelson) Ltd. is formed by E.C. Fox and R.F.B. Older. The company is renamed Aerial Surveys Ltd in 1965, and a new company is formed in 1980, named Aerial Surveys (1980) Ltd. (The Company is removed from the Companies Registr in 2002).

1963-1964

- The New Zealand Geological Survey continues its mapping programme in the Ross Dependency. A Northern Party, led by J.H. Miller, is active in northern Victoria Land, while the Southern Party, led by Victor Raymond McGregor, conducts geological and topographical surveys of the mountains bordering the Ross Ice Shelf between the Axel Heiberg and Shackleton Glaciers. These surveys complete the topographical reconnaissance mapping of 147,000 square miles in the Ross Dependency.

1964

- The State Services Commission calls a meeting to resolve long-standing problems with land use surveys, and an Interdepartmental Committee is formed.

- At the request of the East Coast Development Research Association the Department of Lands and Survey undertakes a land utilisation survey of the Gisborne-East coast region. A report and various maps are published. The maps include detailed land cover and land tenure maps for the region.

- The Department of Lands and Survey completes the standard survey of Hamilton City.

- Ray J. Owen retires as the Department of Lands and Survey Chief Computer, and is succeeded by Laurence Patrick Lee.

- The Department of Lands and Survey completes Section 1 of its "Cartographic Manual of Instruction", covering all cartographic work carried out by the Department, and has in hand the production of a "Manual of Instruction" for district office draughtsmen.

- The Public Service Draughting Examination is held for the last time. Future draughtsmen wishing to qualify by examination are now required to pass the New Zealand Certificate in Draughting.

- P.M. Berrill from the Department of Lands and Survey carries out a technical assistance project in Niue which involves surveys in connection with well-drilling operations. He also carries out control surveys and makes recommendations for the establishment of a survey system suitable for the island's land-title system.

1964-1965

- The soils of mid Manuherikia Valley, central Otago, are surveyed and mapped by Gary Edward Orbell, Clifford Harry Thompson and D.M. Dimmock. The maps are published in 1971, the accompanying bulletin in 1974.

- Following the completion of the topographical reconnaissance mapping in the Ross Dependency, selected small areas are studied and mapped in closer detail.

1965

- Colour aerial photography is used for the first time to identify crop disease in forests. Parts of the southern Kaingaroa Forest are flown at scales of 1:3168 and 1:18,200 in an effort to detect pine needle blight, but the results are disappointing.

- An undergraduate course specifically teaching cartography and aerial photographic interpretation is established within the Department of Geography at Victoria University of Wellington by Donald Wallace McKenzie and David Winchester.

- The Survey Training School at Trentham is re-opened under the control of the Lands and Survey Department. The school provides training in basic survey operations. Courses are for three months with ten students in each intake. Courses are completed by trainees from a variety of organisations, including the Navy, New Zealand Forest Service, New Zealand Electricity Department, Ministry of Works, and the Lands and Survey Department.

- The New Zealand Geological Survey starts preparation of a series of industrial maps, being geological maps of the main cities showing rock types likely to be encountered in average construction projects. Only the Hamilton and Auckland sheets are eventually published.

- A map of isostatic gravity anomalies for New Zealand is published at a scale of 1:4,000,000. This follows a project whereby topographic-isostatic correct-ions, including the indirect effect, are calculated at 8 points per degree square over the New Zealand region, following the Airy-Heiskanen system with normal thickness of crust T=30 km. The utility of the isostatic correction in removing much of the influence of the transition from oceanic to continental crust, which is strongly reflected in the Bouguer anomalies throughout New Zealand,

leads to the inclusion of isostatic anomaly maps in the basic 1:250,000 series of gravity anomaly maps.

- The first sheet in the New Zealand Geological Survey's 1:250,000 Gravity *map of New Zealand* is published. The series is completed in 1987 with the publication of the Chatham sheet. The gravity maps each comprise two to four sheets showing Bouguer anomalies, isostatic anomalies, and in some cases, isostatic vertical gradient anomalies.

- Field work and map compilation is completed for the New Zealand Geological Survey's Four-Mile Project.

- The New Zealand Oceanographic Institute commences publication of a 1:200,000 coastal sediments series for New Zealand.

- The Department of Lands and Survey undertakes a major mapping project in the Taupo Basin so that Government can consider reserve proposals put forward by the Taupo County Council.

- The first edition of *New Zealand railway & tramway atlas* is published by the Quail Map Company, Exeter. The atlas is compiled by John Roger Yonge. A second revised edition is published the same year.

1965-1966

- John Martin Ragg surveys and maps the soils of part of Taieri County, Otago. The map is published in 1973, the accompanying bulletin in 1978.

1966

- The Surveyors Act consolidates and revises the Surveyors Act 1938 and its amendments, and provides for corporate and non-corporate membership of the New Zealand Institute of Surveyors and allows for persons other than registered surveyors to be either corporate or non-corporate members. The Act continues the New Zealand Survey Board which is entrusted with the training, registration and discipline of the survey profession and the control of survey standards and procedures.

- The Technicians Certification Authority introduces the Survey Technicians' Certificate as a new qualification.

- The Government purchases a Wild RC9 superwide angle aerial camera and several items of Wild stereoplotting equipment to utilise the photography in mapping for the NZMS 1 inch to the mile topographical series. The camera is operated by New Zealand Aerial Mapping on contract to the Crown.

- The Lands and Survey Department carries out further work on Niue, completing 19 title surveys, extending the survey control, laying out road lines, completing a detailed topographical survey of the wharf area, and reobserving latitude and longitude at the initial station.

- Printing of the soil maps for the New Zealand Soil Bureau's *General Survey of the Soils of South Island, New Zealand* is completed. Field work for areas in the South Island not previously mapped was started in 1948; and a provisional series of maps and an extended legend were issued to a limited number of organisations in 1959. Printing of the final maps commenced in 1964. The bulletin accompanying the maps is published in 1968.

- A soil survey bulletin with maps is published for Waimea County. The bulletin is based on field work commenced as far back as 1920, on soil classification carried out for tobacco companies before and after the Second

World War, on soil mapping carried out in 1949 for the general survey of the soils of the South Island, and on subsequent revision work.

- The Soil Bureau starts to revise its soil classification and mapping in the Waikato, Taranaki, Hawke's Bay and Wairarapa districts, because of advances in soil classification methodologies.

- The New Zealand Oceanographic Institute commences publication of a series of bathymetrical charts of various Pacific and sub-Antarctic islands.

1966-1967

- Doppler satellite surveys are first used in New Zealand, following the establishment of two satellite stations as part of the world-wide PAGEOS and TRANET geodetic networks.

1966-1968

- Michael Robert Johnston surveys and maps the geology of the Tinui – Awatoitoi district of the Wairarapa. The maps and accompanying bulletin are published in 1980.

- Iain Bruce Campbell surveys and maps the soils of part of Wanganui County. The map is published in 1974, the accompanying bulletin in 1977.

- Willem Cornelis Rijkse surveys and maps the soils of Pohangina County, northern Manawatu. The map is published in 1975, the accompanying bulletin in 1977.

1967

- The New Zealand Soil Bureau publishes maps and a bulletin describing the soils and land use in the Upper Clutha Valley, Otago, based on the work of Michael Lucas Leamy and William Munro Hutchison Saunders.

- The Department of Lands and Survey undertakes to produce 1:63,360 land inventory county maps for all 120 counties, over a period of about 10 years. The pilot area for this project is Ohinemuri County, and six maps, showing land cover, geology, soil types, potential pastoral uses of soils, land tenure and land use are printed.

- A report on the reproduction of plans by microfilm systems is completed by an Interdepartmental Committee and submitted to various government departments for consideration. The Department of Lands and Survey adopts the report, and proposes to introduce a pilot system into the Wellington district office to implement the report's recommendations. (Copying of the Wellington survey plans on to microfilm aperture cards is completed in 1969). The Surveyor-General accepts in principle a proposal that a single colour plan be adopted for all surveys.

- New Zealand Minimaps Ltd. is established in Christchurch.

1967-1968

- The Department of Lands and Survey and the Hydrographic Division of the Navy complete a coastal control traverse from Jackson Bay in south Westland to Tuatapere in Southland. This completes such work around the New Zealand coastline.

1968

- The *Gazetteer of New Zealand Place Names* is published by the Department of Lands and Survey. The initial design of the gazetteer is made by Russell Gladstone Dick, a former Surveyor-General and Alfred W. Hampton, a former Chief Cartographer within the

Department. The list is compiled from a variety of published topographical maps, but is not a complete listing of all place names because some of the sheets in the NZMS 1 1:63,360 topographical series have yet to be published.

- The Department of Lands and Survey obtains a Model 8 Laser Geodimeter to make earth deformation measurements.

- The School of Surveying at the University of Otago introduces a Bachelor of Surveying degree.

- The Surveyors' Assistants' Examination, limited to public servants, is discontinued.

- The *Geological Map of New Zealand 1:250,000* series is completed. (The first sheet was published in 1959).

- A Wild RC8 camera is purchased by the Government and leased to New Zealand Aerial Mapping.

1969

- The first sheet in the New Zealand Geological Survey's 1:250,000 M*agnetic map of New Zealand* is published. The series is completed in 1979.

- Douglas G. Francis is succeeded by Paul Sadler as Chief Cartographer at the Department of Lands and Survey.

- The New Zealand Institute of Surveyors becomes a member of the Federation Internationale des Geometres (FIG) – the International Federation of Surveyors. (The Federation itself was established in 1878). The Institute also becomes a member of the Commonwealth Association of Surveying and Land Economy – CASLE.

- Aero Surveys is purchased by the Nelson based firm Aerial Surveys.

1970

- Robert Phillip Gough retires as Surveyor-General. William Seaton Boyes is appointed in his place.

- The Department of Lands and Survey obtains a MA 100 tellurometer for earth deformation studies and to assist with the replacing of many destroyed survey marks.

- Following the Inangahua earthquake of 1968 and an extensive resurvey of local triangulation and traverses to measure the amount of crustal deformation, the Department of Lands and Survey purchases the first laser Geodimeter for accurately measuring long distances up to 60km.

- Brian Marshall is appointed as the first Map Librarian at the Alexander Turnbull Library.

- Elwyn Griffiths surveys and maps the soils of the Port Hills area, Christchurch. The map and accompanying bulletin are published in 1974.

- Three Kings Islands are surveyed by Commander G.B.W. Johnson, HMNZS *Lachlan.*

- The New Zealand Forest Service commences publication of a series of 1:250,000 maps showing broad classes of indigenous forest in New Zealand. The series is later continued by Landcare Research.

- The Hydrographic Office of the Royal New Zealand Navy moves from cramped accommodation in Wellington to a new specially constructed building in Auckland.

1970-1979

- In 1970 the Soil Conservation and Rivers Control Council requests the Ministry of Works to prepare a three

map series of New Zealand, at a scale of 1:250,000. These maps are to be based on land resource inventory field sheets at a scale of 1:63,360, showing land use capability, potential land use, and erosion. A policy change results in this information becoming more widely available than originally planned, and the Ministry of Works commences publication of the worksheets in 1975. National coverage is completed by 1979. The New Zealand Land Resource Inventory is a nationwide survey which uses the Land Use Capability (LUC) method of land evaluation. The survey classifies New Zealand into approximately 90 000 map units each containing five sets of inventory information (rock, soil, slope, erosion and vegetation). Interpretive data (pastoral and forestry production potentials, potential erosion, soil conservation measures) are provided for each LUC unit. The data is stored on computer and utilised by a wide range of clients for regional and national land use planning.

1971

- The survey and draughting staff of the Department of Maori and Island Affairs is absorbed into the Department of Lands and Survey.

- The Computing Branch of the Department of Lands and Survey recomputes the 1868 triangulation of the Chatham Islands.

- David Kear, Director of the New Zealand Geological Survey, arranges for the United States Geological Survey in California to produce a demonstration orthophotograph of an area of geological significance near Dunedin.

- The New Zealand Cartographic Society is formed.

- The National Film Unit makes a 14 minute colour feature titled *An Inch to a Mile*, which according to the Unit's catalogue, looks at "surveyors in the hills, specialist pilots with aerial cameras, technicians remote-controlling drawing equipment in dust-free rooms – these people produce maps, one of the bases of our civilisation".

1972

- Soil maps of the Waioptapu region, central North Island, are published by the Soil Bureau, based on the mapping work of Colin George Vucetich and others.

- Survey Regulations set out the standards that regulate the conduct of surveys and the preparation of related survey plans affecting all classes of land.

- The Department of Lands and Survey completes the publication of the sheets in its NZMS 18 1:250,000 topographical coverage of New Zealand. Photogrammetric mapping of Fiordland is also completed.

- An extensive control survey is carried out by the Department of Lands and Survey in the Ruatoria area of the North Island to facilitate New Zealand Forest Service planning and development of the East Coast Afforestation Scheme.

- The Department of Lands and Survey completes the mapping of 11 state forests, covering 686 square kilometers.

- Mapping control is fixed by the Department of Lands and Survey on the Antipodes Islands, Raoul Island in the Kermadec Group and on Auckland and Campbell Islands.

- William (Bill) F. Cree retires as Chief Photogrammetrist and is succeeded by Robert (Bob) C. Barrett.

- Agreement is reached between Civil Aviation authorities in New Zealand and Australia to standardise as much as possible the presentation of radio navigation charts, and to share one chart covering the trans-Tasman routes.

1973

- The Land Amendment Act 1972 determines that surveying measurements from 1 January 1973 will be metric.

- New survey regulations implemented on 1 January stipulate that survey plans are no longer to be drawn in colour on mounted drawing paper but will be in black lines on transparent A-2 sized sheets, and stipulates metric standards for measurements. Two plans for each survey are now provided – one showing survey information, the other title information.

- The New Zealand Map Grid (NZMG), derived from mathematical analysis by W.Ian Reilly, is introduced for metric cadastral and topographic mapping. This replaces the separate National Yard Grids for the North Island and the South Island.

- William Seaton Boyes retires as Surveyor-General. Ian Francis Stirling is appointed in his place.

- Following the success of a pilot project in its Wellington district office, the Department of Lands and Survey installs microfilm equipment in all district offices for the copying of survey plans, in order to reduce wear and tear on the original plans.

- The Remote Sensing Section is formed at the Physics and Engineering Laboratory, Department of Scientific and Industrial Research. Its role is to liaise with NASA concerning environmental satellites, to act as a co-ordinating agency within New Zealand and to take responsibility for introducing overseas technology and developing an indigenous technology for processing and analysis of new forms of data.

- Photogrammetric mapping of Fiordland, at a scale of 1:63,360, is completed. This completes the Department of Lands and Survey's photogrammetric mapping of New Zealand for the basic 1:63,360 topographical series, and photogram- metric mapping of a new basic metric topographic series at 1:25,000 scale, with contours at 20 metre intervals, is commenced, allowing for cartographic publication at 1:50,000.
- The Map Holding and Distribution Centre of the Department of Lands and Survey is renamed the Map Centre.

- The Department of Lands and Survey starts to provide medium scale 1:10,000 aerial photography coverage for urban areas, starting with Christchurch and Invercargill. The photography is to be utilised to produce photo mosaics and to provide a basis for new series topographical mapping at 1:10,000.

- A 1:63,360 soil survey of the Mackenzie Plains, South Canterbury, is completed with new computer technology being used for the soil classification work.

- The New Zealand Soil Bureau publishes the first in a series of Soil Survey Reports. The reports are used for publishing small or specialised surveys and for making basic soil survey information and maps available as quickly as possible.

- The Royal Society of New Zealand's National Committee for Geological Sciences publishes a *Report on Earth Deformation Studies*. This recommends an extensive programme of major triangulation, precise levelling and local networks to detect and monitor crustal deformation. The major projects of this programme are commenced by the

Department of Lands and Survey and the New Zealand Geological Survey in 1976, and continue through until 1984.

- The New Zealand Technician Surveyors Association (NZTSA) is formed.

- The New Zealand Certificate in Land Surveying is introduced as a qualification for survey technicians.

1973-1974

- The Geophysics Division completes gravity mapping of the North Island.

1974

- The Navy's surveying ship HMNZS *Lachlan* completes her last surveying season and is decommissioned.

- The United States National Aeronautics and Space Administration (NASA) agrees to supply New Zealand with multispectral imagery collected by earth resources satellites.

- The first Earth Resources satellite pictures of New Zealand are taken by Landsat I.

- The Department of Lands and Survey completes triangulation and mapping control from Karamea and Murchison to Hokitika for the West Coast beech utilisation scheme.

- The Department of Lands and Survey acquires two Wild B8 plotters, to cope with increased demand for mapping from a variety of other Government departments, including the New Zealand Forest Service, the Ministry of Works (power and highway development), the Mines Department (large scale mapping of the Huntly and Rotowaro coalfields), and the Department of Scientific and Industrial Research (large scale mapping of the Chatham Islands for re-vegetation purposes).

-The Department of Lands and Survey issues the first photogrammetric topoplots for sheets in the 1:50,000 basic mapping programme.

- Laurence Patrick Lee retires as the Department of Lands and Survey's Chief Computer and is succeeded by Jim Hall.

1975

- The Department of Lands and Survey occupies new accommodation in the new Charles Fergusson Building in Wellington.

- The second edition of the Department of Lands and Survey's *Catalogue of Maps* is published.

- Publication by the Department of Lands and Survey of NZMS 1 sheet S106 (Aspiring) completes the inch to the mile topographic coverage of New Zealand.

- The Department of Lands and Survey completes 2106 square kilometres of 1:10,000 forest mapping, covering 20 State forest units, for the New Zealand Forest Service (compared with 727 square kilometres in 1974).

- New Zealand and the United States cooperate to establish a satellite tracking station near Napier, enabling 16 positions to be precisely established around New Zealand and on the Chatham Islands. This enables the Department of Lands and Survey to participate in an international project at little cost, and provides useful extra survey control.

- The final edition in the NZMS 177 1:63,360 cadastral series is published.

- The Remote Sensing Section of the Department of Scientific and Industrial Research's Physics and Engineering Laboratory is appointed by NASA to be

the central agency for the Landsat II programme.

- Landsat II coverage of New Zealand begins with two images of the Canterbury Plains from Kaikoura to Oamaru.

- The attendance of an officer from the Department of Lands and Survey at a photogrammetric course at the International Training Centre for Aerial Survey (ITC) in the Netherlands results in improved assessment of control requirements, computing techniques, instrument capability and photogrammetric mapping methods generally. (Another photogrammetrist is sent in 1976).

- HMNZS *Monowai* is selected as a replacement for HMNZS *Lachlan*.

- The Pacific Regional Survey School is established in Honiara as a New Zealand Aid Project. The School is attached to the Honiara Technical Institute. (New Zealand aid to the School continues until 1985, when both survey and draughting teaching positions are localised).

1975-1977

- A combined United States / Department of Lands and Survey team establishes 19 Doppler stations throughout New Zealand, including four on the Chatham Islands. This is in conjunction with a United States programme to monitor the GEOS 3 satellite.

1976

- The *New Zealand Atlas*, edited by Ian Wards, is published by the Government Printer, Wellington. It consists of 80 pages of maps, 73 pages of photographs and more than 100 pages of text. Kirkpatrick (1999) notes that the atlas was a commercial success but was ridiculed by many critics.

- The New Zealand Cartographic Society becomes a member body of the Royal Society of New Zealand.

- The Department of Lands and Survey reviews past methods of land inventory mapping and, as a result of this and metrication, introduces the NZMS 290 Land Inventory Mapping series.

- The Photogrammetric Branch, Department of Lands and Survey, purchases a Zeiss Psk-2 Stereocomparator for computer-based analytical aerial triangulation. A Wild B8S stereoplotter, fitted with a dual ocular system, is installed.

- A start is made on transferring the printing by the Government Printer of Lands and Survey maps to Masterton.

- New drawing techniques are devised by the Department of Lands and Survey to speed up the production of record maps (which are the base for all cadastral mapping). As a result, nearly 190% more record maps are produced in 1976-77 than in 1974-75.

- A four year Bachelor of Surveying degree course is introduced at the University of Otago.

- Edward Forsyth Lloyd and Simon Nathan survey and map the geology and tephrochronology of Raoul Island in the Kermadec Group.

- HMNZS *Monowai* acquires a gravity meter suitable for measurements at sea. It is proposed that regional gravity maps will be produced for New Zealand's continental extension as part of the assessment of the country's resources beneath the seabed.

1976-1977

- The Department of Scientific and Industrial Research establishes a

number of test sites to enable the use of remote sensing to monitor crop production on the Canterbury Plains.

1977

- The New Zealand Mapkeepers Circle is formed at Dunedin.

- The first 1:50,000 topographical sheet in the NZMS 260 series (sheet T12 – Thames) is published.

- Two major surveys, from Raglan to Gisborne, and from Dunedin to Fiordland, are completed by the Department of Lands and Survey for earth deformation studies.

- Field work is completed by the Department of Lands and Survey for a triangulation network from Canterbury to Westland across the Alpine Fault.

- Landsat II investigations in New Zealand are formally concluded. Following a further submission to NASA, the Department of Scientific and Industrial Research continues to acquire imagery over New Zealand from Landsat II and from Landsat III.

- Cabinet approves the purchase of a Rockwell Commander 690B pressurised turbo prop aircraft for aerial photography purposes. The aircraft comes into service in December 1978, and is owned jointly by the Crown and New Zealand Aerial Mapping.

- The Lands and Survey Department purchases a Hasselblad 500 EL/M camera for use by field parties to photograph ground marked photo control.

- The Photogrammetric Branch, Department of Lands and Survey, installs the Wild OR1 Avioplan system for the production of orthophotographs by analytical methods.

- Large-scale engineering mapping is undertaken by the Department of Lands and Survey for the Clutha, Lower Waitaki, Buller and Tongariro power schemes.

- The Cartographic Branch of the Department of Lands and Survey and the Government Printing Office combine to produce a screen catalogue which standardises for the first time the screens available for map-printing work.

- The Surveyors Professional Regulations 1977 and the Survey Regulations 1972 (Amendment No.1) are promulgated.
- GeoSmart (NZ) Ltd. is established, to provide aerial photography and mapping services.

- A. Grant Anderson's *New Zealand in maps* is published by Hodder and Stoughton, London; and Holmes & Meier, New York. The 141 page book consists of black and white thematic maps and text.

1977-1978

- The Department of Lands and Survey coordinates a major land use study of the King Country. The reports and maps are published 1977-1978. Three sheets, at a scale of 1:63,360 are produced to cover the King Country, and each sheet comprises six basic data maps plus five suitability overlays. They appear as NZMS 288. Another land use use study is undertaken in south Westland, in conjunction with the New Zealand Forest Service. Fifteen maps are prepared and reproduced to accompany a report for this study. The maps of south Westland are issued as the NZMS 289 series.

1978

- The Department of Lands and Survey issues the first sheets in the NZMS 260 1:50,000 topographical series.

- A Computer Mapping Unit is established by the Department of Lands and Survey.

- The Department of Lands and Survey publishes the first sheets in its NZMS 290 land inventory series. The maps are at a scale of 1:100,000, with sheet lines and sheet identification based on those used for the 1:50,000 topographical series. Base maps are printed in full colour to show a variety of themes, and suitability theme overlays are also produced, printed on transparent paper. The maps display a range of data surveyed by the Department of Lands and Survey, the Geological Survey and the Soil Bureau.

- The Department of Lands and Survey purchases from Stuttgart University in West Germany a computer programme for block adjustment of aerial triangulation data. The programme is installed at the State Services Commission Trentham computer centre.

- The Lands and Survey Department publishes a history of the *First-Order Geodetic Triangulation of New Zealand, 1909-1949, 1973-1974* by Laurence Patrick Lee, a former Chief Computer of the Department.

- The *Atlas of the South Pacific* is published for the External Intelligence Bureau by the Department of Lands and Survey. A second edition is published in 1986.

- Wilfred Irvin Smith issues a report on New Zealand archives, commenting adversely on the state of the cartographic archives at National Archives in Wellington.

- The Department of Scientific and Industrial Research purchases a colorwrite machine which generates high quality colour transparencies directly from digital data.

- HMNZS *Monowai* arrives in New Zealand to replace the *Lachlan* which had been retired three years earlier. In those three years limited survey work is carried out by the Navy's motor launches *Takapu* and *Tarapunga*.

1979

- The Geological Survey publishes the first in a series of urban geological maps, of the Nelson urban area.

- Paul Sadler retires as Chief Cartographer, Department of Lands and Survey, and is succeeded by Graham F. Jeune.

- The Department of Lands and Survey uses Doppler receivers to establish an additional four stations in the North Island.

- The company New Zealand Aerial Photography is formed in Auckland by Craig Atchison and Barbara I. Thomson. The company quickly changes its name to Air Logistics (N.Z.) Ltd.

1979-1982

- The Physics and Engineering Laboratory in conjunction with IBM NZ Ltd., the Department of Lands and Survey, and the New Zealand Forest Service, develop a project to use the earth resource management (ERMAN) land classification computer package at the IBM Centre in Sydney, to produce a land use classification map from Landsat imagery. The imagery is of areas in the King Country, the Darfield agricultural area in Canterbury, and the Eyrewell State Forest. Within the King Country region the Department of Lands and Survey classifies the agricultural and pastoral areas, while the Forest Service classifies the extensive forest

areas in as many practical classes as possible. Final products resulting from this project are multi-coloured ERMAN classification maps of land use/cover and forestry types for each area, combined with catographic line work reproduced at a scale of 1:1 000 000.

1979-1984

- Michael Robert Johnston surveys and maps the geology of the St. Arnaud district, southeast Nelson. The map and accompanying bulletin are published in 1990.

1980

- The 9th United Nations Regional Cartographic Conference for Asia and the Pacific is held in Wellington.

- At the Photogrammetric Branch, Department of Lands and Survey, the Wild Aviotab TA semi-automated coordinatorgraph is interfaced with a Wild A8, giving a substantial improvement in the quality of initial maps drawn by the stereoplotter. This means that very little fair drawing is required.

- The Lands and Survey Department's Chief Computer Jim Hall becomes Director (Mapping) and is succeeded by Cliff H. Couch.

- The Department of Lands and Survey completes publication of the 1st edition of the NZMS 261 1:50,000 cadastral map series.

- William (Bill) F. Jaques replaces Ian S. Munro as Hydrographer, Royal New Zealand Navy.

- The Advisory Committee on Coordination of Surveying Education is established to define the levels of occupational activity within the surveying industry; to define objectives of educational and training programmes; to establish educational and training guidelines; and to formulate an educational policy.

- The Te Aute limestone facies are mapped by Alan G. Beu, Thomas Ludovic Grant-Taylor and Norcott de Bisson Hornibrook. The maps (2 sheets) are published as *Institute of Geological and Nuclear Sciences miscellaneous map* no.13.

- A soil survey of the Rangitaiki Plains, Bay of Plenty is completed by the Soil Bureau.

- The New Zealand Institute of Surveyors becomes a member body of the Royal Society of New Zealand.

1980-1981

- The Physics and Engineering Laboratory, Department of Scientific and Industrial Research, hires an 11-channel multispectral scanner from the United States to make 35 short aerial surveys over New Zealand.

- HMNZS *Monowai* surveys the route for the ANZCAN cable connecting Australia, New Zealand and Canada.

- Two inshore survey craft, *Tarapunga* and *Takapu*, are delivered from Whangarei Engineering and Construction Ltd., to the Royal New Zealand Navy. The two craft are named after two survey launches initially acquired by the Navy in 1950.

1981

- Ian Francis Stirling retires as Surveyor-General.

- Warren Neil Hawkey is appointed Surveyor-General.

- The *New Zealand atlas of coastal resources*, edited by Philip Tortell, is

published by the Government Printer, Wellington. The atlas identifies coastal resources (in a deliberately broad sense). It also indicates the sensitivity of coastal areas to oil pollution, and highlights those areas thought to be most in need of protection. Because most of the maps are drawn at a scale of 1:500,000, they provide an overall picture rather than the fine detail, so priorities for protection are not assigned.

- *The New Zealand cave atlas*, compiled by Peter C. Crossley, Brian Hurst, and Ruth G. West, is published by the Department of Geography, University of Auckland, for the New Zealand Speleological Society. Subsequent editions compiled by Peter Crossley are published in 1988 (for the North Island) and 1990 (South Island). Further editions for the South Island are compiled by Lindsay Main in 1993 and Nick Smith in 2004. All the subsequent editions are published at Waitomo Caves by the New Zealand Speleological Society.

1982

- The merger of the Department of Lands and Survey and the New Zealand Forest Service, and the organisational structure for a national Land Information System, are investigated but not implemented.

- Robert (Bob) C. Barrett retires as Chief Photogrammetrist, Department of Lands and Survey, and is succeeded by Mairi E. Clark. (In 1973 Mairi Clark was the first woman to be admitted as associate member of the New Zealand Institute of Surveyors, and in 1981 she was admitted to full membership).

- The University of Otago offers a new degree course, known as the Bachelor of Science (Measurement Science). This is in response to approaches made by the Department of Lands and Survey. The course is aimed at non-professional staff and draughting officers engaged in geodetic computing, photogrammetry and cartography. Students holding a B.Sc. (Measurement Science) are not eligible for registration as professional surveyors.

1983

- New Zealand's first maps incorporating satellite data in their design are published in October 1983, by the Department of Lands and Survey. The maps are part of the NZMS 290 land inventory series, and relate to the Waitaki Basin region.
- Cabinet gives approval to the computerisation of land related records in the Departments of Lands and Survey, Justice, Valuation and Maori Affairs.

- The Soil Bureau completes the compilation of soil maps and Soil Taxonomic Unit Descriptions for 10 Fijian agricultural research stations. A soil survey report and maps are completed for Tonga as well.

- New Zealand commences a major survey and draughting project in Fiji to extend and enhance the geodetic and survey control systems, to provide a new cadastral records and mapping base and to implement metrication.

- The Department of Lands and Survey purchases a Compugraphic MCS Composing System for typesetting names in its Cartographic Branch. Significant savings are obtained in the preparation of scientific map legends, street indexes, and aerodrome chart revisions.

1984

- NASA uses the Space Shuttle to fly a synthetic aperture radar survey of New

Zealand. This is a new remote sensing technique.

- The Department of Lands and Survey's first analytical plotter, a Wild BC1 Aviolyt, is installed. The cost of the plotter is $320,000. A second analytical plotter – a Wild BC2 – is installed in 1986. New Zealand Aerial Mapping also purchases a Wild BC1 analytical plotter in 1984, and a Wild BC2 in 1986.

- Mairi E. Clark retires as Chief Photogrammetrist at the Department of Lands and Survey, and is succeeded by John A. Spittal, who is the Lands and Survey Department's first graduate from the International Training Centre for Photogrammetry and Air Survey in the Netherlands.

1985

- The New Zealand Geological Survey completes a 1:2,000,000 geological map of New Zealand. The Geological Survey also completes a 1:2,000,000 minerals map for printing and publication by the Economic and Social Commission for Asia and the Pacific, in Bangkok.

- Campbell Island, The Snares, Bounty Islands and the Antipodes Island Group are surveyed by HMNZS *Monowai*, under the command of Ken J. Robertson, together with field survey parties from the Department of Lands and Survey.

- Ken J. Robertson replaces William F. Jaques as Hydrographer, Royal New Zealand Navy.

1986

- The Department of Survey and Land Information (DOSLI) is established under the Survey Act 1986, replacing the Department of Lands and Survey and incorporating the survey and mapping functions of the also disestablished New Zealand Forest Service. This change is part of a widespread government restructuring programme, initially of environmental agencies, and separates out the commercial or trading arms of Lands and Survey and the New Zealand Forest Service into State Owned Enterprises. At the same time DOSLI is required to increase substantially the level of cost recovery from its core activities, resulting in substantial price increases for maps, copies of survey plans and statutory services. Survey and mapping services for other Government departments also have to be charged at full cost of production.

- Warren Neil Hawkey is formally appointed Director-General/Surveyor-General of the Department of Survey and Land Information in October.

- The Department of Survey and Land Information carries out New Zealand's first GPS control survey, in Fiordland for mapping control, using recently purchased Ashtec receivers.

- The Science Mapping Unit of the Department of Scientific and Industrial Research produces New Zealand's first fully digital map. The map is titled *Maps of Masterton urban environs, North Island, New Zealand showing land attributes*, and consists of four maps printed on one sheet. The topographical base is digitised from Department of Lands and Survey topographical mapping, digital manipulation is performed on the "Intergraph" Interactive Graphics System at the Wellington office of GECO NZ, and final plate-ready films are produced on the GECO "SCITEX" laser plotter. (An earlier bathymetric map of McMurdo Sound used a combination of digital and analogue techniques).

- The Department of Statistics makes census figures available as a database with mapping software, called

Supermap. Supermap is a New Zealand derivation of a successful United States and Australian product from Space-Time Research Limited.

- The New Zealand Geological Survey starts to make available a series of Geological Resource Maps at a scale of 1:250,000. The maps are plotted from a computerised database and show locations of mines, dredges, wells, seeps, and outcrops for aggregate, minerals, coal, hydrocarbons and thermal water. Each sheet is accompanied by a substantial text.

- As part of a foreign aid project, the Department of Lands and Survey finalises the geodetic datum for Fiji with new co-ordinates and trig data published for all first- and second-order stations. This is based on a Doppler survey by the Australian Army Survey Corps.

- The Soil Conservation Centre at Aokautere is commissioned by the Ministry of Foreign Affairs to arrange aerial photography and photographic interpretation for Guadalcanal and Mailaita islands in the Solomon Islands, as an aid package following the destruction caused by Hurricane Namu. The photographs are taken by New Zealand Aerial Mapping.

1987

- The Department of Survey and Land Information formally comes into existence on 1 April.

- The New Zealand Mapkeepers Circle changes its name to New Zealand Map Society.

- Warren Hawkey retires and is succeeded by W.A. (Bill) Robertson as Director General / Surveyor General in October.

- Computer equipment and systems are installed in DOSLI's five major district offices (Auckland, Hamilton, Wellington, Christchurch and Dunedin) to enable digital capture of parcel information for the creation of a Digital Cadastral Data Base (DCDB).

- Investigations are made by DOSLI into the provision for the Army of a separate 1:50,000 series and the development of graphics for computer-assisted battlefield simulation.

- The Science Mapping Unit within the Department of Scientific and Industrial Research is required by Government to be 100% cost recoverable, contracting for work both within DSIR and on the commercial market.

- The Biological Resources Centre publishes *Ecological Regions and Districts of New Zealand*, as four books with accompanying maps. These map and describe New Zealand's 268 ecological districts within 85 ecological regions.

1988

- The Department of Survey and Land Information creates and puts into effect its first marketing plan.

- The Department of Survey and Land Information completes the installation of equipment and systems into district offices to enable the capture of property information for the creation of local databases.

- The Department of Survey and Land Information commences a major programme of cadastral surveying for the sale and transfer of commercial forests and farmlands to the newly established State Owned Enterprises and for the transfer of indigenous forested areas to the Department of Conservation.

- The Hydrographic Office of the Royal New Zealand Navy publishes a New Zealand edition of *INT 1 Symbols Terms and Abbreviations used on Charts.* This is a modified reproduction of *INT 1* published by the Deutsches Hydrographisches Institut for the International Hydrographic Office. *INT 1* also expands the content of *Symbols and Abbreviations for New Zealand Charts* published by the Hydrographic Office of the RNZN in 1987.

- Ray J. Gillbanks replaces Ken J. Robertson as Hydrographer, Royal New Zealand Navy.
- The New Zealand Institute of Surveyors celebrates its centenary with a FIG (Federation Internationale des Geometres) conference in Wellington.

1988-1997

- The Hakluyt Society, in association with the Australian Academy of the Humanities, publishes *The Charts and Coastal Views of Captain Cook's Voyages* in three volumes, edited by Andrew David. Assistant editors for the coastal views are Rudiger Joppien and Bernard Smith. Volume 1 is published in 1988, volume 2 in 1992 and volume 3 in 1997.

1989

- The New Zealand Map Society publishes a *Directory of New Zealand Map Collections.*

- Software is purchased by the Department of Survey and Land Information to enable photogrammetric restitution from stereoscopic SPOT imagery.

1990

- *He korero purakau mo nga taunahanahatanga a nga tupuna: place names of the ancestors, a Maori oral history atlas*, compiled by Te Aue Davis and edited by John Wilson, is published by the New Zealand Geographic Board. The atlas relates specific place names to the exploits of early Maori discoverers, explorers and travellers, and was a response from the New Zealand Geographic Board to a concern that Maori place names be properly recorded and understood in an appropriate cultural context.

- A Cooperative International GPS Network (CIGNET) station is established in Wellington, operated by the Department of Survey and Land Information.
- The Department of Survey and Land Information tests SPOT stereo imagery for 1:50 000 topographical mapping of the Dry Valleys in the Ross Dependency. The imagery is to be used in the Department's analytical photogrammetric plotters to capture 50 m contours and detail.

- Following a widespread restructuring of the Department of Scientific and Industrial Research, the Science Mapping Unit becomes part of DSIR Land Resources along with the former Soils, Ecology and Botany divisions. The Unit is shifted from Wellington to the DSIR Taita campus in June.

- The New Zealand Geological Survey is renamed DSIR Geology and Geophysics. It retains this name only until 1992.

- The *New Zealand Geographer* publishes an issue (volume 46 no.1) solely devoted to the consideration of GIS (geographic information systems) in New Zealand.

- A second edition of the *Gazetteer of New Zealand place names* is published by the Department of Survey and Land Information, and made available to the public on microfiche.

1990-1991

- In conjunction with the Department of Justice and The Treasury, the Department of Survey and Land Information negotiates an alternative means of funding for the support of the survey system which recognises that land transfer activity depends on the outputs of registration in Justice and of the survey system in DOSLI. At the same time the New Zealand Institute of Surveyors conducts its own Survey Industry Review.

1991

- The Department of Survey and Land Information and the Lands and Deeds Division of the Department of Justice commence a project to capture data on an estimated 800,000 titles in the Auckland Land Registry. The reason is to compile an automated Index to Titles for Justice and to create the Land Information Systems Central Index.

- William (Bill) D. Frisken replaces Ray J. Gillbanks as Hydrographer, Royal New Zealand Navy.

- New Zealand becomes a member of the Australian Land Information Council (ALIC), which is renamed ANZLIC. ANZLIC is concerned with developing nationally-agreed (in both countries) policies and guidelines aimed at achieving “best practice” in spatial data management.

- Trimble Navigation New Zealand Limited is set up to purchase the assets of Datacom Software Research Limited (DSR).

- The New Zealand Oceanographic Institute publishes a *Gazetteer of seafloor features in the New Zealand region*, compiled by Rose-Marie Thompson. The gazetteer is issued as NZOI miscellaneous publication no.104.

1991-1994

- The Department of Survey and Land Information, together with the Swedish National Survey, is commissioned by the United Nations to demarcate and map the border between Kuwait and Iraq. The Director General/Surveyor General, W.A. (Bill) Robertson, becomes a member of the United Nations Iraq/Kuwait Border Commission and the department provides a team of geodesists, surveyors, photogram-metrists and cartographers to carry out this work in conjunction with their Swedish colleages.

1992

- DSIR Geology and Geophysics becomes a government owned Crown Research Institute known as the Institute of Geological and Nuclear Sciences.

1993

- The Department of Survey and Land Information completes the task of demarcating and mapping the Kuwait Iraqi border following the Gulf War. The Secretary General of the United Nations praises DOSLI for its prompt and successful conclusion of the project.

- DOSLI undertakes an organisational development review to streamline its structure into a modern business operation.

- The *Porritt Report* to the State Sector Committee reviews New Zealand’s research vessel needs. One of the recommendations of the report is that hydrographic surveying should be moved to the Department of Survey and Land Information.

- The South West Pacific Hydrographic Commission (SWPHC), of which New Zealand is a member, is established and holds its inaugural meeting in Sydney. SWPHC is one of the 15 regional commissions of the International Hydrographic Organisation. The other members of SWPHC are Australia, Fiji, France, Papua New Guinea, Tonga, the United Kingdom, and the United States.

- N. Mortimer maps the geology of the Otago schist. The map is published as *Institute of Geology and Nuclear Sciences Geological Map* 7.

- The Institute of Geological and Nuclear Sciences commences publication of a series of coastal geophysical maps at a scale of 1:250,000. The first sheet to be published is the Maui gravity anomaly map.

- Tuki's map of New Zealand, originally drawn for Lieutenant-Governor King in 1793, is reproduced on a $1.20 postage stamp issued by Norfolk Island.

- The New Zealand Geographic Board publishes two 1:1,000,000 maps (North Island and South Island) showing a selection of Maori place names, pa and kainga existing in 1840, together with topographic relief and land cover.

1994

- Peter F.K. Usher replaces William D. Frisken as Hydrographer, Royal New Zealand Navy.

- The Australasian Hydrographic Surveyors Accreditation Panel is established.

1994-1995

- The restructuring of the Land Data Services of the Department of Survey and Land Information results in a significant redevelopment of the National Topographic Infrastructure Strategy and a comprehensive revision programme for the 1:50,000 topographical map sheets.

- A comprehensive review of the Survey System is undertaken by the Department of Survey and Land Information, with new initiatives being commenced, such as research into a new datum and survey control network, a Global Positioning System strategic review, the organizing of an Australian and New Zealand Cadastral Reform Conference, the upgrading of equipment for both field and office applications, and the development of strategies for the increased automation of geodetic and cadastral survey processes and records.

- Cabinet appoints Dr. Ron Heath of the University of Otago to conduct a further review (see 1993) of hydrographic services. Part of Heath's task is to determine whether there is a case for a statutory office for the Hydrographer, and whether it is possible to turn the Hydrographic Office into a commercial business unit. Heath's report, *Review of New Zealand Hydrographic Services*, is completed by March 1995. The report identifies the need to link the Hydrographic Information Startegy with other initiatives, in particular the Research Vessel Committee, the redevelopment of a strategy for New Zealand marine science, and the delineation of New Zealand's legal continental shelf.

1995

- The Land Transfer Office of the Department of Justice is transferred to the Department of Survey and Land Information and renamed the Land Titles Office.

- The Council of the New Zealand Institute of Surveyors passes a

resolution in favour of voluntary membership of the Institute.

1996

- For the year ended June 1996 the Department of Survey and Land Information is able to report that it has recovered 73% of its costs from external sources, exceeding the target of 70% originally set.

- The Department of Survey and Land Information is restructured to form Land Information New Zealand (LINZ) and Terralink New Zealand Limited. LINZ commences business on 1 July, and has responsibility for the policy, regulatory, standard setting and core government service delivery functions of the former DOSLI and Land Titles Office, and for the purchase of hydrographic services from the New Zealand Defence Force. LINZ is also required to contract out the provision of geodetic survey, survey network maintenance and topographic mapping services to private sector agencies. Terralink, a state owned enterprise, takes over the contestable work previously undertaken by DOSLI.

- Russ Ballard is appointed Chief Executive Officer for Land Information New Zealand. A.T. (Tony) Bevin is appointed Surveyor-General. John A. Spittal is appointed Chief Topographer/Hydrographer.

- The building of a national digital cadastral database and Survey Data Index (SDI) is completed by the Department of Survey and Land Information and handed over to the new department, Land Information New Zealand. As this provides complete and continuously updated cadastral mapping coverage of New Zealand maintenance and publication of paper 1:50,000 cadastral maps is consequently discontinued.

- The Institute of Geological & Nuclear Sciences starts publication of a new 1:250,000 series available in map and book form, as digital images, GIS data and as downloadable images, designed to give nationwide coverage. The maps, known as QMAPS, use lithostratigraphic rather than time stratigraphic divisions, and are drawn from geological data stored in the QMAP geographic information system, which is a database built and maintained by the Institute and running on ARC/INFO software.

- The soils of the Heretaunga Plains, Hawkes Bay, are mapped by Manaaki Whenua Landcare Research.

- The Geological Society of New Zealand publishes a *Union list of archival, manuscript, and theses geological maps of New Zealand.* The lsit is compiled by Claren M. Kidd, University of Oklahoma.

1996-1997

- Imagery is gathered for the compilation of the Land Cover Data Base (LCDB1). LCDB1 is a representation of New Zealand land cover circa 1997. The database is a digital thematic map of land cover designed for use in a geographical information system or as a printed map. LCDB1 provides total coverage of the New Zealand mainland, and is derived mainly from summer 1996/1997 satellite imagery.

- Land Information New Zealand establishes a LINZ web site providing information about itself and public access to the geodetic and geographical names databases.

- Core topographic map specifications are developed by Land Information New Zealand as a prerequisite to the outsourcing of topographic work.

- In conjunction with the United States Geological Survey, Land Information New Zealand carries out a major GPS

control survey in the Ross Sea region in order to develop a new Ross Sea Region Geodetic Datum.

1996-2003

- In 1996 the Government ratifies the United Nations Convention on the Law of the Sea. This grants to New Zealand rights and obligations relating to the exploration and management of the continental shelf. In 1998 the National Institute for Water and Atmospheric Research (NIWA) and the Institute of Geological and Nuclear Sciences undertake a desktop study of available data relating to the management of the legal continental shelf, and in 1999 and 2000 the NIWA research ship *Tangaroa* surveys the northern, southern and western boundaries of the continental shelf. The research vessel *L'Atalante* makes a survey of the Resolution Ridge area in 2000. The research vessel *Melville* conducts a multi-beam survey of Bollons Seamount and Wishbone Spur to the southeast of New Zealand in 2002, and *Tangaroa* surveys the eastern boundaries of the continental shelf. Survey work for the Continental Shelf Project is completed by 2003. Land Information New Zealand (LINZ) is the lead agency for the project and has overall responsibility for the survey programme, collection, processing, analysis and interpretation of data.

1997

- Cabinet approves the automation of the New Zealand survey and land titles information system. This results in a seven year programme (later called Land*online*) to redesign and integrate cadastral survey and land titling processes and to develop software to automate transaction processing, remote access to survey and title records, digital lodgement of survey and registration data and database maintenance. This also involves the digital conversion of all current land parcels, together with intensive geodetic control, in urban and peri urban areas to establish a survey accurate digital cadastral database. One later consequence (2000-2002) is the closure of seven smaller LINZ district offices, with survey and titling processes consolidated into five regional offices.

- Land Information New Zealand releases its *New Zealand Hydrographic and Bathymetric Information Strategy*. The goals of the strategy are to achieve greater responsiveness to user needs; to promote effectiveness and efficiency by clarifying the purchaser role and creating an environment to stimulate the development of a contestable provider market; to ensure that hydrographic and bathymetric information is widely available; and to establish the New Zealand Marine Survey Information System.

- *Bateman New Zealand Historical Atlas* is published by David Bateman in association with the Department of Internal Affairs. The atlas is edited by Malcolm McKinnon, and its chief cartographer is Barry Bradley. Kirkpatrick (1999) argues that the success of this atlas is that the scholarship was based on current historiography and that the cartography was sympathetic to the scholarship rather than to the tradition of atlas making. (A second edition, which includes a number of new plates, and with current information drawn from 2001 census figures and subsequent data, is published in 2005).

- The US Navy ship *Tenacious,* purchased in 1996, is commissioned into the Royal New Zealand Navy as HMNZS *Resolution*, and is used as a hydrographic surveying and oceanographic research ship.

- The last portion of a hydrographic chart in current use still to be directly attributed to Cook is replaced by a modern survey. A new chart for Dusky Sound (NZ 7653) removes the inset of Pickersgill Harbour as drawn by Pickersgill, but a historic cartouche of Cook's plan of Pickersgill Harbour ensures the perpetuation of Cook's name in its association with this area.

- Te Puni Kokiri develops an online Maori Land Information Base (MLIB) containing Maori Land Court information about Maori freehold land, which the Maori Land Court has approved for release on the Internet. This information is overlaid on a digital cadastral database and includes the size of each Maori land block, an indication of the number of owners, some topographical information, and relevant management information.

- The New Zealand Region of the Australasian Hydrographic Society is established. The AHS is a southwest Pacific and southeast Asian focus for those interested in hydrography, and is part of a federation of Hydrographic Societies that have evolved from the original Hydrographic Society founded in the United Kingdom in 1972.

- The first Trans Tasman Surveyors Conference, incorporating the 38th Australian Surveyors Congress and the 109th New Zealand Institute of Surveyors Annual Conference, is held in Newcastle, New South Wales. The second such conference is held in Queenstown in 2000.

1998

- Larry Robbins replaces Peter F.K. Usher as Hydrographer, Royal New Zealand Navy.

- The Royal New Zealand Navy's surveying ship HMNZS *Monowai* is decommissioned.

- The first meeting of the Hydrographic Commission on Antarctica is held, in Wellington.

- Land Information New Zealand introduces a voluntary system of accreditation of cadastral surveyors.

- Land Information New Zealand introduces a New Zealand Geodetic Strategic Business Plan, in order to articulate a vision and plan for the development of the geodetic system, including the establishing of three year and ten year goals.

- The Office of the Valuer General is established within Land Information New Zealand, following the restructuring of Valuation New Zealand.

- Full contestability for most of Land Information New Zealand's mapping and charting requirements is introduced.

- HSA New Zealand Business Group is established as a private supplier of products and services to the New Zealand hydrographic industry, including the production of nautical paper and digital charts for Land Information New Zealand, and acting as a national distributor for New Zealand topographic maps and nautical charts.

- Hydrolink, a consortium of four organisations created to provide hydrographic and bathymetric products and services, makes a survey of the waters around the Snares and Solander Islands. Use is made of the Scanning Hydrographic Operational Airborne Lidar Survey system to conduct the survey.

- The Office of the Surveyor-General within Land Information New Zealand launches a three year Geodetic Strategic Business Plan.

1999

- Government approves a budget of $44 million to gather and process seismic and bathymetric data as part of the Continental Shelf Project.

- Land Information New Zealand develops a programme to gather and analyse the necessary data to enable New Zealand to lodge a claim with the United Nations Conference on the Law of the Sea (UNCLOS).

- The New Zealand Geodetic Datum 2000 (NZGD2000), using the GRS80 ellipsoid, is implemented. 28 new TM meridional circuits are established for cadastral survey, based on those already in existence. This is a semi-dynamic datum, using estimates of crustal deformation to convert geodetic observations to epoch 2000.0.

- Mark Hambrey (a civilian) is placed in charge of the Royal New Zealand Navy Hydrographic Office. Clive Holmes is designated Hydrographer.

- HMNZS *Resolution* conducts her first survey as the New Zealand Navy's primary hydrographic survey ship. The area surveyed is around southern Stewart Island and the western part of Foveaux Strait.

- The *Bateman contemporary atlas New Zealand*, by Russell Kirkpatrick, is published. The atlas consists of 50 coloured plates of maps, and employs innovative cartography to show not only where places are, but why.

- The New Zealand American PLUme Mapping Expedition (NZAPLUME) surveys the southernmost 260 km of the Kermadec arc, north of New Zealand, using swath mapping technology. A second survey in 2002 covers the mid-segment of the Kermadec arc, and a third survey, covering the area north of Giggenbach volcano, is made in 2004.

1999-2000

- Land Information New Zealand converts its paper hydrographic charts to raster image format.

- Land Information New Zealand lets a contract to place electronic maps online during 2000.

2000

- Land*online*, an online database for land title and survey information and transactions, is launched, initially in the Otago region, by Land Information New Zealand.

- The Ross Sea Region Geodetic Datum 2000 (RSRGD2000) is implemented.

- Larry Robbins retires from the Royal New Zealand Navy.

- The inshore survey craft HMNZS *Takapu* and *Tarapunga* are decommissioned after twenty years service.

- The regional bathymetric map of New Zealand is submitted to the British Oceanographic Data centre in digital form by the National Institute of Water and Atmospheric Research (NIWA) as a contribution to the General Bathymetric Chart of the Oceans (GEBCO).

2000-2001

- A *Virtual Agency Strategy – Moving to eLINZ* is developed to assist Land Information New Zealand in implementing e-government initiatives and in moving to become an electronic virtual agency by 2004.

2001

- Land Information New Zealand adopts a new Transverse Mercator Projection (NZTM) using NZMG2000.

- Land Information New Zealand commences the development of an active control network (PositioNZ) in partnership with the Institute of Geological and Nuclear Sciences. PositioNZ stations are the highest accuracy points in the New Zealand Geodetic Datum 2000. It is planned that the network will consist of approximately 30 continuous tracking GPS stations across New Zealand and the Chatham Islands, and will be in place by 2005/06.

- Land Information New Zealand issues its *Startegic business plan* for 2001-2006. The goals of the plan are to meet New Zealand's needs for authoritative core land and seabed information; to enable access to this information; and to provide suitable staffing and management systems that meet government and customer expectations.

- Terralink New Zealand, a State Owned Enterprise providing geographic spatial information services, goes into liquidation.

- Terralink International Limited is formed, after a consortium comprising Animation Research, New Zealand Aerial Mapping and Mike and Lesley Bundock pay $7.2 million to rescue Terralink New Zealand.

- An updated version of the Land Cover Data Base (LCDB1.1) is released by Terralink.

- Land Information New Zealand contracts NIWA to conduct a hydrographic survey of the Balleny Islands – Cape Hallett – Possession Islands area in the western Ross Sea, Antarctica.

- The Institute of Cadastral Surveying, Inc. is established. The objectives of the Institute are to provide an organisation to which those actively engaged in cadastral surveying may belong; to promote best practice with regards to cadastral surveying; to promote a high standard of professionalism among its members; and to make representations on cadastral surveying matters as appropriate.

- The Hydrographic Business Unit of the Royal New Zealand Navy develops a procedure of going direct from digital survey to digital chart, allowing surveys to be entirely processed, manipulated, merged and plotted digitally, saving considerable time.

- A national cartographic conference, *GeoCart*, is organised by the New Zealand Cartographic Society. The conference is held at Wairakei. (A second similar conference is held in 2003).

- The New Zealand Cartographic Society, which is the official New Zealand representative to the International Cartographic Association (ICA), organises the first ever ICA event to be held in New Zealand – a meeting of the ICA Commission on Visualisation and Virtual Environments.

- The New Zealand Survey Board celebrates its centenary of establishment.

2001-2002

- Landsat satellite images are acquired for a revised and updated Land Cover Data Base (LCDB2).

2002

- NZTopo*Online,* which is the Internet version of the New Zealand Topographic Database (NZTopo), is launched by Land Information New Zealand. NZTopo*Online* displays seamless coverage of the 1:50,000 scale topographic mapping of New Zealand.

- The first edition of *NZ Mariner* is issued by Land Information New Zealand. *NZ Mariner* consists of Raster Navigational Charts (RNCs); which are raster copies of the New Zealand paper charts.

- Having closed its branch offices in New Plymouth, Gisborne, Napier, Nelson, Blenheim, Hokitika and Invercargill over the previous two years as part of its programme of introducing Land*online*, LINZ decides that its paper records – those records not available online – will continue to be available from LINZ Processing Centres in Auckland, Hamilton, Wellington, Christchurch and Dunedin.

- The Joint Geospatial Support Facility, a commercial enterprise within the Ministry of Defence, is opened at Devonport.

- The Cadastral Survey Act is passed, disestablishing the Survey Board of New Zealand and creating a Cadastral Surveyors Licensing Board, with responsibility for setting and enforcing standards for the competencies and licensing of cadastral surveyors, and for disciplinary requirements. The Act transfers responsibility for setting standards for the conduct of cadastral surveys and the auditing of cadastral surveyors to the Surveyor-General. The new Act repeals the Survey Act 1986 and removes statutory provisions for the New Zealand Institute of Surveyors, which becomes NZIS (Inc).

- The Trans Tasman Hydrographic Commission is established, to encourage professional development of hydrographic surveyors in Australia and New Zealand.

2003

- The Land*online* system is fully implemented with the operational introduction of the option of digital lodgement for all cadastral surveys and most title transactions, and the completion of survey conversion.

- The Land Environments of New Zealand (LENZ) database, which is a classification of New Zealand's environments mapped across New Zealand's landscape, is released by the Ministry for the Environment, Manaaki Whenua Landcare Research and David Bateman. The classification uses numerical data layers to describe various aspects of New Zealand's climate, landforms and soils.

- Russ Ballard retires as CEO, Land Information New Zealand. Brendan Boyle is appointed in his place.

- The Land Information New Zealand 2003-2008 Geodetic Strategy is released. The Strategy is in terms of the Cadastral Survey Act 2002 which provides for a national geodetic system and a national survey control system to be maintained.

- Land Information New Zealand releases its Ross Sea Region Strategy for the period 2003-2012. The Strategy allows for collaboration with other national and international agencies; management of a geodetic reference system; management of place naming; the provision of topographical and hydrographic digital data, maps and charts; and the provision of geospatial standards and advice.

- The Institute of Cadastral Surveying makes available on two external hard drives (and 89 DVDs) 1.38 million survey maps of New Zealand land blocks from the beginning of official surveys through to the present time. The maps are grouped by land district and indexed by plan type and number.

2003-2004

- Terralink undertakes a major aerial photography exercise in the Waikato as part of its National Imagery Acquisitions Project.

2004

- Land*online* records its one millionth online property registration.

- A.T.(Tony) Bevin retires from his post as Surveyor-General. Don Grant is appointed Acting Surveyor-General.

- Terralink photographs 42,000 square kilometers in the South Island, from Kaikoura to the McKenzie Basin as part of a project designed to create seamless integrated high resolution imagery of all of New Zealand.

- David Mundy, Commanding Officer of HMNZS *Resolution*, replaces Clive Holmes as Hydrographer, Royal New Zealand Navy.

- HSA Systems is awarded a contract by Land Information New Zealand to provide Zone of Confidence (ZOC) assessments based on the International Hydrographic Office S57 CATZOC criteria for all the hydrographic surveys used in the compilation of New Zealand's nautical charts.

- Land Information New Zealand undertakes its second major hydrographic survey of the Ross Sea area.

- The Land Cover Data Base (LCDB2) is released.

- Land Information New Zealand calculates the coordinates for the common Continental Shelf boundary negotiated between Australia and New Zealand.

- Land Information New Zealand completes the first stage of a new vertical datum for New Zealand with the development of a preliminary geoid model.

- Land Information New Zealand commences its Hydrographic Data Infrastructure (HDI) Project. The project is designed to deliver a business case recommending improvements to ensure that LINZ continues to meet its obligations in accordance with Government policy directions and existing legislation.

- Land Information New Zealand releases a Discussion Document on *Geospatial Information: the future role of Government*, and a report on the results of the consultation is released in 2005.

- HMNZS *Resolution* completes a survey of Shipping Lane One, thus completing the single largest survey project in the history of the Royal New Zealand Navy. The survey was commenced in 1998 and covers the area from Cape Reinga to the approaches to Tauranga. *Resolution* commences a survey of Shipping Lane Two, which includes parts of Cook Strait and the Wairarapa and Kaikoura coasts.

- The Government initiates a review of the New Zealand Geographic Board Act 1946. The review is completed in 2005.

- Omnistar HP GPS Service becomes available in New Zealand, providing a high resolution wide area differential correction capability across the New Zealand region.

- Animation Research Holdings lifts its stake in Terralink International to 80%.

- The soils of the Wairau Plain are mapped by Manaaki Whenua Landcare Research.

- Auckland City Libraries makes available on its website a selection of about 650 maps from its collections.

- The National Institute for Water and Atmospheric Research (NIWA) launches a climate mapping service, providing to the public maps from a national scale to the local scale, using data from NIWA's national climate database, satellite data, and output from global-scale and local-scale climate models.

2005

- The Government launches Ocean Survey 20/20, a 15 year project to investigate and map the seafloor to the edge of the continental shelf around New Zealand. The survey is designed to allow the exercising of sovereign rights; the conservation, management and use of ocean resources; and to facilitate safe navigation of the waters around New Zealand. The project is coordinated by Land Information New Zealand and involves the Ministry of Research, Science and Technology and other government departments and agencies.

- Land Information New Zealand releases its *Topographic Information Strategy 2005-2010*. The strategy provides for "ready access to topographic information neds to realise a safe, sustainable and innovative society". The strategy includes a proposal to implement the full adoption of the new NZGD2000 datum and NZTM projection, and the introduction of a new paper-based map series in 2008/09.

- Google launches Google Earth, a satellite imagery-based mapping product that includes satellite imagery of New Zealand. The product is freely available on the web.

- Government decides to further develop a One-Stop Geospatial Information Portal, following a scoping study that looks at ways in which New Zealand's geospatial information can be accessed, and the costs and benefits of different access options are assessed.

- Don Grant is appointed Surveyor-General, after being Deputy Surveyor-General from 1996, and acting Surveyor-General from early 2004. Following the Cadastral Survey Act 2002 the Surveyor-General's role is concerned with cadastral survey, the geodetic survey system, electoral boundaries, and the activities of the New Zealand Geographic Board.

- The Ministry for the Environment releases its Marine Environment Classification, a GIS-based environmental classification which classifies over 8 million square kilometers of oceans around New Zealand. The classification is based on a combination of eight factors, and provides information and maps of the physical and biological variations of the oceans within New Zealand's exclusive economic zone.

- The New Zealand Automobile Association launches AA SmartMap, an online mapping system providing a comprehensive street directory and result of a collaboration between the Automobile Association and GeoSmart.

NOTES

(1). This outline is based on the work of Davis (*He Korero Purakau mo nga taunahanahatanga a nga tupuna: Place names of the ancestors, a Maori oral history atlas) p*ublished by the New Zealand Geographic Board in 1990. For a differering account see the works of Steedman, listed under Sources.

(2). There is some confusion about whether this was R. J. Harrison or Henry Shafto Harrison. McClymont has R. Harrison, as does the account published in the New Zealand Company's *New Zealand Journal*. Lawn (1977) however, states with reference to Henry Shafto Harrison that he is "not to be confused with the surveyor, R.J. Harrison, who was Captain Thomas' partner in the contract surveys for the Otago settlement in 1846". There is also the possibility that R. Harrison and R.J. Harrison are not one and the same person!

(3). The 1950 annual *Report on Surveys* notes, for example, that the Photogrammetric Branch was doing work for the State Hydro-electric Department (George and Caswell Sounds, Kaituna River, Waikato River); New Zealand Forest Service (704 square miles in Southland), Geological Survey (Kaitangata and Buller Coalfields), New Zealand Railways (a new rail alignment near Otaki), plus work for the Fiji Government, and of course for its own mapping and land development purposes. The 1955 annual report notes photogrammetric work being done for the Mines Department (Maramarua Coalfield; the Hydro Department (Rotoiti-Murchison area); and the State Forest Service (Kaingaroa Forest); reports that "every possible assistance" is given to the Ministry of Works; and notes "a growing appreciation by other Departments and the public of the opportunities that aerial photography and photogrammetry offer for planning and examination of land-use potential, whether such be for forestry, soil conservation, irrigation, land development, hydro-electric development, or housing…".

The 1960 annual report notes field control being provided for the production by Photogrammetric Branch of large scale closely-contoured plans for the Auckland Motorway and the Blenheim-Nelson railway; engineering control for the Ministry of Works at Mangere Airport; and work being done by the Department checking for dam-deflection movements on the hydro-electroc schemes along the Waikato River. The 1970 report of the Department notes engineering surveys being conducted for the New Zealand Forest Service and the Ministry of Works, maps being drawn for the Ministry of Foreign Affairs, Ministry of Transport, Department of Scientific and Industrial Research and the Meteorological Service, and special surveys for the Marine Department.

(4). Eden (1955, pages 174-75) has a quote that reads "I, George Palmer, Captain of her Britannic Majesty's Navy, and at present commanding her Majesty's ship *Rosario*, do hereby make known … and … do hereby declare the … Bounty islands to be annexed to her Majesty's Colony of New Zealand…" According to Ross (1969) the survey of Tauranga Harbour was conducted by J.R. Palmer on board the *Rosario*. Whether J.R. should read George, or whether there were two Palmers on board the ship, is not clear.

SOURCES

INCLUDING BOTH WORKS CONSULTED AND REFERRED TO IN THE TIME LINE.

BOOKS / JOURNAL ARTICLES

Adams, C.W. 1903. *The measurement of distances with long steel tapes.* Wellington, Government Printer.

Alfonce, J. 1544. *La cosmographie, avec l'espace l'espére et régime du soleil et du Nord.* [Original manuscript held by Bibliotheque nationale, Paris].

Alfonce, J. 1559. *Les Voyages avantureux du capitaine Ian Alfonce, Sainctongeois.* Poitiers, Jan de Marnef & Bouchetz freres.

Allen, M.S. 2005. (Senior Lecturer, Department of Anthropology, University of Auckland). pers. comm. 22 August 2005.

Amodeo, C. 2003. *Forgotten Forty-niners, being an account of the men & women who paved the way in 1849 for the Canterbury Pilgrims in 1850.* Christchurch: Caxton Press.

Andersen, J.C. 1934. *Place-names in New Zealand: rules of nomenclature and list of names approved, or changed, or expunged.* Wellington, Honorary Geographic Board of New Zealand.

Anderson, A.G. (ed.) 1977. *New Zealand in maps.* London, Hodder and Stoughton, New York, Holmes & Meier.

Atkinson, J.D. 1976. *DSIR's first fifty years.* Wellington: Department of Scientific and Industrial Research.

Bagnall, A.G. (comp.) 1969-1985. *New Zealand national bibliography to the year 1960.* Wellington: Government Printer.

Baird, H.F. and Cullington, A.L. 1952. *Magnetic resurvey of New Zealand at epoch 1st July, 1945.* Wellington: Department of Scientific and Industrial Research.

Baker, N. (ed.) 1932. *A surveyor in New Zealand 1857-1896, the recollections of John Holland Baker.* Auckland: Whitcombe & Tombs.

Barton, P.L. 1996. "Surveying and mapping the Tararua mountain system (Part One)", *Otaki Historical Society journal*, 19: 16-27.

Barton, P.L. 1997. “Surveying and mapping the Tararua mountain system (Part Two)”, *Otaki Historical Society journal*, 20: 40-50.

Barton, P.L. 1998. “Maori cartography and the European encounter”. *In The history of cartography, Volume Two, Book Three: Cartography in the traditional African, American, Arctic, Australian, and Pacific societies, edited by David Woodward and G. Malcolm Lewis.* Chicago: University of Chicago Press.

Bauche, P. 1739. *Carte des terres Australes: comprises entre le Tropique du Capricorne et le Pole Antarctique ... par les ordres de Mrs. de la Compagnie des Indes ... / par Phillippe Buache* [map]. Paris, Rue des Noyers pres celles des Anglois, sous le Privilege de L'Academie R'le des Sciences, 5 Septembre 1739.

Beattie, H. 1947. *The pioneers explore Otago, a record of explorers, travellers, surveyors, bushmen, seekers of pastoral country, inland voyagers, and wayfaring men.* Dunedin: Otago Daily Times and Witness Newspapers Ltd.

Blaeu, J. 1648. *Nova Totius Terrarum Orbis Tabula* [map]. Amsterdam, J. Blaeu.

British Museum. 1967. *Catalogue of printed maps, charts and plans.* London: Trustees of the British Museum.

Brodie, J.W. 1952. Features of the sea floor west of New Zealand. *New Zealand journal of science and technology B*, 33: 373-384.

Brodie, J.W. 1964. *Bathymetry of the New Zealand region.* Wellngton: Department of Scientific and Industrial Research.

Browne, C.B. 1929. *Maori witchery, native life in New Zealand.* London, J.M. Dent.

Bruny-Dentrecasteaux, J.A. 1807. *Atlas du voyage de Bruny-Dentrecasteaux … en 1791, 1792 et 1793.* Paris, Dépôt Général des Cartes et Plans de la Marine et des Colonies.

Burrows, A.L. 1967. *The geomagnetic field in New Zealand at epoch 1960.5.* Wellington: Department of Scientific and Industrial Research.

Burton, P. 1965. *The New Zealand Geological Survey 1865-1965*. Wellington: Department of Scientific and Industrial Research.

Byrne, T.B. 2002. *The unknown Kaipara, five aspects of its history 1250-1875.* Auckland: T.B. Byrne.

Campbell, J. 1744-1748. *Navigantium atque Itinerantium Bibliotheca: or, a Compleat Collection of Voyages and Travels, consisting of above four hundred of the most authentick writers* [*Carefully revised, with large additions, and continued down time [by John Campbell*]. (Originally compiled by John Harris). London.

Cassini, G.M. 1792-1801. *Nuovo atlante geografico universale delineato sulle ultime osservazioni.* Rome, Calcografia camerale.

Church Missionary Society. 1816. "New Zealand. Church Missionary Society. Proceedings of the Rev. S. Marsden". *Missionary register for MDCCCXVI*: 459-471.

Clerk, J. le 1602. *Orbis Terrae Novissima Decriptio* [map]. Paris, I. Hondius sculp. I. Le Clerc excu.

Conly, G. 1986. *Piet's eye in the sky, the story of NZ Aerial Mapping Ltd.* Wellington, Grantham House.

Coronelli, V. 1691-1696. *Atlante Veneto.* Venice, Appresso Domenico Padouani.

Coutts, B. 2003. "(De)Regulation of the New Zealand surveyors", *New Zealand surveyor*, 293: 20-24.

Crossley, P.C. 1988. *The New Zealand cave atlas: North Island.* Waitomo Caves, New Zealand Speleological Society.

Crossley, P.C. 1990. *The New Zealand cave atlas: South Island.* Waitomo Caves, New Zealand Speleological Society.

Crossley, P.C., Hurst, B. and West, R.G. 1981. *The New Zealand cave atlas.* Auckland, Department of Geography, University of Auckland.

Cullington, A.L. 1954. *The geomagnetic field in New Zealand at epoch 1950.5.* Wellington: Department of Scientific and Industrial Research.

Cumberland, K.B. 1943. *Whitcombe's map reading in geography*. Christchurch, Whitcombe and Tombs.

Dana, J.D. 1894. *Manual of geology, treating of the principles of the science : with special reference to American geological history*. 4th ed. New York, American Book Company.

David, A. 1988-1997. *The charts and coastal views of Captain Cook's voyages.* 3 vols. London, Hakluyt Society.

Davis, Te A. (comp.) 1990. *He Korero Purakau mo nga taunahanahatanga a nga tupuna: Place names of the ancestors, a Maori oral history atlas.* Wellington: New Zealand Geographic Board.

Dawson, R.K. 1840. *Report on surveying; considered with reference to New Zealand, and applicable to the colonies generally*. London, Her Majesty's Stationery Office.

Day, A. 1967. *The Admiralty Hydrographic Service 1795-1919.* London: Her Majesty's Stationery Office.

De Vries, B.F. 1966. The role of the land surveyor in the development of New Zealand 1840 – 1876. M.A. thesis (Geography), Victoria University of Wellington, Wellington.

Dictionary of New Zealand biography. 1990-2000. Auckland: Auckland University Press. 5 vols.

Dingwall, P.R. 1982. *Castaways of the Auckland Islands, the changing image of the Auckland Islands.* Wellington: Government Printer.

Dobson, A.D. 1930. *Reminiscences of Arthur Dudley Dobson, engineer, 1841-1930.* Auckland: Whitcombe and Tombs.

D'Orbigny, A. 1843. *Voyage dans l'Amerique Méridionale.* Paris, Pitois-Levrault.

Dumont d'Urville, J-S.C. 1832-1834. *Voyage de découvertes de l'Astrolabe, éxecuté par ordre du Roi pendant les années 1826-1827-1828-1829 sous le commandement de M.J. Dumont d'Urville.* Paris, J. Tastu.

Dumont d'Urville, J-S.C. 1847. *Voyage au Pole Sud … Atlas hydrographique.* Paris, Dépôt-général de la Marine.

Duperrey, L-I. 1826-1830. *Voyage autour du monde, executé par ordre du Roi, sur la corvette de Sa Majesté, la Coquille, pendant les années 1822, 1823, 1824 et 1825…* Paris, Arthus Bertrand.

Easdale, N. 1988. *Kairuri, the measurer of land.* Petone: Highgate / Price Milburn, for the New Zealand Institute of Surveyors.

Farr, C.C. 1916. *A magnetic survey of the Dominion of New Zealand and some of the outlying islands for the epoch 30th June, 1903.* Wellington: Lands and Survey Department.

Ferrar, H.T. 1925. "Soundings in the seas around New Zealand". *New Zealand journal of science and technology*, 7: 295-297.

Fletcher, R.S. 1978. *Single track, the construction of the North Island Main Trunk Railway.* Auckland: Collins.

Furkert, F.W. 1953. *Early New Zealand engineers.* Wellington: Reed.

Gillbanks, R.J. 1977. "Hydrographic surveying in New Zealand", *Hydrographic Journal*, 3(1): 15-21.

Glue, W.A. 1966. *History of the Government Printing Office.* Wellington: Government Printer.

Gordon, D.R. 1989. "Opportunity and pitfall for LINZ", *Technical papers, 1989 ASPRS/ACSM Annual Convention. Volume 5, Surveying & cartography*. Baltimore, American Society for Photogrammetry and Remote Sensing/American Congress on Surveying and Mapping, pages 76-86.

Great Britain. Admiralty. 1856. *The New Zealand pilot. From surveys made in H.M. Ships Acheron and Pandora… Compiled by … G.H. Richards and F.J. Evans*. Hydrographic Office, London.

Green, W.S. 1884. "Recent explorations in the Southern Alps of New Zealand". *Proceedings of the Royal Geographical Society and monthly record of geography*, 6: 57-70.

Grent, W. 1625. *A new and Accurate Map of the World Drawne According to the truest Descriptions, latest Discoveries, and best Observations, that have been made by English, or Strangers…* [map]. London, Will Grent.

Grindley, G.W., Harrington, H.J. and Wood, B.L. 1961. "The geological map of New Zealand 1:2,000,000", *New Zealand Geological Survey bulletin* no.66.

Hall-Jones, J. 1971. *Mr. Surveyor Thomson, early days in Otago and Southland.* Wellington: Reed.

Hall-Jones, J. 1979. *The South explored, an illustrated history of New Zealand's deep south*. Wellington: Reed.

Hannah, J. and Knight, P. 1999. Hydrography in New Zealand – a new economic and political approach. http://www.hydrographicsociety.org.nz/reports/report_reporthydro.htm (Accessed 17 May 2005).

Hargreaves, R.P. 1966. *French explorers maps of New Zealand.* London: The Map Collectors' Circle.

Hawke's Bay Surveyors' Association. 1886. *Hawke's Bay Surveyors Association rules and schedule of prices*. Napier, printed by R.C. Harding.

Hawkesworth, J. 1773. *Account of the voyages undertaken … for making discoveries in the Southern Hemisphere, and successively performed by Commodore Byron, Captain Wallis, Captain Cartaret, and Captain Cook … drawn up from the journals … Illustrated with cuts, and a great variety of charts and maps.* London, printed for W. Strahan and T. Cadell.

Heale, T. 1871. *Principles and practice of surveying, to be adopted by officers employed in the field in connection with the Inspector of Surveys' Department.* Wellington, Government Printer.

Heath, R. 1995. *Review of New Zealand hydrographic services.*

Hector, J. 1879-1886. *Handbook of New Zealand*. Wellington, Government Printer. 4v.

Hervé, R. 1983. *Chance discovery of Australia and New Zealand by Portuguese and Spanish navigators between 1521 and 1528.* Translated by John Dunmore. Palmerston North: Dunmore Press.

Hochstetter, F. von. and Petermann, A.H. 1863. *Geologisch-topographischer atlas von Neu-Seeland.* sechs *Karten hauptsächlich Gebiete der Provinzen Auckland und Nelson umfassend mit kurzen Erläuterungen.* Gotha, Perthes.

Hochstetter, F. von. and Peterman, A.H. 1864. *Geological and topographical atlas of New Zealand: six maps of the provinces of Auckland and Nelson*. Auckland, T. Delattre.

Holdaway, R.N. 1996. "Arrival of rats in New Zealand". *Nature*, 384 (6606): 225-226.

Holm, J. 2005. *Caught mapping, the life and times of New Zealand's early surveyors.* Christchurch: Hazard Press.

Hondius, H. 1636. *Polus Antarcticus* [map]. Amsterdam, Henricus Hondius.

Hondius, J. 1589. *Typvs orbis terrarvm / Indocus Hondius, fecit 1589* [map]. [London?] : I. Hondius.

Hooker, B. 1988/89. "A preliminary list of survey-charts by Thomas Wing". *Archifacts*, 1988/4 & 1989/1: 30-32.

Hooker, B. 1990. "Early New Zealand coastal views by John Rodolphus Kent". *Archifacts*, October 1990: 17-20.

Hooker, B. 1990. "The origin of 'Taranaki Bay' in early New Zealand maps". *New Zealand geographer*, 46: 92-94.

Hooker, B. 1997. "Raphael Clint's map of Auckland, 1839". *Auckland Waikato historical journal*, 69: 37-39.

Hooker, B. 2000. *Early New Zealand printed maps.* Orewa: DelZur Research.

Hooker, B. 2000. *Dictionary of New Zealand map-makers & an appendix: Early cartography in New Zealand – a guide.* Orewa: DelZur Research.

Hooker, B. 2004. "The earliest cartographic representation and name for New Zealand in a printed map", in Hooker, B., *Finding New Zealand – a review of the discovery of New Zealand from ancient times until the 1840s with appendices*. Orewa: DelZur Research: 111-119.

Hotine, M. 1927. *Simple methods of surveying from air photographs*. London, His Majesty's Stationery Office. (Air Survey Committee. Professional papers, no. 3).

Howard, G. 1981. *The Navy in New Zealand, an illustrated history.* Wellington: Reed.

Howgego, R.J. 2004. *Encyclopedia of exploration 1800 to 1850.* Potts Point, NSW, Hordern House.

Humphries, T. 1899. *Directions for testing traverse bearing by observations on circumpolar stars with 5-in. theodolite, and appendix on time and computation of latitude and longitude geodetically*. Wellington, Government Printer.

Jenks, H.J. 1991. *Forgotten men, the survey of Tauranga and district 1864-1869.* Tauranga: Tauranga Historical Society.

Jourdain, W.R. 1925. *Land legislation and settlement in New Zealand.* Wellington: Government Printer.

Judd, B. 2003. *The desert railway, the New Zealand Railway Group in North Africa and the Middle East during the Second World War.* Auckland: Penguin Books.

Kelly, J. 1999. "Maori maps". *Cartographica*, 36(2): 1-30.

Kerr, I.S. 1976. *Campbell Island, a history*. Wellington: Reed.

Kidd, C.M. 1996. *Union list of archival, manuscript, and theses geological maps of New Zealand.* Lower Hutt, Geological Society of New Zealand.

Kirkpatrick, R. 1999. *Bateman contemporary atlas New Zealand: the shapes of our nation.* Auckland, David Bateman.

Land Information New Zealand. 1997. *New Zealand hydrographic and bathymetric information strategy.* http://www.linz.govt.nz/rcs/linz/5754/Bath_Info.pdf

Land Information New Zealand. 1998. *New Zealand geodetic strategic business plan.* http://www.linz.govt.nz/rcs/linz/6135/nz_geodetic_sbp.pdf

Land Information New Zealand. 2000. *Realisation of Ross Sea region geodetic datum 2000.* http://www.linz.govt.nz/rcs/linz/6129/rosssea_geodeticdatum2000.pdf

Land Information New Zealand. 2001. *Virtual agency strategy: building capacity.* http://www.linz.govt.nz/rcs/linz/5518/vasummary.pdf

Land Information New Zealand. 2001. *Strategic business plan.* http://www.linz.govt.nz/rcs/linz/5568/sbp.pdf

Land Information New Zealand. 2003. *Ross Sea region: strategy.* http://www.linz.govt.nz/docs/supporting_info/publications/ross_sea_strategy_v1.0.pdf

Land Information New Zealand. 2005. *Topographic information strategy 2005-2010.* http://www.linz.govt.nz/docs/topography/topo_info_strategy_2005_2010.pdf

Langren, A.F. van 1594. *Typus Orbis Terrarum* [map]. Amsterdam, Arnoldus F. ab Langren Auth. et sculp.

Lawn, C.A. 1977. *The pioneer land surveyors of New Zealand.* Wellington: New Zealand Institute of Surveyors.

Lee, L.P. and Adam, R.S. 1997. *Law for surveyors Chapter 4: A History of the New Zealand survey system.* Dunedin: Department of Surveying, University of Otago, and New Zealand Institute of Surveyors.

Lipyeat, M. and Wright, L. 2003. *Delving deeper: half a century of cave discovery in New Zealand.* Waitomo: New Zealand Speleological Society / Christchurch: Hazard Press.

Locker, R.H. 2001. *Jade River, a history of the Mahurangi.* Warkworth: Friends of the Mahurangi.

Lovell-Smith, B. 1988. *Maps, a catalogue of historical maps in the Canterbury Museum, Christchurch, New Zealand September 1988.* Christchurch: Canterbury Branch, NZ Institute of Surveyors.

Lucas, K. 1904. "A bathymetrical survey of the lakes of New Zealand". *Geographical journal*, 23: 645-660, 744-760.

McClymont, W.G. 1935. Historical summary of the mid-Southern Alps 1642 – 1883. *New Zealand alpine journal*, 6(22): 112-128.

McCormack, T. 1988. *A history of surveying and mountaineering in Westland.* Hokitika: Department of Conservation.

McDougall, R.J. 1989. *New Zealand naval vessels.* Wellington: GP Books.

McEwan, W.M. (ed.) 1987. *Ecological regions and districts of New Zealand.* Wellington, Biological Resources centre, Department of Conservation.

McKerrow, J. 1886. *New Zealand system of survey.* Wellington, Government Printer.

McKinnon, M. (ed.) 1997. *Bateman New Zaland historical atlas.* Auckland, D. Bateman in association with Historical Branch, Department of Internal Affairs.

McKinnon, M. 2004. "The uncompleted Centennial Atlas", in Renwick, W. (ed.)., *Creating a national spirit, celebrating New Zealand's centennial.* Wellington, Victoria University Press, pages 149-160.

McLintock, A.H. 1949. *The history of Otago*. Dunedin: Otago Centennial Historical Publications.

McLintock, A.H. 1959. *A descriptive atlas of New Zealand*. Wellington, Government Printer.

Maclean, C. 1994. *Tararua, the story of a mountain range*. Wellington: Whitcombe Press.

McRae, J.A. 1989. *New Zealand Institute of Surveyors 1888-1988*. Dunedin: New Zealand Institute of Surveyors.

McRae, J.A. and Baldwin, A.J. 1997. *Law for surveyors. Chapter 3 Title to land: its origins and development of the land transfer system.* Dunedin: Department of Surveying, University of Otgo, and the New Zealand Institute of Surveyors.

Main, L. 1993. *The New Zealand cave atlas. Volume 2, South Island.* Waitomo Caves, New Zealand Speleological Society.

Maling, P.B. (ed.) 1958. *The Torlesse papers, the journals and letters of Charles Obins Torlesse concerning the foundation of the Canterbury Settlement in New Zealand.* Christchurch: Pegasus Press.

Maling, P.B. 1996. *Historic charts & maps of New Zealand, 1642-1875.* Auckland: Reed.

Menzies, G. 2003. *1421, the year China discovered the world.* London: Bantam Books. [For a review of this book see: Finlay, R. 2004. "How not to (re)write world history: Gavin Menzies and the Chinese discovery of America", *Journal of world history*, 15(2): 229-242. See also Hartz, B. 2005. "Gavin's fantasy land, 1421: the year China … http://www.hallofmaat.com/modules.php?name=Articles&file=article&sid=91 for a systematic examination of the (in)accuracy with which Menzies has used his sources.]

Modriniak, N. and Marsden, E. 1938. *Experiments in geophysical survey in New Zealand.* Wellington: Department of Scientific and Industrial Research.

Morgan, P.G. 1921. "The status of areal geological mapping in New Zealand". *New Zealand journal of science and technology*, 4: 254-256.

Morris, R.O. 1995. *Charts and surveys in peace and war, the history of the Royal Navy's Hydrographic Service 1919-1970.* London: HMSO.

Mountfort, C.A. 1890. *Surveyor's pocket-book for rapidly and accurately reducing in the field distances measured on the slope to their horizontal value, also a table for putting in side pegs of roads and section pegs with a few useful problems that sometimes occur in field-work*. Napier, printed by R.C. Harding.

Murray, J. 1906. "On the depth, temperature of the ocean waters and marine deposits of the southwest Pacific Ocean", *Queensland geographical journal*, n.s.21: 71-134.

Murray, J. and Hjort, J. 1912. *The depths of the ocean*. London, Macmillan.

Nathan, S. 2005. *Harold Wellman, a man who moved New Zealand.* Wellington, Victoria University Press.

Neill, W.T. 1903. *The use of the barometer for the determination of heights.* Wellington, Government Printer.

New Zealand Cartographic Society. 2003. Cartographic activities in New Zealand 1999-2003, national report to the 12th General Assemby of ICA, Durban, August 2003. Auckland: New Zealand Cartographic Society.

N.Z. Department of Lands and Survey. 1946. *Geodetic and transverse Mercator projection tables: for the computation of geodetic and transverse Mercator projection positions between latitudes 34º and 48º (international spheroid).* Wellington, Government Printer.

N.Z. Department of Lands and Survey. 1949. *Catalogue of maps.* Provisional edition. Wellington, Lands and Survey Department.

N.Z. Department of Lands and Survey. 1959. *Catalogue of maps.* Wellington, Lands and Survey Department.

N.Z. Department of Lands and Survey. 1959. *Report on land utilisation survey, West Coast region, South Island, New Zealand.* Wellington, Government Printer.

N.Z. Department of Lands and Survey. 1961. *The land utilisation survey of north east Taranaki.* Wellington, Department of Lands and Survey.

N.Z. Department of Lands and Survey. 1964. *The land utilisation survey of Gisborne-East Coast region.* Wellington, Department of Lands and Survey.

N.Z. Department of Lands and Survey. 1968. *Gazetteer of New Zealand place names.* Wellington, Department of Lands and Survey.

N.Z. Department of Lands and Survey. 1975. *Catalogue of maps.* 2nd edition. Wellington, Lands and Survey Department.

N.Z. Department of Lands and Survey. 1977-1978. *King Country land use study.* Wellington, Department of Lands and Survey. 5 vols.

N.Z. Department of Lands and Survey. 1978. *Atlas of the South Pacific.* Wellington, Department of Lands and Survey, for the External Intelligence Bureau, Prime Minister's Department.

N.Z. Department of Lands and Survey. 1986. *Atlas of the South Pacific.* 2d edition. Wellington, Department of Lands and Survey, for the External Intelligence Bureau, Prime Minister's Department.

N.Z. Department of Survey and Land Information. 1990. *Gazetteer of New Zealand place names.* 2nd edition. Wellington, Department of Survey and Land Information. Issued on microfiche.

New Zealand Forest Service and N.Z. Department of Lands and Survey. 1977. *South Westland land use study.* Wellington, New Zealand Forest Service and Department of Lands and Survey.

New Zealand Map Society. 1989. *Directory of New Zealand map collections.* Wellington, New Zealand Map Society.

N.Z. Navy. 1959. *Chart catalogue & index.* Wellington, Hydrographic Branch.

N.Z. Navy. 1988. *INT 1 Symbols terms and abbreviations used on charts.* Auckland, Hydrographic Office, Royal New Zealand Navy.

New Zealand Soil Bureau. 1987. *New Zealand Soil Bureau publications list.* Wellington, Department of Scientific and Industrial Research.

Office of the Surveyor General. 2003. *New Zealand geodetic operations 1999-2002. Report for the General Assembly of the International Union of Geodesy and Geophysics: Sapporo,Japan 2003.*

http://www.linz.govt.nz/docs/surveysystem/survey_publication/NewZealandGeodeticNationalReport1999-2002.pdf (Accessed 1 November 2003).

O'Leary, D.J. 1986. "National forest surveys, land surveying, and mapping". In Levack, H. (ed.). *1986 Forestry handbook.* Wellington, New Zealand Institute of Foresters.

Oliver, W.H. 1966. "Discovery and exploration",in *An Encyclopaedia of New Zealand, Volume 2*, edited by A.H. McLintock. Wellington: Government Printer.

Patterson, B. 1980. *The surveying & mapping of Wellington Province 1840-76, an exhibition of manuscript maps … the Alexander Turnbull Library*. Wellington: Alexander Turnbull Library.

Patterson, B.R. 1984. Reading between the lines: people, politics and the conduct of surveys in the southern North Island, New Zealand 1840-1876. Ph.D. thesis (Geography), Victoria University of Wellington.

Petersen, G.C. 1973. *Palmerston North, a centennial history.* Wellington, A.H. & A.W. Reed.

Pickens, K. 1997. "Surveys". In *National overview, Volume II (Waitangi Tribunal Rangahaua Whanui Series).* Wellington: Waitangi Tribunal, 323-335.

Pickett, J.E. 1891. *A short comparison of the New Zealand and Victorian survey systems.* Melbourne, J.C. Stephens.

Pierre, B. 1981. North Island Main Trunk, an illustrated history. Wellington: Reed.

Plancius, P. 1594*. Orbis terrarvm typvs de integro multis in locis emendatus, auctore P. Plancio* [map]. Amsterdam, Petrus Plancius.

Porritt, W. 1993. *Our oceans: a wealth of opportunities. Research vessel needs for the 21st century. Report of the Marine Vessel Needs Review Committee to the State Sector Committee, September 1993*. Available from the Ministry of Research, Science and technology, PO Box 5336, Wellington.

Purdy, J. 1816. *The Oriental navigator: or, directions for sailing to, from, and upon the coasts of, The East Indies, China, and Australia.* London, James Whittle & Richard Holmes Laurie.

Reed, A.W. *Two hundred years of New Zealand history, 1769-1969, a sampler chronology***.** Wellington: Reed Trust.

Reilly, W.I. 1970. *Topographic-isostatic gravity corrections for New Zealand*. Wellington: Department of Scientific and Industrial Research.

Rinckes, D.R. and Blaikie, A.G. 1997. *Law for surveyors. Chapter 2 The administration of the surveying profession.* Dunedin: Department of Surveying, University of Otago, and New Zealand Institute of Surveyors.

Riseborough, H. 1989. *Days of darkness, Taranaki 1878-1884.* Wellington: Allen & Unwin.

Ritchie, G.S. 1967. *The Admiralty chart, British naval hydrography in the nineteenth century.* London: Hollis & Carter.

Robertson, E.I. and Reilly, W.I. 1958. "Bouguer anomaly map of New Zealand". *New Zealand journal of geology and geophysics*, 1: 560-564.

Robinson, G.F. 1899. *The use of explosives … a short paper for the use of road inspectors on government roadworks.* Wellington, Government Printer.

Robinson, W.F. 1912. *The survey cadet's manual, for cadets entering the New Zealand Lands and Survey Department and for beginners in surveying.* Wellington, Government Printer.

Robson, J. 2000. *Captain Cook's world, maps of the life and voyages of James Cook R.N.* Auckland: Random House.

Ross, J. O'C. 1969. *This stern coast, the story of the charting of the New Zealand coast.* Wellington: Reed.

Ross, M. 2002. "The mysterious Eastland revealed". *The Globe*, 53: 1-22.

Rotz, J. 1542. Rotz Atlas [Boke of Idography]. (World map. Eastern and Western hemispheres). [British Library: Record number: c4194-02, Shelfmark: Royal 20 E. IX, Page Folio Number: ff.29v-30]

Royal Society of New Zealand. 1973. *Report on earth deformation studies.* Wellington, Royal Society of New Zealand.

Shirley, R.W. 1987. *The mapping of the world, early printed world maps 1472-1700.* London, The Holland Press.

Shortland, E. 1851. *The Southern districts of New Zealand: a journal, with passing notices of the customs of the aborigines.* London, Longman, Brown, Green & Longmans.

Smith, N. 2004. *The New Zealand cave atlas. Volume 2, South Island.* Waitomo Caves, New Zealand Speleological Society.

Smith, S.P. 1897. *Regulations for conducting the survey of land in New Zealand; together with land transfer survey regulations.* Wellington, Government Printer.

Smith, W.I. 1978. *Archives in New Zealand, a report.* Wellington, Archives and Records Association of New Zealand.

Speed, J. 1627. *A New and Accurat Map of the World Drawne according to ye truest descriptions, latest Discoveries & best Observations yt have been made by English or Strangers 1626* [map], in Speed, J., *A Prospect of the most famous parts of the world…* London, Printed by Iohn Dawson for George Humble.

Spittal, J.A. 1981. “Photogrammetry: a forecast of the future”. *New Zealand cartographic journal*, 11(1): 40-42.

Steedman, J.A.W. 1996. *A new concept in Maori history. Vol I.* Tauranga, J.A.W. Steedman.

Steedman, J.A.W. 1999. *Fabrications of traditional Maori history exposed*. Tauranga, Publicity Printing Ltd.

Steedman, J.A.W. 2001. *Mataatua*. Tauranga, J.A.W. Steedman.

Stephens, P., van Asch, P., and Clark, M. 1991. *No clouds today*. Palmerston North, Dunmore Press.

Thévenot, M. 1663. *Relations de divers voyages curieux.* Paris, Jacques Langlois.

Thompson, R-M. (comp.) 1991. *Gazetteer of seafloor features in the New Zealand region.* Wellington, New Zealand Oceanographic Institute.

Thomson, J.T. 1861. *An outline of the principles and details connected with the colonial survey of the Province of Otago.* Dunedin, Otago Witness.

Thomson, J.T. 1875. *An exposition of processes and results of the survey system of Otago.* Dunedin, Henry Wise.

Thomson, J.T. 1876. *Instructions for settlement surveyors on demesne lands of the Crown.* Dunedin, Henry Wise.

Tortell, P. (ed.) 1981. *The New Zealand atlas of coastal resources.* Wellington, Government Printer.

United Nations. 1984. *Ninth United Nations Regional Cartographic Conference for Asia and the Pacific, Wellington, 11-12 February 1980. Volume II. Technical Papers.* New York: United Nations.

United Nations. 1986. *Tenth United Nations Regional Cartographic Conference for Asia and the Pacific, Bangkok, 17-28 January 1983. Volume II. Technical Papers.* New York: United Nations.

United Nations. 1990. *Eleventh United Nations Regional Cartographic Conference for Asia and the Pacific, Bangkok, 5-16 January 1987. Volume II. Technical Papers.* New York: United Nations.

United Nations. 1995. *Twelfth United Nations Regional Cartographic Conference for Asia and the Pacific, Bangkok, 20-28 February 1991. Volume II. Technical Papers.* New York: United Nations.

United States. Board on Geographic Names. 1954. *New Zealand: official standard names approved by the United States Board on Geographic Names.* Washington, Department of the Interior.

Urewera National Park Board. 1975. *Handbook to the Urewera National Park.* 3d ed. Auckland: Urewera National Park Board.

Wakefield, F. 1849. *Colonial surveying: with a view to disposal of waste lands.* London, John W. Parker.

Wallis, H. 1981. *The Maps and text of the Boke of idrography presented by Jean Rotz to Henry VIII : now in the British Library / edited by Helen Wallis*. Oxford, Printed for presentation to the members of the Roxburghe Club.

Wallis, H. 1992. "The challenge that is an Australian map". *The Globe*, 37: 4-9.

Wards, I. 1976. *New Zealand atlas.* Wellington, Government Printer.

Willett, R.W. 1940. "Air photography and geology". *New Zealand journal of science and technology*, 22: 21B-33B.

Whitehead, A. 1848. *A treatise on practical surveying, as particularly applicable to New Zealand and other colonies.* London, Longman and Co.

Whitfield, P. 2001. "The European discovery of the Pacific – a cartographic mystery". Stanford's newsletter [no.1] http://www.stanfords.co.uk/newsletter/current/archive/september_letter/htm/special-feature.htm (Accessed 14 June 2005).

Williams, G. 1999. " 'To make discoveries of countries hitherto unknown', the Admiralty and Pacific exploration in the eighteenth century". In *Pacific empires, essays in honour of Glyndwr Williams, edited by Alan Frost and Jane Samson*. Melbourne: Melbourne University Press, pages 13-31.

Wiseman, R. 1996. *The Spanish discovery of New Zealand in 1576.* Auckland: Discovery Press.

Wiseman, R. 1998. *Pre-Tasman explorers*. Auckland: Discovery Press.

Wylde, H.J. 1897. *Field tables, for surveyors, engineers, mine managers and others : comprising a complete set of tables for facilitating calculations in the field, with diagrams and examples illustrating their use : formula for levelling by barometer and a few constant numbers, &c., sometimes necessary in field-practice.* Auckland, H. Brett.

Yonge, J.R. 1965. *New Zealand railway & tramway atlas.* Exeter, Quail Map Company.

Zatta, A. 1775-1778. *Atlante novissimo.* Venice, Antonio Zatta.

JOURNALS

Appendix to the Journals of the House of Representatives

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C-1A 1912-1963 Department of Lands and Survey

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Bulletin (new series), New Zealand Geological Survey. 1906-

Hydro International 1997-

InfoNews (published by DOSLI) 1989-1996

Landscan (published by LINZ) 1997-

Memoir, N.Z. Department of Scientific and Industrial Research 1925-1954

New Zealand cartographic journal 1971-1990.

New Zealand journal of science and technology 1918-1957

New Zealand Map Society journal 1987-

New Zealand surveyor 1893-

Records of the Survey of New Zealand…, annual reports of parties and officers conducting basic surveys and scientific operations 1923/24 – 1927/28.

Reports of geological explorations 1866-1892/93. [Titles of reports prior to 1870/71 vary].

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