

MINERAL DEPOSITS OF NEW ZEALAND | CONTENTS

INTRODUCTION, OVERVIEWS AND REGIONAL REVIEWS

Introduction to Monograph 31: New Zealand Mineral Deposits – Exploration and Research <i>A B Christie</i>	3
Exploration and Mining in New Zealand since 2006 <i>R G Barker, A V Haworth and A B Christie</i>	5
Regional Geological Framework of New Zealand’s Mineral Deposits <i>N Mortimer, A B Christie, R L Brathwaite and H J Campbell</i>	15
New Geological Map Data Sets for Resource Exploration of New Zealand <i>M S Rattenbury and D W Heron</i>	31
Integrating Airborne Geophysical Data into New Geological Maps of New Zealand Mineral Provinces <i>M S Rattenbury, S C Cox, S W Edbrooke and A P Martin</i>	37
Regional Mineral Resource Assessments to Promote Recognition of Mineral Resource Potential <i>A B Christie and R G Barker</i>	45
A Review of Mineral Prospectivity Modelling in New Zealand During the Past 15 Years <i>K J Peters, G A Partington, C J McKenzie, M P Hill, A V M Miller and S H H Nielsen</i>	53
Mineral Exploration in the Northland Region <i>R G Barker and A B Christie</i>	61
Lithospheric Controls on the Metallogeny of Basement Rocks in Southern and Western New Zealand <i>A H Allibone and D Craw</i>	71
A Summary of New Zealand’s Deep Water Marine Physical Resources <i>R Wood</i>	83

OROGENIC GOLD DEPOSITS

Introduction to Orogenic (Mesothermal) Gold Deposits in New Zealand <i>A B Christie</i>	92
The Nature and Origin of Hard Rock Gold Mineralisation in the Aorere Goldfield, North-west Nelson <i>A Mason, J Scott, T Ritchie and S Stephens</i>	93
The Endeavour Inlet Antimony Mine, Marlborough <i>G D Price</i>	99
Exploration of Orogenic Gold Deposits in the Lyell Goldfield, West Coast Region <i>A B Christie</i>	109
The Geology and Mining of the Globe-Progress Orogenic Gold Deposit, Reefton Goldfield, West Coast Region, from 2006 to 2015 <i>C McIntosh and R Cooksey</i>	119

Paragenesis of Orogenic Mineralisation in the Reefton Goldfield, West Coast Region <i>D MacKenzie, H Blakemore and D Crow</i>	125
Cretaceous Tectonics and Gold Mineralisation in the Otago Schist <i>N Mortimer, D Crow, D MacKenzie, J Mortensen, U Ring and I Pitcairn</i>	133
Glass Earth Regional Gold Exploration Program in Otago – Area Selection to Mining within Ten Years <i>S M Henderson, A P Martin and J A Coote</i>	141
Rise and Shine Orogenic Gold Prospect, Otago – Exploration Summary <i>A P Martin and D MacKenzie</i>	149
Gold-bearing Normal Faults at Oturehua, Central Otago <i>D MacKenzie, S C Cox and D Crow</i>	157
Exploration of the Ophir Orogenic Gold Deposit, Central Otago <i>A B Christie and J H Youngson</i>	163
Gold-bearing Faults of the Old Man Range, Central Otago <i>D MacKenzie, S Stephens and D Crow</i>	175
Mining and Exploration at the Macraes Orogenic Gold Deposit, East Otago <i>S Doyle, A B Christie and A P Martin</i>	183
Paragenesis of Mineralisation in the Hyde-Macraes Shear Zone, East Otago <i>D MacKenzie, J Moore, L Farmer and D Crow</i>	191
On 45 Years of Gold Exploration at Barewood and Nenthorn, Compared with 20 Years Prior to Mining at Macraes, East Otago <i>A P Martin and S C Cox</i>	199
 INTRUSION-RELATED GOLD DEPOSITS	
Exploration Update (2011–2015) on the Sams Creek Porphyry Gold Deposit, North-west Nelson <i>P Angus, R Jongens, M Phillips, M McCulloch, Y Nazimova and G Ryan</i>	209
 EPITHERMAL GOLD–SILVER DEPOSITS	
Introduction to Epithermal Gold–silver Deposits in New Zealand <i>A B Christie</i>	218
Puhipuhi – a High-level Epithermal Gold–silver Prospect in Northland <i>V Beach and J M Hobbins</i>	219
Exploration for Epithermal Gold–silver Deposits in the Hauraki Goldfield, North Island <i>R G Barker and A B Christie</i>	225
Glass Earth Staged Exploration for Epithermal Gold–silver Deposits in the Southern Hauraki Goldfield and Taupo Volcanic Zone, North Island, 2003–2013 <i>S M Henderson, A B Christie, S Soengkono, D Henderson, K Howie, B Smith, A Coote and J Cahill</i>	237
Tectonic and Structural Controls on Late Miocene-to-Recent Epithermal Gold–silver Mineralisation, Northern New Zealand <i>J V Rowland, E A Bahiru, M Schofield, A Hamilton, R Pickle, M de P Zuquim and J D Eccles</i>	247

Exploration of the Wharekirauponga Epithermal Gold–silver Prospect, Hauraki Goldfield, Coromandel Volcanic Zone <i>A B Christie, S M Henderson and P L Grieve</i>	259
Exploration and Geology of the Waitekauri Epithermal Gold–silver Deposits and Prospects, Hauraki Goldfield <i>M P Simpson</i>	273
Exploration and Geology of the Karangahake and Rahu Epithermal Gold–silver Deposits, Hauraki Goldfield <i>M P Simpson, M R Stevens, J L Mauk, M C Harris and A G J Stuart</i>	283
Ore Mineralogy and Textural Zonation in the World-class Epithermal Waihi Vein System, Hauraki Goldfield <i>J L Mauk, E G Skinner, S J Fyfe, A H Menzies, H A Lowers and A E Koenig</i>	293
Mining and Exploration of the Epithermal Gold–silver Deposits at Waihi, Hauraki Goldfield <i>L K Torckler, J M Hobbins and A B Christie</i>	303
Exploration at the Muirs Reefs Epithermal Gold–silver Prospect, Southern Hauraki Goldfield, Coromandel Volcanic Zone <i>A B Christie, S M Henderson, P L Grieve and K Howie</i>	313
Exploration for Epithermal Gold–silver Deposits in the Taupo Volcanic Zone, North Island <i>R G Barker and A B Christie</i>	325
 PLACER GOLD	
Introduction to Placer Gold Deposits in New Zealand <i>A B Christie</i>	334
Alluvial Gold Mining on the West Coast, South Island, 2005–2016 <i>R J Cotton and J W Wood</i>	335
Exploration and Development of the Ross Alluvial Goldfield, West Coast, South Island 2005–2016 <i>R J Cotton</i>	341
An Overview of Offshore Placer Gold Exploration – the Seafield Project, Westland, 2006–2010 <i>J H Youngson and I Stevenson</i>	345
Alluvial Gold Mining at Earnsclough, Alexandra, Otago <i>A B Christie and S J Herridge</i>	353
Gold Nuggets in Proximal Placers, Old Man Range, Central Otago <i>M Hesson, J Stewart, S Stephens, G Kerr and D Crow</i>	359
Manuherikia Valley Placer Gold Project, Central Otago <i>S M Henderson, J Fenton, A Bartle, A Hamilton and D Crow</i>	367
Stratigraphy of the Drybread Placer Gold Mining Area, Central Otago <i>D Crow, S M Henderson, G Kerr and J Druzicka</i>	373
Gold and Sediment Provenance in Southland Placer Goldfields <i>D Crow, G Kerr and D Falconer</i>	381
Waikaia Placer Gold Mine, Southland <i>W N Becker and W D Batt</i>	387

RESEARCH RELATED TO SUBMARINE AND SUBLACUSTRINE HYDROTHERMAL SYSTEMS

Introduction to Research Related to Submarine and Sublacustrine Hydrothermal Systems Offshore and Onshore New Zealand <i>C E J de Ronde</i>	396
Potential Sources of Metals in Kermadec Arc Lavas <i>C Timm, R J Wysoczanski and C E J de Ronde</i>	397
Structural Control on the Development of Submarine Volcano Hydrothermal Systems in the Kermadec Arc – Near Sea Floor Magnetic Mapping by Autonomous Underwater Vehicles <i>F Caratori Tontini and C E J de Ronde</i>	403
Assessing Ages and Duration of Mineralisation of Submarine Volcanic Arc-related Metal-rich Deposits Using Naturally Occurring Radioactive Isotopes <i>R G Ditchburn and C E J de Ronde</i>	407
Hydrothermal Vent Fluids – Understanding Subsurface Processes and Surface Mineralisation <i>V K Stucker and C E J de Ronde</i>	413
Mapping Mid-water Bubble (Gas) Plumes – a New Tool for Deciphering the Active Hydrothermal Systems of Lake Rotoiti and Calypso Vents <i>T J Stewart and C E J de Ronde</i>	419

IRONSAND DEPOSITS

Introduction to Ironsand Deposits in New Zealand <i>A B Christie</i>	426
Aotea Ironsand Deposit, Waikato Region, North Island <i>J Wood, J Meyers and P Vidanovich</i>	427
Process Mineralogy of Ironsands in the Waikato North Head Deposit, Waikato Region, North Island <i>J L Mauk, H A Cocker, H Rogers, J Ogiliev and A B Padya</i>	435
Exploration of Placer Titanomagnetite Ironsand Deposits Offshore from the West Coast of the North Island <i>A B Christie</i>	443

METALLIC MINERAL DEPOSITS OTHER THAN GOLD AND IRONSAND

Introduction to Metallic Mineral Deposits, Apart from Gold–silver and Ironsand Deposits, in New Zealand <i>A B Christie and R G Barker</i>	452
Exploration of Nickel–copper Mineralisation in Mafic and Ultramafic Rocks of the Riwaka Complex, West Nelson, South Island <i>A B Christie and R E Turnbull</i>	453
Exploration for Chromite, Platinum Group Element and Nickel Mineralisation in the Dun Mountain Ophiolite Belt, East Nelson <i>R L Brathwaite, A B Christie and R Jongens</i>	463
A Review of the Kirwan Hill Tungsten and Gold Prospect, West Coast <i>P M J Durance and D Polette</i>	471

Longwood Range Platinum, Southland 481
D Crow, D MacKenzie and P Ashley

Revised Three-dimensional Geometry of the Platiniferous Hekeia Gabbro, Longwood Range, Southland 487
N Mortimer, F Caratori Tontini and C E Martin

NON-METALLIC MINERAL DEPOSITS

Introduction to Non-metallic Mineral Deposits in New Zealand 494
R G Barker and A B Christie

The Rhyolite-hosted Matauri Bay and Maungaparerua Halloysite Clay Deposits, Northland 495
R L Brathwaite and A B Christie

Epithermal Zeolite and Gold–silver Mineralisation in the Ngakuru Area, Taupo Volcanic Zone 503
R L Brathwaite and S M Henderson

Silica Deposits of Southland 511
D T Strong, I M Turnbull and P J Glassey

Chatham Phosphate – a Strategic Resource 517
R Wood and R Falconer

MINERALS INFORMATION AND DATABASES

Introduction to New Zealand Minerals Information 524
A B Christie and R G Barker

Geoscience Information for Mineral Exploration 525
A B Christie, M S Rattenbury and S J Lomas

The Geological Resource Map Series and Commodity Database 535
A B Christie and M S Rattenbury

Regional Exploration Geochemistry Database of Geochemical Data Compiled from Open-file Mineral Reports 543
A B Christie and T J Stewart

New Zealand's Legacy Mine Plans and Geological Maps 549
J Taylor

Author Index 555

ADDITIONAL IMAGES

Image 1 – Tongariro Volcanic Centre in the southern Taupo Volcanic Zone 1

Image 2 – Sea floor topography 2

Image 3 – Tarawera rift zone, Taupo Volcanic Zone 14

Image 4 – Schist outcrop, south Westland 30

Image 5 – Airborne geophysical survey, West Coast 36

Image 6 – North Red Head hydrothermal system, Ruggedy Mountains, Stewart Island / Rakiura 70

Image 7 – Phosphorite sampling with a box corer, Chatham Rise 82

<i>Image 8</i> – Golden Bar quartz lode, Wakamarina, Marlborough	91
<i>Image 9</i> – Empress Lode, Reefton goldfield	108
<i>Image 10</i> – Globe-Progress open pit gold mine, Reefton, West Coast	118
<i>Image 11</i> – Rise and Shine Shear Zone, Central Otago	148
<i>Image 12</i> – Whites Reef in Otago Schist of the Old Man Range, Central Otago	174
<i>Image 13</i> – Frasers pit, Macraes gold mine, Central Otago	182
<i>Image 14</i> – Hyde-Macraes Shear Zone, Frasers pit, Macraes mine, Central Otago	190
<i>Image 15</i> – Hyde-Macraes Shear Zone, Frasers pit, Macraes mine, Central Otago	190
<i>Image 16</i> – Gold-bearing sulfide veins, Sams Creek	207
<i>Image 17</i> – The Sams Creek dyke	208
<i>Image 18</i> – Laminated quartz vein, Empire Vein Zone, Golden Cross mine	217
<i>Image 19</i> – Golden Cross mine in the upper Waitekauri Valley, Hauraki goldfield	272
<i>Image 20</i> – Golden Cross mine rehabilitation, Hauraki goldfield	272
<i>Image 21</i> – Electrum bands in quartz vein sample, Talisman 8 level, Karangahake	282
<i>Image 22</i> – Thin veins in Martha pit wall, Waihi	302
<i>Image 23</i> – Cross-cutting veins, Favona 905 level, Waihi	302
<i>Image 24</i> – Champagne Pool and sinter terrace, Waiotapu	324
<i>Image 25</i> – Champagne Pool with orange precipitates, Waiotapu	324
<i>Image 26</i> – Gold-bearing Blue Spur Conglomerate, Gabriels Gully, south-east Otago	333
<i>Image 27</i> – Drybread Hecklers placer gold mine, Central Otago	358
<i>Image 28</i> – Waikaka alluvial gold mine, Southland	380
<i>Image 29</i> – Bucket wheel excavator, Waikaka alluvial gold mine	380
<i>Image 30</i> – A remotely operated vehicle surveys the sea floor at Havre volcano, Kermadec arc	395
<i>Image 31</i> – Waikato North Head ironsand mine	425
<i>Image 32</i> – Laminated dune ironsands, Waikato North Head mine	434
<i>Image 33</i> – Bucket wheel excavator, Waikato North Head mine	434
<i>Image 34</i> – Volcanogenic massive sulfide lens, Upokongaruru, East Cape	451
<i>Image 35</i> – Hekeia Gabbro boulders, Longwood Range	480
<i>Image 36</i> – Matauri Bay halloysite clay mine in Northland	493
<i>Image 37</i> – Zeolite altered tuffs, Twist Road quarry, Ngakuru	502
<i>Image 38</i> – Quartz gravels in a pit at Pebbly Hills, Southland	510
<i>Image 39</i> – Phosphate nodules in seafloor sediments, Chatham Rise	516
<i>Image 40</i> – Layered themes of digital map data for Otago and southern South Island	523
<i>Image 41</i> – Historic head frame and boiler, Oturehura gold mine, Central Otago	534