A national-scale GIS and prospectivity models of mesothermal gold mineralisation in New Zealand

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Scope and aims of the prospectivity modelling

Many national and state governments lack the ability to readily determine the mineral wealth or potential of their territories. Traditional mineral assessments are difficult and time-consuming to undertake, as geological data is widespread and in a variety of formats. In addition, the assessments are in a text format that has limited application, lacking digital output. Furthermore, accurate mineral assessment is usually difficult, as government agencies tend to hold large unknown and uncompiled amounts of data relating to the mineral wealth of a country, collected by mineral exploration companies over many years. This information has great value for any mineral explorer wishing to invest in that country, serving as a guide as to where undiscovered mineral deposits may be located. At the present time, however, this information is not easily accessible in New Zealand. Thus, there is less incentive for explorers to undertake exploration activity, as the costs involved in acquiring geological information for regional targeting are high. The adoption of Geographic Information System software (GIS) for the management of mineral permitting and the Crown Mineral Estate offers a new and exciting platform for storing and analysing geological data, especially as GIS is now a common exploration tool used by the mining industry.

The scope of the GIS based minerals initiative, of which this CD is the first output, was to develop a product that could be used to highlight the mineral potential of New Zealand at a regional scale to the international exploration market. Like Australia and Canada, New Zealand has experienced a significant downturn in exploration. As a consequence, many areas considered prospective during the exploration boom in the 1980s are now open to exploration. The aim of this project was to highlight those areas to explorers who may have discounted New Zealand as an exploration destination in the past, or are new to New Zealand.

More importantly, the project delivers a new regional scale digital dataset, including geology, structure, geochemistry, current tenement information, land use, national parks and historical prospect information that explorers will be able to use to assess and target gold mineralisation in New Zealand.

The most important aim of this project was to try and reduce risk for explorers entering New Zealand at the important first step by combining one hundred years worth of data and information, held by Crown Minerals and GNS with current knowledge from research by GNS. This is intended to speed up the exploration process and allow a more focussed exploration effort. The prospectivity models, with their data coverage limitations, are not intended to find ore bodies for companies, but rather encourage companies to use their own knowledge to take advantage of the new data provided by this study. The study uses significant new geological knowledge from recent research carried out by GNS, which is summarised in a report by Christie (2002) contained on this CD.

This report is not intended as a scientific publication, but rather to document and explain the geological variables present in the GIS on the CD, how to use them and provide comments on the significance of the results of the prospectivity modelling to future exploration in New Zealand. The mesothermal gold GIS on the accompanying CD can be used by novice and expert GIS users alike. Inexperienced GIS users can browse the different geological data sets on the CD in relation to topographic and land tenure information. Expert GIS users can upload the GIS onto their own systems directly if using ESRI GIS software or convert the data files into their preferred GIS format. All data files attached to the GIS vector and grid files can also be accessed using common database, spreadsheet and word processing software. The Arc-SDM software used for the prospectivity modelling and derivative grid files are also provided for those users who intend to carry out their own prospectivity analyses.

All exploration models contain a certain amount of inherent bias due to the translation of any genetic model for mineralisation into an exploration model. Not all of the elements that form a genetic mineralisation model can be included in an exploration model as some data are not easy to collect, other data are expensive to collect and some data are used or discarded due to personal choice. The prospectivity models for Paleozoic and Mesozoic mineralisation in this analysis are no different, and users are encouraged to carry out their own analysis using the data provided in this GIS.

As discussed in more detail below, this project is the first part of a larger initiative to convert all exploration data held both by GNS and Crown Minerals into a digital format. Consequently, the study focussed on data collected at a scale of 1:20,000 and smaller. This means that data coverage should be taken in to account when assessing mineral potential. It is intended that the GIS and prospectivity models only be used as a positive exploration tool for near surface mineralisation. Prospect scale exploration targeting can be carried out if the more detailed exploration data, for example drilling information, soil sampling and trenching information, held by Crown Minerals are converted into digital data and incorporated into this GIS at a later date. Additional data from drilling information, seismic data and geophysical data is required before an assessment of the potential for deeper mineralisation can be made.

It is also hoped that the prospectivity modelling will also give all levels of government in New Zealand the on-going capacity to better manage and utilise the New Zealand Mineral estate. This will hopefully lead to better-informed decisions regarding land and mineral resource use at the national and local government level.

Data

The data themes on this CD have been derived from five databases maintained by the Institute of Geological and Nuclear Sciences Ltd:

- GERM (Geological Resource Map of New Zealand) is a mineral occurrence database featuring information on location, mining history, geological setting, and commodities.
- GMNZ is the digital version of the 1972 1:1,000,000 Geological Map of New Zealand published by the New Zealand Geological Survey. Only GIS-related modifications have been made, including rectification to a modern topographic base.
- GSNZ/GNS refers to a joint geochronological database project between the Geological Society of New Zealand and the Institute of Geological and Nuclear Sciences Ltd.
- QMAP is the comprehensively revised edition of the 1:250,000 Geological Map of New Zealand. QMAP is a fully digital, information-rich ArcInfo GIS dataset that currently covers half of the country and is planned to be complete by 2010.
- Petlab (incorporating Regchem) are recently compiled geochemical databases covering all of New Zealand. The databases are managed by GNS with data compiled from a variety of sources including GNS databases, university databases and from Open File Exploration reports held by Crown Minerals.

There are more than one hundred new data themes provided on this CD (Appendix 1). However, New Zealand still lacks good regional coverage of some digital data that are taken for granted in other countries, states and territories. Additional datasets that either need to be acquired or converted from paper form into digital form include:

- High resolution gravity
- High resolution EM
- High resolution DTMs
- High resolution radiometric data
- High resolution magnetic data
- Prospect-scale soil sample geochemistry
- Prospect scale drill geochemistry from all drilling methods (RAB, RC and Diamond)

Model definition

Defining the deposit model is the foundation phase for any prospectivity study. Accepted genetic models for mesothermal gold mineralisation in New Zealand were documented (Christie 2002), and are provided on the CD as a separate PDF report. These models were used to constrain the data collected and complied from Crown Minerals exploration reports and GNS digital databases.

New Zealand mesothermal gold deposits can be subdivided into two main types based on their age and host rock association (Table 1 and Figure 1). One class of deposits occur in greywacke rocks of Paleozoic age in western South Island (e.g. Reefton deposits, including Globe-Progress >2 M oz), whereas the second class occur in Mesozoic age schist of Marlborough and Otago (e.g. Macraes Flat >5 M oz Au), and in schist and greywacke of the Southern Alps. Christie (2002) provides a more in depth discussion of the main characteristics of mesothermal gold deposits in New Zealand.

The specific geological and geochemical data that was compiled for use in the subsequent GIS prospectivity analysis are summarised in Table 2.

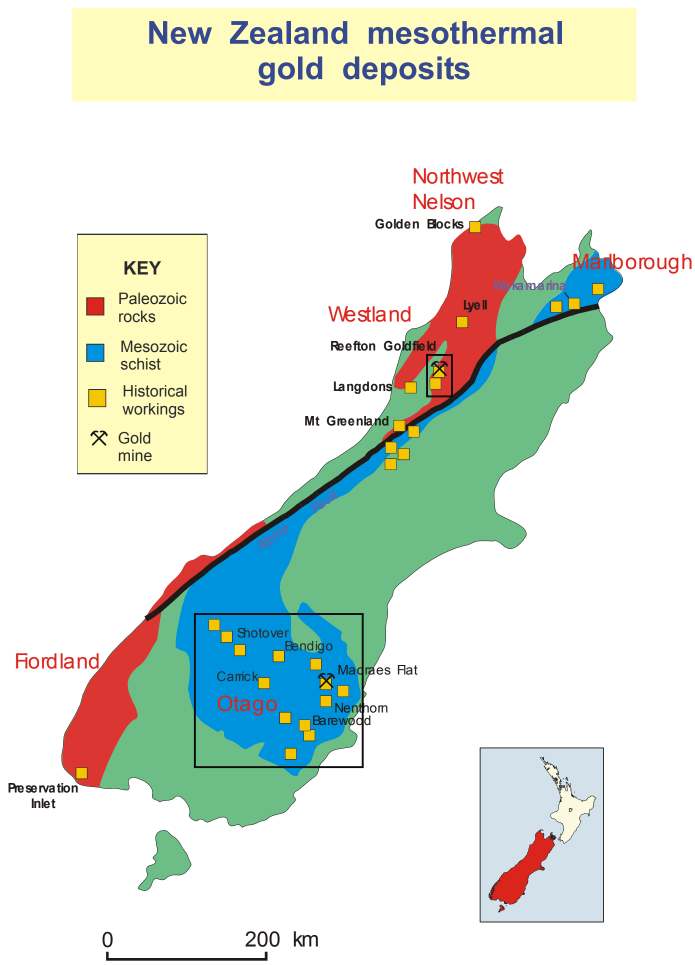

Figure 1: Major mesothermal gold deposits in New Zealand.

	Paleozoic deposits	Mesozoic deposits
Geographic occurrence	West Coast, Nelson and Fiordland	Marlborough, Southern Alps and Otago
Mineralisation style	Quartz lode and disseminated Au in shear zones	Quartz lode and disseminated Au in shear zones
Operating mines	Globe-Progress in development	Macraes Flat
Maximum known resource in one deposit	>2 M oz Au	>5 M oz Au
Lode dimensions L x D x W	1070 m x 1000 m x 14 m	1800 m x 150 m x 21 m
Host rock	Greywacke	Schist
Age of host rocks	Cambrian-Ordovician	Permian-Triassic
Age of metamorphism	Silurian-Devonian	Jurassic to Cretaceous
Age of mineralisation	Silurian-Devonian	Early Cretaceous
Geologic terranes	Buller	Caples, Torlesse
Metamorphism	Lower greenschist facies, weakly cleaved	Greenschist facies, strongly foliated
Structural controls	Faults, shears and folds. Lodes parallel strike of fold axes. Density of quartz veining	Faults and shears. Lodes parallel axis of schist belt
Hydrothermal alteration	Sericite, carbonate, arsenopyrite and pyrite	Sericite, arsenopyrite and pyrite. (Graphite at Macraes)
Lithological controls	Sandstone/mudstone, and bedding	Psammitic/pelitic/interlayered schist, and bedding
Potential source influences	Nearby granites	Greenschists and metacherts
Main metallic minerals	Gold, arsenopyrite, pyrite	Gold, arsenopyrite, pyrite
Minor metallic minerals	Local stibnite	Local stibnite and scheelite
Main non-metallic minerals	Quartz and carbonate	Quartz and carbonate
Minor non-metallic minerals	Feldspar and chlorite	Graphite at Macraes
Geochemical signature	Au, As, ±Sb	Au, As, ±Sb, ±W

Table 1: Characteristic features of New Zealand Paleozoic and Mesozoic mesothermal gold deposits.

Relationship	Feature	Data source
Distribution of known deposits	Occurrences and past production	GERM
Terranes and lithologic associations	Host rock lithology	QMAP
	Terranes	QMAP
Potential source rock influences	Granites and greenschists	QMAP
Metamorphic controls	Metamorphic grade	QMAP, Petlab
	Textural grade	QMAP
	Relative structural depth	QMAP and data of Mortimer (2001)
Structural controls	Relationship to faults	QMAP
	Relationship to folds	QMAP
	Relationship to major regional discontinuities	QMAP and data of Mortimer (2000, 2001) and Mackenzie & Craw (2001)
Regional geochemistry	Stream sediments	Regchem
	XRF whole-rock	Petlab
	Rock chip	Regchem - to be compiled from mining company reports
	Soil	Regchem - to be compiled from mining company reports
Deposit geochemistry	Rock chip	Regchem - to be compiled from mining company reports
	Soil	Regchem - to be compiled from mining company reports

Table 2: Summary of data reviewed.

Data collection and compilation

The accompanying CD contains more than 100 new vector and grid GIS data themes that have not been readily accessible for exploration targeting. More importantly, the data are complied at a national-scale, and some themes, especially the geochemical data themes, have not been viewed in this format or scale before. A significant amount of geological data and information was sourced from open file technical reports held by Crown Minerals, and from various databases held by GNS, such as Regchem (regional stream sediment/soil geochemistry, GERM (mine, prospect, and mineral occurrence database), and Petlab (geochemical rock sample database). GNS also compiled geological information (structure, lithology, quartz veins etc) from the relevant 1:250,000 QMAP map sheets. A detailed description of the directory structure and GIS file metadata is given in Appendix 1.

Over 7500 new geochemical point data were derived from over 100 open-file reports held by Crown Minerals and integrated into the GNS Regchem database. These data included stream sediment and rock chip data. The data selected from technical reports were at scale appropriate for the study (1:10,000 and smaller), and for this reason prospect-scale drill hole data and soil geochemical data were unable to be included. Several hundred hours were spent sourcing, assessing and entering the data, as well as carrying out important QA checks.

The paper-based data held by Crown Minerals in open file exploration reports provides an invaluable geochemical resource that remains to be fully utilised at a national or regional scale for mineral and environmental studies. The quality of the data held in the reports was better than expected, with more than 70 percent of reports reviewed providing data of acceptable quality. This project has started the process of converting an important national resource into a format that can be more easily used and updated in GIS and other information systems. It is vital that this process continues and that all new geochemical information obtained from explorers is provided in digital form. The development of a National Minerals Information System to manage and distribute this type of information is an important next step in the process, and will be critical to the future of the exploration industry in New Zealand.

Data classification in GIS and spatial modelling techniques

Data classification

Data compiled prior to the modelling stage were reclassified in accordance with the mineralisation models described by Christie (2002). These reclassified maps were either computer-generated from predetermined spatial criteria such as buffering, extrapolation or interpolation, or from expert-assigned attributes of genetic significance within the GIS data tables. These data were used to calculated spatial relationships between the exploration model data layers and the data layer containing the spatial data to be modelled; in this case historic occurrences of mesothermal Au mineralisation. The key derivative exploration data that were tested for geological spatial association with known mineralisation in this study included:

- Host rock and terrain preference of known deposits
- Proximity to macroscopic fold hinges
- Proximity to concentrations of mesoscopic folds
- Lithofacies (e.g., sandstone:mudstone occurrences, greenschist horizons)
- Correlation with density of quartz veins
- The relative structural depth of Mesozoic deposits, particularly in relation to the textural zones, isograds and the foliation thickness and mica grain size work of Mortimer (2001)
- Metamorphic grade discontinuities as shown in Mortimer (2000)
- Relationship to mesoscopically “folded” versus “platy” schist
- Relationship to the dip of foliation
- Geochemistry of host rocks

Spatial correlation analyses

As a first step in the spatial correlation calculation, a 200 by 200 m grid was generated over the Mesozoic and Paleozoic areas of gold mineralisation respectively. The size of the grid was chosen to represent the minimum likely extent that would be covered by an economic gold deposit given current technology and economic constraints. These areas were defined for each deposit type using the models described by Christie (2002). The spatial correlations were calculated assuming the known deposits have a 0.7 km^2 sphere of influence. As described by Bonham-Carter (1997), the spatial correlation (prior probability) of a feature can be calculated by using the relationship of the area covered by the data variable being tested and the number of training data points (Weights of Evidence technique). This produces a W+ result for when the feature is present and a W- result when the feature is absent (Appendix 2). A contrast value C is then calculated from the difference. The standard deviations of W (Ws and Cs) are calculated, from which the Studentised value of the contrast (StudC) can then be calculated (the ratio of the standard deviation of the contrast Cs to the contrast C). StudC gives an informal test of the hypothesis that C=0 and as long as the ratio is relatively large, implying the contrast is large compared with the standard deviation, then the contrast is more likely to be real. Ideally a StudC value larger than (-)1.5 can be considered as a positive or negative correlation (Bonham-Carter 1997). This ratio is best used as a relative indicator of spatial correlation, rather than an absolute sense. In this study a strong correlation is inferred from StudC values >3.0, moderate correlations inferred from StudC values between 3.0-1.5, weak correlations inferred from StudC values between 1.5-0.5 and poor correlations inferred from StudC values <0.5.

Mineral deposit locations for hard rock gold mineralisation were extracted from the GERM mineral deposit database. Following data validation, the prospect database was then reviewed, checking data and excluding all prospects that are alluvial or unrelated younger gold mineralisation. A training data set was then subset from this database by selecting those prospects with historic production recorded in the database. This training data-set accounts for 60% of the total number of hard rock mesothermal gold deposits in the GERM database. The training datasets were then subdivided according to the Paleozoic or Mesozoic mineral deposit classification of Christie (2002), with 144 deposits used for the Paleozoic training dataset and 182 deposits used for the Mesozoic training dataset.

Spatial correlation results

The results from the spatial correlation analysis are listed in Appendix 2 and summarised for each deposit type in Tables 3 and 4. The summaries have been compiled to highlight the most important exploration parameters for each deposit model. This was done to put the genetic models for mesothermal gold mineralisation into an exploration context. The results from the spatial analysis can therefore be used to develop realistic models to help targeting during more detailed scale exploration.

The spatial correlation analysis was subdivided into general geologically related themes, which are discussed below:

- Internal structure
- External structure
- Geology - temporal
- Geology - lithology
- Geochemical.

Exploration Data	Comment
Qtz Vein Density	Simple and effective exploration tool to be collected during geological mapping
Stratigraphy	Good geological mapping critical.
Rock type	Strong host rock control, geochemical or mechanical?
SS As, Au, Pb, Ag and Cu	Mesozoic mineral systems geochemically complex. Therefore multi-element geochemical techniques appropriate.
Structural Intensity	Suggests a structural control at a regional scale. Detailed structural mapping and analysis in GIS critical.
Rock Au, As, Pb, Zn, Ag, Sb and Cu	Geochemistry a strong indicator of mineralisation. More detailed sampling should be carried out. Soil sampling appropriate targeting technique.
Regional Fault Intensity	There appears to be a regional structural control along deep-seated faults.
Fold Style	Relates to degree and style of deformation. Possible depth relationship. More detailed mapping
Foliation style	Suggests a relationship to metamorphism. Studies on metamorphism important.
Lower Order Fault Intensity	Structural control is important at a local scale, but which faults?
Textural Grade	Suggests a metamorphic control at a broad scale.

Table 3: Key geological and geochemical criteria for exploration for Mesozoic mesothermal gold mineralisation in order of greatest spatial correlation.

Exploration Data	Comment
Stratigraphy	There is a strong stratigraphic control at a regional scale that defines permissive areas. These appear to be age related.
Structural Intensity	Significant structural control at a regional and prospect scale. Detailed structural mapping and analysis in GIS critical. Need to identify zones of intense folding and faulting.
Rock type	Sandstone units with interbedded shale horizons important. Strong host rock control, geochemical or mechanical?
Bedding Variance	Requires detailed mapping. Identifies areas of structural disruption.
Fold Tightness Density Map	Mineralisation in the Reefton area appears to be controlled by areas where folds become tighter at a prospect scale. Requires detailed prospect mapping.
Crustal Faults	There appears to be a regional structural control along deep-seated faults.
Qtz Vein Density	Simple and effective exploration tool to be collected during geological mapping
SS As and Au	Paleozoic mineral systems geochemically simple. Therefore focus on Au and As.
Rock Au and As	Geochemistry a strong indicator of mineralisation. More detailed sampling should be carried out. Soil sampling appropriate targeting technique.

Table 4: Key geological and geochemical criteria for exploration for Paleozoic mesothermal gold mineralisation in order of greatest spatial correlation.

Internal and external structural geology

The variability of internal structures such as bedding, lineation, foliation and cleavage measurements were modelled using a moving average technique. These derivative maps were developed to test the spatial relationship between mineralisation and areas of structural complexity. These maps had no to weak correlation with Mesozoic mineralisation. However, the bedding disruption map had a high correlation of 11.6 with Paleozoic mineralisation, possibly related to the association of this style of mineralisation with folding. Structural intensity maps were also produced by combining all the structures mapped in an area and gridding the density of the number of structures per unit cell using a kernel gridding technique in Spatial Analyst. Both Paleozoic and Mesozoic mineralisation gave high spatial correlations of 14-16 with the high-density structural zone, which probably represent areas of higher strain on a regional scale. Mesozoic gold mineralisation has an interesting correlation with areas of variable foliation measurements (3.1) and to a greater degree those areas mapped as S2 foliation (11.3). This suggests mineralisation may be constrained to a particular deformation event, which can be mapped in the field.

Linear trace data, including fold axial plane and fault orientations and intersections, were then buffered using the methodology described by Partington et al. (2001) to determine the optimum distance for the greatest number of prospects from the feature. Each data layer was coded with relevant attributes and processed using ArcView and the Arc-SDM extension software (Kemp et al., 2001) to assess the spatial correlation of each modified variable with a training data set. The folds and faults from both QMAP and GMNZ 1:1M map data sets were tested. The GMNZ 1:1M data gave better defined StudC values (7-8 compared to –6.3-0.8) compared to the more detailed QMAP data. It is clear that although both Mesozoic and Paleozoic mineralisation are associated with faults, not all faults are associated with mineralisation. The attributes mapped for the QMAP dataset are not of sufficient detail to distinguish faults associated with mineralisation compared to those with no association, and more work is required to clarify this relationship. It is interesting, however, that the GMNZ 1:1M scale faults give a good spatial correlation, but only at a regional scale of 3-4 km. This suggests there may be a regional scale structural control on the location of hydrothermal systems responsible for mineralisation that breaks down at a more detailed scale. This emphasises the need for detailed structural mapping, especially the timing of structures with respect to mineralization, when targeting prospect scale exploration. Both GMNZ 1:1M and QMAP scale fault intensity maps, gridded using the kernel method in Spatial Analyst, gave high spatial correlations for both mineralisation types (9-11 and 5-8), in contrast to the buffered fault data. It appears that there are localised areas controlling mineralisation even along faults spatially associated with mineralisation. The density of faulting in an area seems to provide a better indicator of mineralisation than distance from or along particular faults.

There is no correlation of Mesozoic mineralisation with folding and a weak correlation with Paleozoic mineralisation (1.6). This contrasts with the strong spatial correlation of folding with Paleozoic mineralisation in the Reefton area (a 500 m area around the fold axes, C=1.8 and studC=5.4) and 600m from faults, C=1.3 and studC=4.2: Partington et al., 2001). This suggests that fold axes are relatively more important in controlling mineralisation at a local scale and differs from mining district to mining district. This may relate to a lack of good geological information away from Reefton, or more likely, and similar to Victorian Slate Belt deposits, Paleozoic mineralisation has a variety of structural controls on mineralisation at a local level.

Both the folds and faults were split into sub-domains relating to strike and summarised according to their trend. They were buffered and the spatial correlation of deposits with distance from the structures graphed. The sub-domain trends of the folds and faults were then used to see if mineralisation was related to a preferred structural trend (Appendix 2). Mesozoic mineralisation is spatially correlated with NE and NW trending faults (1.7 and 2.7) and there is a good spatial correlation of E trending faults with Paleozoic mineralisation (3.6). The relationship between mineralisation and differing fault-fault intersection and fold-fault intersections was investigated by creating a point theme of intersections using ArcView and buffering around the intersection points. The results for this analysis for both types of mineralisation are given in Table 5 and Table 6. The spatial correlations are very weak suggesting exploration models using structural intersections are not appropriate for either type of mesothermal gold mineralisation in New Zealand.

	1 N-S	2 NE-SW	3 E-W	4 NW-SE
1 N-S	NA	NC	NC	1400, 1.74
2 NE-SW		NA	NC	NC
3 E-W			NA	2200, 1.16
4 NW-SE				NA

Table 5: Mesozoic fault intersection spatial correlation matrix.
NA Not applicable
NC No Correlation

	1 N-S	2 NE-SW	3 E-W	4 NW-SE
1 N-S	NA	800, 3.97	NC	NC
2 NE-SW		NA	NC	NC
3 E-W			NA	NC
4 NW-SE				NA

Table 6: Paleozoic fault intersection spatial correlation matrix.
NA Not applicable
NC No Correlation

Lithology

Lithological and stratigraphic controls on mineralisation for both type of deposits were tested using the QMAP data theme. Various rock type and stratigraphic attributes were tested for spatial correlations with known mineralisation. There is a strong host rock control on both types of mineralisation at a regional scale (Appendices 2, 3, 4, 5 and 6). Paleozoic mineralisation is strongly spatially associated with the Greenland Group of rocks (27.2) and other sequences of a similar age (Appendix 3). Sandstone, mudstone, argillite sequences have the greatest spatial correlation with Paleozoic mineralization (Appendix 4), although there is also a strong correlation with basalt in one area that is worth investigating further (11.4). Mesozoic mineralisation in contrast has a strong spatial association with metamorphosed rocks (Appendix 6), especially schist (16.3) and metapelite (16.1). There is a strong association with particular textural grades (III: 5.2, IV: 4.0) and foliation thickness (6.9), using maps developed by Mortimer (2001), which can be mapped in the field at a regional scale (Appendix 2). This appears to be related to interpreted depth of burial (Mortimer, 2000), which also gives a similar spatial correlation (6.3).

One of the more controversial questions currently being researched in economic geology is the role that granites play in the genesis of gold deposits. There is often a clear spatial association between granites of a certain age and mesothermal gold mineralisation (e.g. Partington and McNaughton 1997; Partington and Williams 2000), but more commonly the association is inferred from geochemistry or isotope analysis. Granite contacts were buffered for granites with similar ages to both types of mineralisation to test for any spatial relationship between granites gold mineralisation (Appendix 2). Neither type of mineralisation has any spatial association at a regional scale with temporally associated granites. However, this may not hold true at a more detailed scale as suggested by work by Partington et al. (2001) in the Reefton area. This is an area where a more extensive research effort is needed.

Gold deposits are commonly associated with large additions of SiO_2 in the form of quartz veins. Quartz veins host many of the high-grade shoots in both Paleozoic and Mesozoic deposits. However a large proportion of the veins are barren. Despite this, the presence of a high density of quartz veining can define areas of fluid flow within and along regional scale structures (e.g. Partington and McNaughton, 1997; Partington et al., 2001). A quartz vein density map was created by selecting a subset of quartz veins in the Mesozoic and Paleozoic terranes from the QMAP quartz vein data layer. The linear quartz vein theme was converted from polylines to regular points every 10m along the line defining the quartz vein. A density map was then created using Spatial Analyst's density gridding tool, using the kernel technique with a 10 km search radius. The vein-density map is based on veins in the data-set that are believed to be associated with mineralisation. Data are missing from the Marlborough area and the data-set has an uneven data coverage, probably biased by outcrop distribution and historical production. The quartz vein density map gives a very strong correlation with the training data-set (Paleozoic mineralisation 8.6 and Mesozoic mineralisation 27.0; Appendix 2) for both types of mineralisation. The high StudC value for this data layer suggests that this relatively inexpensive data collection technique may be a highly sensitive exploration tool. Additional data from exploration reports and future QMAP sheets should be collected to complete the coverage.

Geochemical data sets

Exploration geochemistry is the method by which a mineral deposit can be delineated by the primary envelope of chemical element enrichment around the mineralised zone and/or a secondary dispersal pattern of chemical elements, developed by weathering and erosion of the deposit. The primary envelope and secondary pattern typically form pronounced geochemical anomalies that present a larger exploration target for mineralisation than would be provided by the economic mineral deposit itself.

In the last twenty years large numbers of mineral deposits have been delineated using exploration geochemistry in many regions of the world. A significant proportion of exploration expenditure since the 1980s has, therefore, been directed towards geochemical exploration, including regional reconnaissance programs, localised follow-up surveys and exploratory drilling. In deeply weathered terrains, exploration geochemistry has generally proved more successful in targeting mineralisation than exploration geophysics. Unfortunately, New Zealand has missed out on the recent advances made in exploration geochemistry to the extent that this project is the first attempt to compile geochemical information at a regional scale in New Zealand. Consequently the datasets currently available in New Zealand are incomplete and analysed using less accurate analytical techniques than are current practise. Never-the-less the paper and digital databases held by Crown Minerals and GNS offer a treasure-trove of new information for explorers wishing to re-evaluate New Zealand's mineral potential.

The objective of exploration geochemistry today remains unchangedand that is to delineate geochemical signatures related to mineralisation. The geochemical information used in this study was restricted to those trace elements traditionally expected to be associated with mesothermal gold deposit (Ag, As, Au, Cu, Pb, Zn, Sb and W; Appendix 2 and Appendix 7). Geochemical anomalies were defined using a simple statistical approach in an attempt to take account of the vast amount of missing data. It is intended that the geochemical anomaly maps used in the study are used as a positive indicator of an areas mineral potential. No areas should be discounted on the basis of the current geochemical coverage. The complete digital geochemical database is provided on the CD for the user to carry out more detailed geochemical targeting studies and we hope it will encourage the collection and submission of any new geochemical information in digital form.

The percentiles for each dataset, excluding missing data (=0), were calculated in ArcView and the top 10 percentile excluded from the definition of anomalous and background datasets (Appendix 7). This was done to account for log-normal distribution of the data. The anomalous threshold value was taken at the 90 percentile of the truncated dataset (Appendix 7). The anomalous dataset was then buffered every 100 m over a 4 km radius to test for a spatial correlation with known mineralisation. Table 7 summarises the chosen anomaly thresholds used to create the geochemical anomaly themes and the resulting spatial correlation values. The spatial correlation values were then added cumulitively from the lowest buffer distance to highest buffer distance. The buffer distance with the greatest spatial correlation was then used to define a sphere of influence for the anomalous samples. The background values were also buffered using a similar sphere of influence and cut by the anomalous buffer. The result is a three value coverage of missing data, background geochemistry and anomalous geochemistry.

The spatial correlations for the pathfinder elements are given in Appendix 2, and the expected geochemical associations of Au and As gave very good correlations over a low buffer distance (Table 7). The distance that gave the best spatial correlations with mineralisation is consistent with known genetic models for gold mineralisation. Also, the distances which gave the best spatial correlations for the rock chip geochemistry is significantly lower than for stream sediment geochemistry, which again is consistent with the greater level of dispersion expected in stream sediments. The most significant result from this analysis is the difference spatial geochemical associations between Paleozoic mineralisation and Mesozoic mineralisation. Paleozoic mineralisation has a relatively simple geochemical association of Au and As, with high spatial correlation values of 4.0-8.0, whereas Mesozoic mineralisation has a more complex association of As, Au, Sb, Ag, Cu and Pb with very high spatial correlation values of 6-16. Traditional geochemical pathfinder exploration techniques appear to work well for Mesozoic gold deposits and are less definitive for Paleozoic gold deposits.

Data Set	Upper cut	Total analysed	Anomalous threshold	Total used	Mesozoic studC	Paleozoic studC
RK Ag	0.1 ppm	1369	0.001	1223	13.3	None
SS Ag	1.3 ppm	9444	0.7 ppm	8282	6.1	4.3
RK As	452 ppm	2239	50 ppm	1368	14.1	3.8
SS As	60 ppm	5958	40 ppm	5375	15.3	8.3
RK Au	1000 ppb	1872	70 ppb	1685	14.6	3.5
SS Au	190 ppb	7880	40 ppb	7096	NA	NA
SS Au PC	712 ppb	2237	119.8 ppb	2013	10.5	4.8
SS Au BLEG	3320	199	1820 ppb	179	NA	NA
SS Au Sieve	80 ppb	5444	17 ppb	4907	NA	NA
SS Au B&S	100 ppb	5643	20 ppb	5102	4.7	6.9
RK Cu	67 ppm	2523	39 ppm	2272	12.5	2.4
SS Cu	55 ppm	15232	39.2 ppm	13719	7.0	5.7
RK Pb	27 ppm	2562	20 ppm	2314	13.5	4.5
SS Pb	35 ppm	14512	28 ppm	13259	None	3.1
RK Sb	32 ppm	841	13 ppm	757	11	None
SS Sb	1.9 ppm	3091	0.38 ppm	2783	4.9	None
RK W	365 ppm	659	19.6 ppm	593	None	None
SS W	34 ppm	6856	14 ppm	6183	5.7	1.5
RK Zn	110 ppm	2546	91 ppm	2303	10.2	4.4
SS Zn	110 ppm	14589	92 ppm	13165	2.8	4.6

Table 7: Summary statistics for chosen geochemical themes used in the study.
PC = pan concentrate sample.
BLEG = bulk leach extractable gold sample.
NA = not analysed.
None = no spatial correlation.
SS = stream sediment.
RK = rock chip
B&S = BLEG and stream sediment combined.

Prospectivity modelling results

Prospectivity mapping, using weights of evidence techniques (Bonham-Carter et al. 1988; Bonham-Carter 1997; Agterberg et al. 1993, Partington et al., 2001), was carried out over the Paleozoic and Mesozoic areas of interest at approximately 1:250,000 scale. Because there is a significant difference in spatial associations between geochemistry and geology, which tend to be independent of each other, two prospectivity models were run for each deposit type: one focussing on geological controls; and the other using the geochemical themes. The themes used in the prospectivity modelling for each model and their weights of evidence StudC values are listed in Tables 8-13. The most important spatial variables that should be used during any more detailed prospect scale exploration for Mesozoic and Paleozoic mesothermal gold mineralisation are listed in Tables 3 and 4 respectively. The accepted genetic model for the formation of mesothermal shear zone Au style mineralisation was used to constrain the input data themes for the analysis along with their spatial correlation to known mineralisation. The scale of the analysis is not intended to target mineralisation at prospect scale, but rather, provide information for the exploration industry to be used to target for tenement acquisition. More detailed data such as prospect scale geological mapping, soil sampling geochemical information and drill assay data need to be acquired for prospect scale work either by new exploration or by converting existing data into digital format from exploration reports held by Crown Minerals. Users are encouraged to create their own models by experimenting with different combinations of the derivative raster grid files provided on the CD.

Mesozoic prospectivity model

Once the prior probabilities for each data layer are calculated, it is then possible to calculate a post probability model by combining the various data layers. These are calculated by weighting the values of each cell in the data layer according to their prior probabilities and then adding the weighted values of each data layer together (Bonham-Carter 1997). A model for the prospectivity of Mesozoic gold mineralisation was constructed using the grid themes listed in Table 8. The model was developed using Arc-SDM software through Spatial Analyst in ArcView. The themes were all converted into binary grid themes where possible to reduce processing time. The number of variables used were also kept to a minimum to reduce the potential for conditional independence between the selected themes as discussed by (Bonham-Carter 1997).

Grid theme	Description	Variables	C	StudC
Qvdenrc	Quartz Vein Density	5	6.95	16.74
Ssas	As stream sediment anomalies	2	2.80	7.86
Rkau	Au rock chip anomalies	2	3.43	6.44
Qstrain	Deformation intensity	3	2.50	13.32
Rkas	As rock chip samples	2	2.58	8.68
Fltauden	Density of faulting related to mineralisation	2	3.80	22.68
Texmet	Textural zones	4	3.41	3.39
Fltmzne	NE trending faults	2	3.62	22.67
Fltmznw	NW trending faults	2	5.13	34.02
Ssau	Au stream sediment anomalies	2	1.58	4.65

Table 8: Grid themes used in the Mesozoic prospectivity model based on the mineral desposit model described by Christie (2002).

The model was created using the Calculate Response menu in Arc-SDM and selecting the grid themes listed in Table 8. The model consists of a grid response theme containing the intersection of all of the input themes in a single integer theme. Each row of the attribute table contains a unique row of input theme values, the number of training points, area in unit cells, sum of weights, posterior logit, posterior probability, and the measures of uncertainty (See attribute table Mzpmap1.dbf and Mzpmap1woe1.dbf on the CD). The variances of the weights and variance due to missing data are summed to give the total variance of the posterior probability. The response theme can be mapped by any of the fields in the attribute table. Various measures to test the conditional independence assumption are also reported (Table 9). Conditional independence is a significant problem in this model, especially between the geological themes. This is not unexpected with geological datasets and the posterior probabilities should be thought of as relative favourabilities. The normalised probability attribute gives a much better measure of probability.

Theme	**SSAS**	**RKAU**	**QSTRAIN**	**RKAS**	**FLTAUDEN**	**TEXMET**	**FLTMZNE**	**FLTMZNW**	**SSAU**
Qvdenrc	0.0000	0.2430	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ssas		1.0000	0.0000	0.4666	0.9894	0.0000	0.8152	0.1442	0.0000
Rkau			0.2478	0.1329	0.9074	0.5602	0.6008	0.8787	0.6985
Qstrain				0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Rkas					0.0000	0.0000	0.0000	0.0000	0.2416
Fltauden						0.0000	0.0000	0.0000	0.0000
Texmet							0.0000	0.0000	0.8009
Fltmzne								0.5907	0.0000
Fltmznw									0.0000

Table 9: Chi^2 test of conditional independence for the Mesozoic model. Those values <0.015 and in red indicate a spatial correlation between themes.

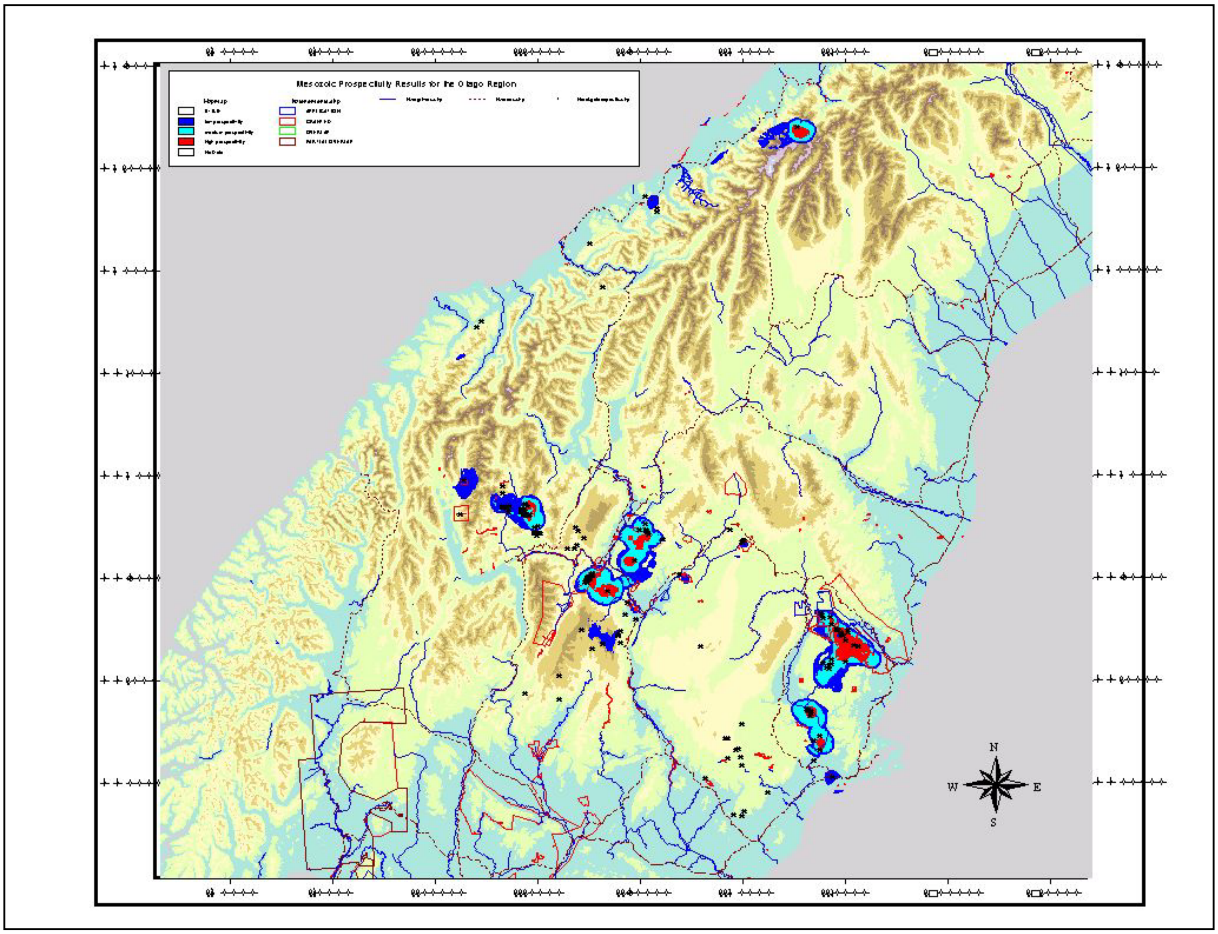

Figure 2: Mesozoic prospectivity map for the Otago region.

The Mesozoic gold mineralisation prospectivity map for the Otago region successfully defines many of the historic goldfields, even though much of the data from the Macraes district remains on closed file due to the continuing operation at the Macraes gold mine (Figure 2). Several new areas are also highlighted that warrant additional follow-up work. The Mesozoic prospectivity map of the Marlborough area highlights several new areas with no historic mineral occurrences and highlights the potential for Mesozoic gold mineralisation on the southern end of the North Island (Figure 3).

The Mesozoic Prospectivity model has successfully reduced the initial search area at a regional scale and focuses on the areas with similar combinations of geological and geochemical variables that have recorded gold production in the past. Data density maps were compiled for the Mesozoic gold areas, which were developed by combining all geochemical sample data points, structural measurements and geochronological sample points into a single theme. A density grid theme was then modelled using the Kernel technique with a search radius of 5 km. This map was then compared with the prospectivity maps to examine the influence of data density on the location of the areas of high prospectivity (Figures 4 and 5). As was expected data density does have some influence on the location of the areas of highest prospectivity, but other geological and geochemical factors are more important. However, those areas with low data coverage still have the potential to be prospective, emphasising that the prospectivity maps should not be used to discount an areas prospectivity in areas of low data density. Those areas with low data density offer potential for new greenfields targets, but with a greater investment risk. These maps are useful in that they highlight the areas where new exploration investment should be focussed.

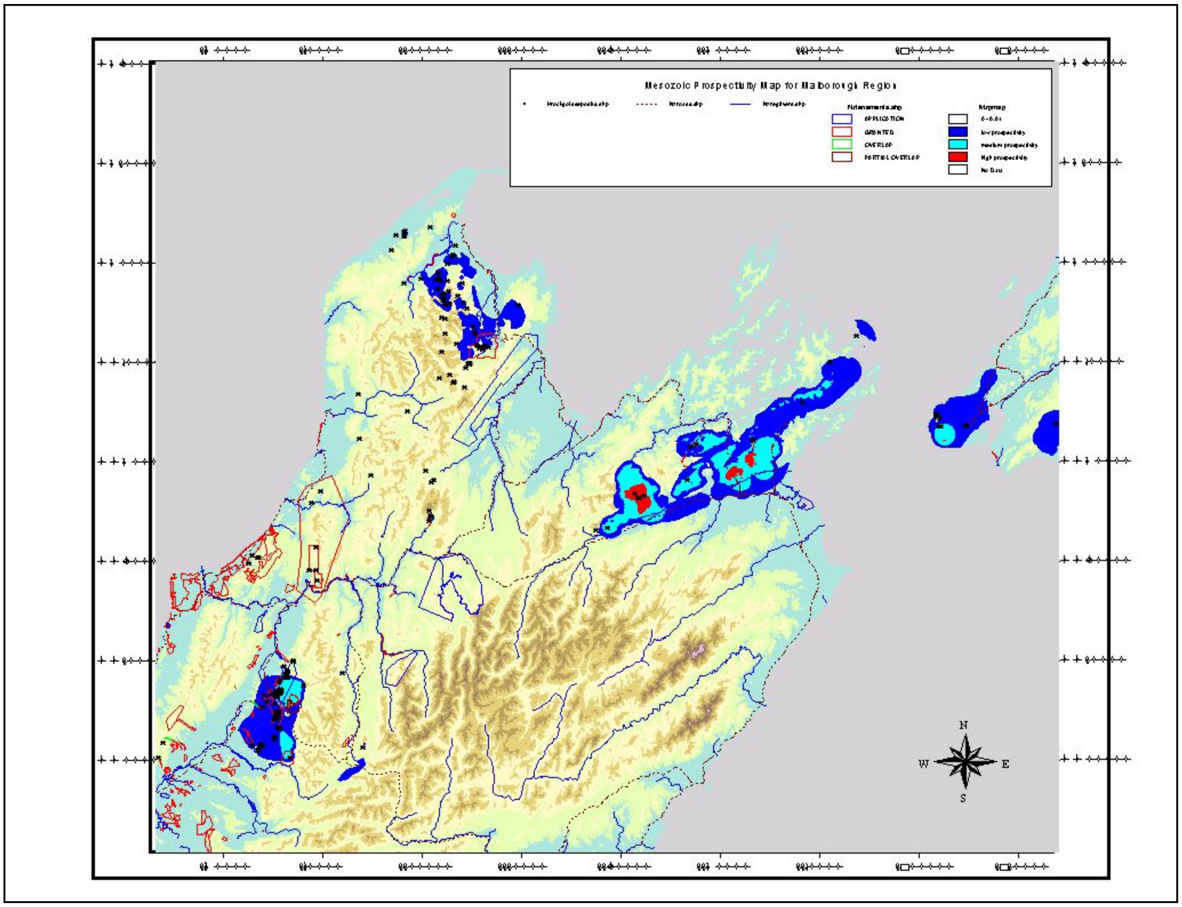

Figure 3: Mesozoic prospectivity map for the Marlborough region.

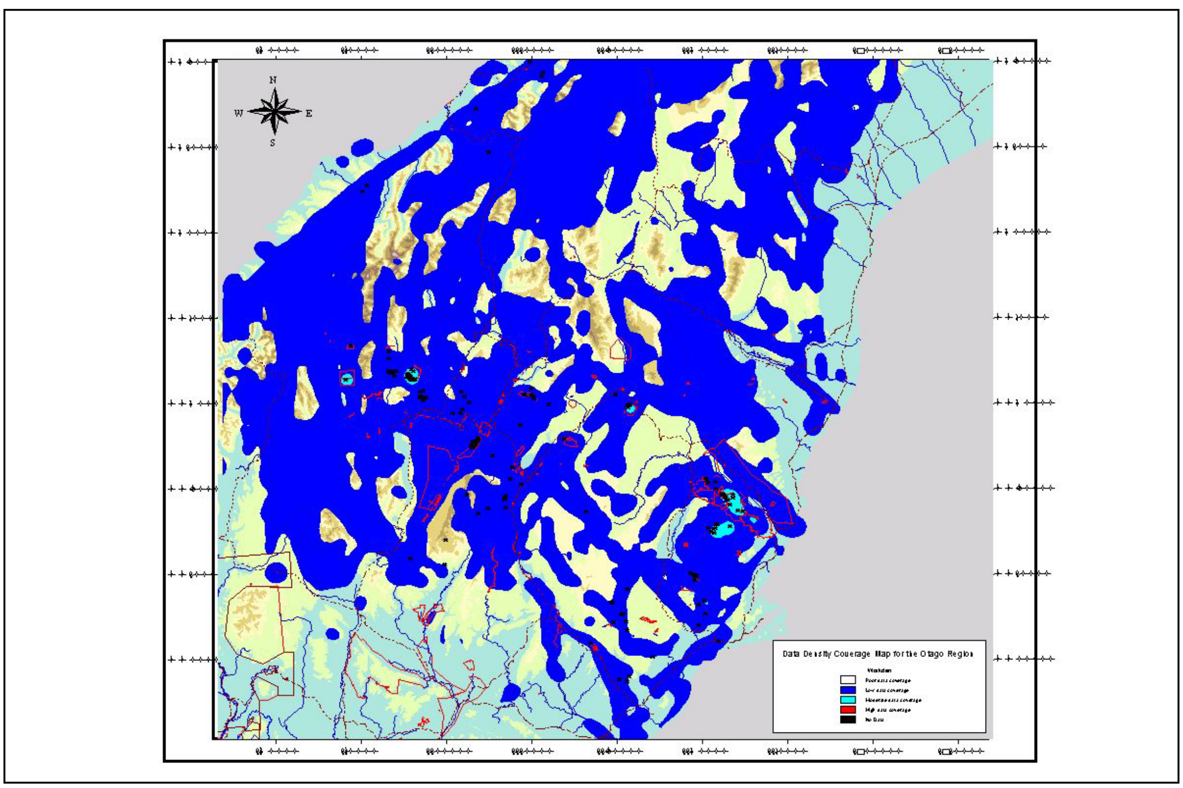

Figure 4: Data density map for the Otago region.

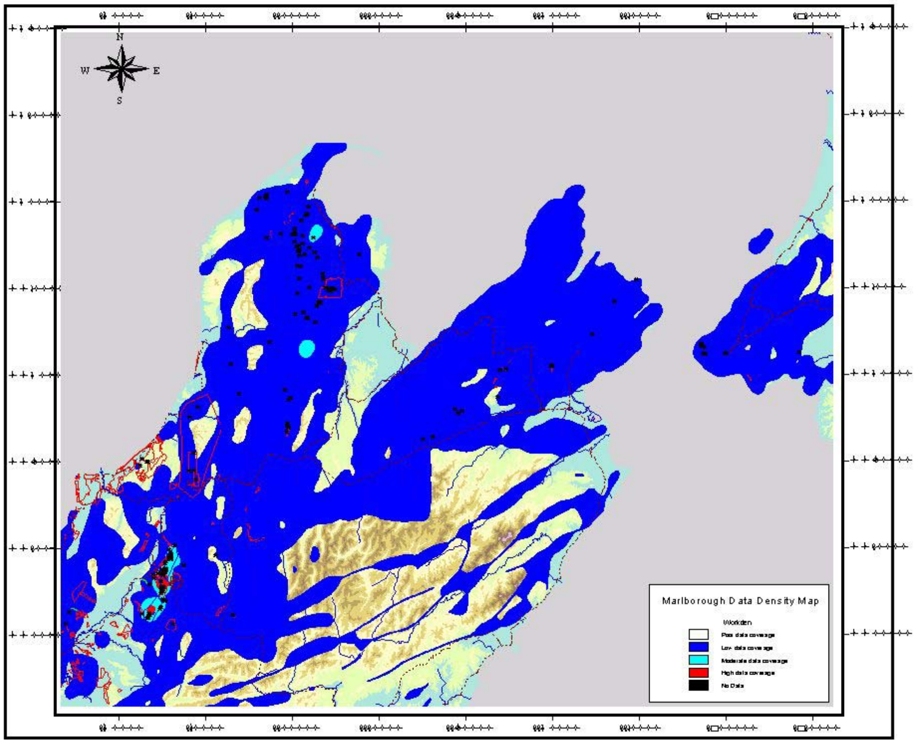

Figure 5: Data density map for the Nelson, Greymouth and Marlborough regions.

The prior probability values from the prospectivity analysis can be used to prioritise the potential for individual prospects or historic mining districts. Table 10 gives a list of historic Mesozoic gold prospects in order of priority as defined by the study. These are highlighted as prospect priority maps on Figures 6 and 7.

Historic prospect	Locality	Probability
New Royal Standard	Carrick Goldfield	0.99997540
Crown & Cross	Carrick Goldfield	0.99997540
Border Chief	Carrick Goldfield	0.99997540
Heart of Oak	Carrick Goldfield	0.99997540
Elizabeth	Carrick Goldfield	0.99997540
Colleen Bawn	Carrick Goldfield	0.99997540
Last Shot	Carrick Goldfield	0.99997540
Kohinoor Number One	Carrick Goldfield	0.99997540
Kohinoor Number two	Carrick Goldfield	0.99997540
New Caledonia	Carrick Goldfield	0.99994961
Vale of Avoca	Garrick Goldfield	0.99991896
Caledonia	Carrick Goldfield	0.99991896
New Find	Carrick Goldfield	0.99991896
Rob Roy	Carrick Goldfield	0.99991896
Star of the East	Carrick Goldfield	0.99991896
John Bull	Carrick Goldfield	0.99991896
Heart of Midlothian	Carrick Goldfield	0.99983400
Round Hill (Golden Point)	Golden Point Road	0.99894057
Berry (Golden Point)	Golden Point Rd	0.99894057
Innes (Macraes Flat lode)	Macraes Flat Lode Field	0.99894057
Mills (Macraes Flat lode)	Macraes Flat lode field	0.99894057

Historic prospect	Locality	Probability
Maritana (Golden Point)	Golden Point lode field	0.99894057
White Horse	Carrick Goldfield	0.99867361
Inkster & Partys' Reef	Dunstan Mountains	0.99707044
Try Again	Carrick Goldfield	0.99585363
Callery River	Burton Glacier	0.99556493
Duke of Edinburgh Lode	west of Golden Point	0.99425673
Golden Ridge (Macraes Fl)	Macraes Flat Lode Field	0.99425673
Tate's Reef (Dunback Rd)	old Dunback Road	0.99425673
Deepdell Mine	Golden Point lode	0.99378755
Deepdell (Golden Point)	Golden Point Road	0.99378755
Golden Bell (Golden Point	Golden Point Rd	0.99287976
Buckland's Workings (Puk)	Barewood, Pukerangi	0.99287976
Shaft No3 (Barewood)	Pukerangi	0.99287976
Welcome Reef (Pukerangi)	Pukerangi	0.99287976
Shaft No1 (Barewood)	Pukerangi Field	0.99287976
Betty's Reef (Pukerangi)	Pukerangi	0.99287976
Main Lode	Macetown District	0.99198400
Germania	above Macetown	0.99198400
Katherine	above Macetown	0.99198400
Homeward Bound Mine	above Macetown	0.99198400
Invercargill	above Macetown	0.99198400
Finns Lease	above Macetown	0.99198400
Tipperary North Mine	above Macetown	0.99198400
Caledonian	above Macetown	0.99198400
Geraldine Mine	above Macetown	0.99198400
Canton Mine	above Macetown	0.99198400
Tipperary Mine	above Macetownn	0.99198400
Otago Prospect	above Macetown	0.99198400
Tipperary South Mine	above Macetown	0.99198400
Dan OConnell	above Macetown	0.99198400
Jubilee No 1	Wairau Valley, Top Valley	0.98751505
Robert Burns	Carrick Gold Field	0.98646792
Nil Desperandum	Carrick Goldfield	0.98646792
Golden Gate	Carrick Goldfield	0.98646792
Leaning Rock Lode System	Leaning Rock	0.98440009
Shaft No2 (Barewood)	near Taieri River	0.97691840
Royal Standard	Carrick Goldfield	0.97668728
Stanely Lode	Carrick Goldfield	0.97668728
Macetown Mine	above Macetown	0.97218491
Dunolly	above Macetown	0.97218491
Bonanza Lode (Dunback Hl)	Dunback Hill, Black Creek	0.96707257
Hawksburn	Hawksburn, Bannockburn	0.94721842
Young Australian	Carrick Goldfield	0.93612778
Ounce Mine	Macraes Flat	0.93171059
Tasman's Choice	Davis Ck, Top Valley	0.93168513
Wellington Mine	abandoned mine, Top Valley	0.93168513
Jubilee No 2	Top Valley	0.93168513
J. Bruhns Lode	Mare Burn	0.90951830
Mt Highlay Mine	Mt Highley, Mareburn	0.90951830
Nunns	Mareburn?	0.90951830
Zealandia Reef	S of Hindon	0.90495782
Rise & Shine Mine	Bendigo Goldfield	0.81059293
Scotsmans	above Macetown	0.80044333
Coronation Lode	Sister Peaks, Horse Flat	0.78222287
Golden Dykes Claim	Yankee Gully, Terawhiti	0.78130157
Phoenix Claim	Breakneck Ck, Terawhiti	0.78130157
Bendigo Gold Mine	Bendigo	0.75793062

Historic prospect	Locality	Probability
Aurora Mine	Bendigo Goldfield	0.75793062
Alta Reef	Bendigo Goldfield	0.75793062
Come in Time	Bendigo Goldfield	0.64409158
Victoria Lode (Nenthorn)	Nenthorn	0.58503257
Consolidated (Nenthorn)	Nenthorn	0.58503257
Hop-pole Creek	Waikakaho-Cullen Saddle	0.51368845
Mahakipawa Claim	Head of Cullen Creek	0.51368845
Mt Patriarch	Mt Patriarch, Wairau Valley	0.46721398
Cotters Creek	Cotters Creek	0.46557144
Mersey Reef	Thompsons Gorge	0.44000728
Defiance Mine	above Macetown	0.42235031
Premier Mine	above Macetown	0.42235031
Sew Hoy & Co	above Macetown	0.42235031
Gladstone Mine	above Macetown	0.42235031
General Havelock	above Macetown	0.42235031
Alliance mine	above macetown	0.42235031
Golden Link	above Macetown	0.42235031
Lady Fayre	above Macetown	0.42235031
Maryborough Mine	above Macetown	0.42235031
Black Angel	above Macetown	0.42235031
All Nations Mine	above Macetown	0.42235031
Garabaldi Mine	Garibaldi Mine	0.42235031
Morning Star	above Macetown	0.42235031
Duke of Edinburgh	above Macetown	0.42235031
Victor Emmanuel	above Macetown	0.42235031
Daddy Lode (Nenthorn)	Nenthorn	0.40766357
Jacob Lode (Nenthorn)	Nenthorn	0.40766357
NZ Gold & Tungsten Mine	Mare Burn	0.38019220
Eureka Lode (Nenthorn)	Nenthorn	0.22542403
Home Rule Lode (Nenthorn)	Nenthorn	0.22542403
Taioma Lode	Nr Mullocky Ck Junction	0.20378033
Sutherlands	Bartletts creek	0.13867576
Sainsbury's Reef	Skippers Goldfield	0.13788930
Leviathan	Shotover Goldfield	0.13788930
Crystal Mine	Skippers	0.11835170
Cornubia	Skippers Goldfield	0.11835170
Eureka/Jennings Reef	Harris Mountains	0.11835170
Shotover Consolidated	Upper Shotover	0.11835170
Zeta Lode	Arrow Gorge	0.10338817
The Pyritic Lode	Schadrach Ck Arrow Valley	0.10338817
West of England (Oturehu)	Oturhua Field	0.10130276
Great Eastern (Oturehua)	Oturehua Field	0.10130276
Rough Ridge	Rough Ridge	0.10130276
Golden Progress Oturehua	Rough Ridge, Oturehua	0.10130276
Galatea Mine	Matarua Stream	0.10026961
Golden Point	Queen Charlotte Sound	0.06958818
Smile of Fortune	Deep Ck, Wakamarina Valley	0.06009611
Game Hen Reef	Game Hen Stream	0.05326032
Wakamarina, Deep Creek	Wakamarina Valley	0.04387968
Endeavour Inlet	Endeavour Inlet	0.03809867
Junction Lodes	Skippers Junction	0.03652912
Invincible Quartz Mine	Rees Valley	0.03086047
Otago Central (Oturehua)	Oturehua Field	0.02273988
Black Gully	Black Gully	0.02067107
Bakers Hill Claim	Kaiwharawhara Stream	0.02067107
Morning Star Claim	Kaiwharawhara Stream	0.02067107
Nicholsons Reef	Otago	0.01740854

Historic prospect	Locality	Probability
Saddle Hill Reef	W of Fairfield	0.01609006
Walshe Vein	Canaan	0.01285692
Achilles Gold Mines	Skippers Gold Field	0.00941555
Fiddes Reef	Wilberforce	0.00890646
Wilsons Reward Reef	Wilberforce	0.00890646
McQuilkans Reef	?	0.00890646
Poerua Reefs (South Lode)	Poerua Reefs	0.00890646
Exhibition Reef	Obelisk Old Man Range	0.00822162
Whites Reef	Obelisk Old Man Range	0.00822162
Surprise Lode (Nenthorn)	Nenthorn	0.00776193
Cape Jackson Mine	Cape Jackson	0.00726906
Lots Wife Lode	Lots Wife	0.00690945
Sams Creek-Riordans	Sams Creek, Takaka River	0.00689300
Sams Creek West	Sams Creek, Takaka River	0.00689300
Sams Creek, Doyles	Sams Creek, Takaka River	0.00689300
Golden Gully (Wiggens)	not known	0.00455152
Maori Lode	Upper Shotover	0.00403047
Excelsior Reef	Obelisk Old Man Range	0.00403047
Nicholsons Reef	Old Man Range Hyde rock	0.00403047
Sams Creek, Main Zone	Sams Creek, Takaka River	0.00393762
Sams Creek, SE traverse	Sams Creek, Takaka River	0.00393762
Sams Creek North	Sams Creek, Takaka River	0.00393762
Anvil Zone, Sams Creek	Sams Creek, Takaka River	0.00393762
No2 Reef Blackstone Hill	Blackstone Hill	0.00388116
Mount Patriarch	South of Mount Patriarch	0.00338358
Wealth of Nations Claim	Te Whiti Creek, Terawhiti	0.00329111
Caledonian Claim	Dowsetts Ck, Terawhiti	0.00329111
Empire Claim	Reef Ck, Terawhiti	0.00329111
Golden Crown Claim	Golden Ck, Terawhiti	0.00329111
Albion Claim	Farley Creek, Terawhiti	0.00329111
Kemp & Symes	Old Man Range	0.00170832
Ridge nr Mt Argentum	Paringa River	0.00144611
Gladstone Reef	300 m off Smith Road	0.00144611
Galena Creek	Argentum Range	0.00144611
Hura Creek	Hura Creek	0.00140385
Taipo Reefs	Taipo Reefs	0.00140385
Nuggety Gully Lode	Nuggety Gully	0.00126094
Canada & Ocean View Lodes	Tokomairiro River	0.00126094
Barrons Flat, Sams Creek	Sams Creek, Takaka River	0.00093968
Skeleton Lode	Roaring Meg	0.00068082
Ridge below Mt Lindsay	Ridge below Mt Lindsay	0.00056743
Groves	Bonnie Jean Ck	0.00052624
Mount Snowden	South of Lake Stanley	0.00044560
Orkney Reef	Dunstan Mountains	0.00038718
Ophir	?	0.00037649
Arethusa Claim	Longwood Mns, Gorge Stm	0.00026500
Printz Battery (Longwood)	Longwood Ranges	0.00026500
Bradshaws Reef	Isthmus Sd,Preservation I	0.00026500
Longwood Tops	Longwood Tops	0.00026500
Pfahlerts Reef	Pfahlerts Reef	0.00020174
Stevensons Claim	Skippers Point	0.00019605
Whitcome River	Whitcome River	0.00012007
Delta lode	Arrow Gorge	0.00010467
Lambda Lode	Arrow Gorge	0.00010467
Criterion mine	Arrow R Bed near Arrowtow	0.00010467
Cornish Lode	Crown Terrace	0.00010467
Columbia Lode	Crown Terrace	0.00010467

Historic prospect	Locality	Probability
Queensbury Lode?	Roaring Meg Valley	0.00010467
Gentle Annie Lode	Roaring Meg District	0.00010467
Roaring Meg Lode Two	Roaring Meg Basin	0.00010467
Roaring Meg Lode One	Roaring Meg Basin	0.00010467
Hendersons Lode	Roaring Meg Creek	0.00010467
Conroys	?	0.00010467
Earnscleugh Quartz Reef	Earnscleugh	0.00006635
Meggat Burn Reef	Prentice Road	0.00004326
Flag Waterfall Lode	Flag Old Woman Range	0.00002205
Crossans Reef	Alexandra District	0.00002205
Bush Point Lode	Garvie Mountains Nokomai	0.00002179
Cowan Ck, 2 km from mouth	Cowan Ck,2 km from mouth	0.00001788
Canton Lode	SSW of Waipori Stn	0.00000982
ABC-Nuggety Gully	Waipori	0.00000982
OPQ Lode	Lawrence-Waipori Road	0.00000982
Bella Lode	Nr Lake Mahinerangi	0.00000982
Coppermine Ck, headwaters	Mataketake Range	0.00000856
Try Again Reef	SW of Table Mound	0.00000746
Alpha Lode	Arrow Gorge	0.00000396
O'Neills Reef	Old Man Range	0.00000377
Blue Lake Lode	Garvie Mountians	0.00000169
Gabriels Gully Lode	West of Wetherston	0.00000169
Gow Creek Lode	Flagstaff	0.00000169
Coxs Lode	Lammerlaw Stream	0.00000071
Bootlemans	Devils Creek	0.00000071
Boatmans	Devils Creek	0.00000071
Cosmopolitan Lode	Lammerlaw Stream	0.00000071
Drain Creek	Little Wanganui tributary	0.00000000
Allen River	Headwaters of Mokihinui R	0.00000000

Table 10: Mesozoic gold prospects prioritised by prior probability values from the prospectivity grid theme.

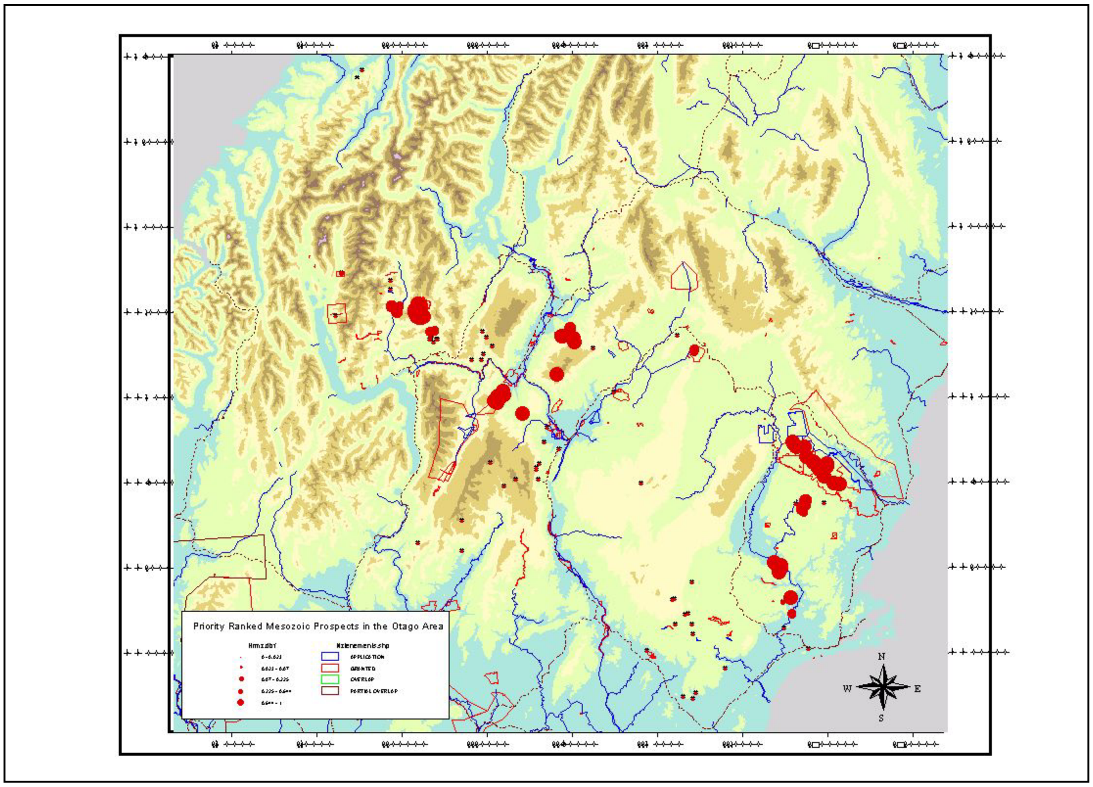

Figure 6: Prioritised Mesozoic gold prospects in the Otago region.

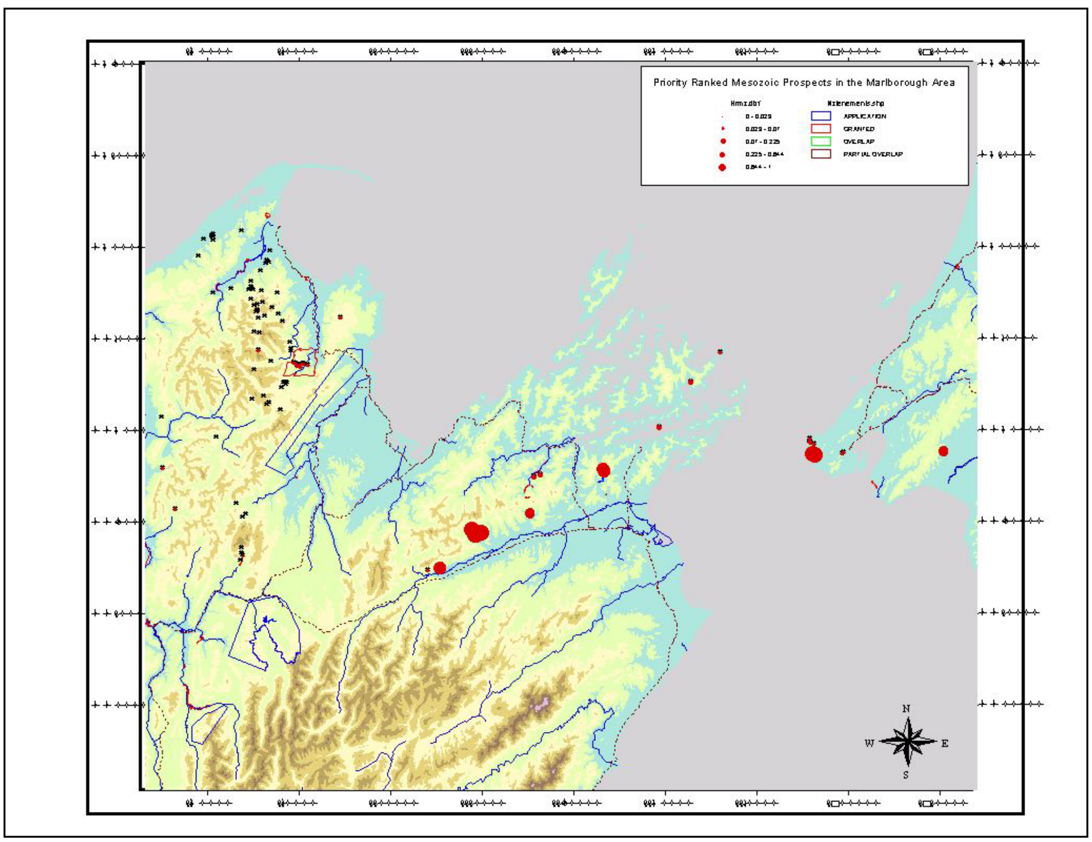

Figure 7: Prioritised Mesozoic gold prospects in the Marlborough region.

Paleozoic prospectivity model

The model for the prospectivity of Paleozoic gold mineralisation was constructed in a similar way to the Mesozoic mineralisation model and used the grid themes listed in Table 11. As with the Mesozoic model the themes were all converted into binary grid themes where possible to speed the processing time up and the number of variables used were kept to a minimum to reduce the potential for conditional independence.

Grid theme	Description	Variables	C	StudC
Pzstrat	QMAP stratigraphy	21	6.78	15.15
Pzlithgrd	Lithologies derived from the QMAP data	9	5.63	15.39
Bedvarrec	Grid theme of bedding strike variability	4	3.38	9.48
Ssas	As stream sediment anomalies	2	1.82	5.27
Ssau	Au stream sediment anomalies	2	2.77	5.27
Pcau	Pancon Au stream sediment anomalies	2	1.73	3.56
Rkas	As rock chip anomalies	2	2.65	3.13
Rkau	Au rock chip anomalies	2	7.15	0.71
Qvdenrc	Quartz vein density grid theme	4	7.27	20.25

Table 11: Grid themes used in the Paleozoic prospectivity model based on the mineral deposit model decribed by Chrisite (2002).

Like the Mesozoic model the Paleozoic model consists of a grid response theme containing the intersection of all of the input themes in a single integer theme (See attribute table Pzpmap2.dbf and Pzpmap2woe1.dbf on the CD). Various measures to test the conditional independence assumption are also reported (Table 11). Conditional independence is not as great a problem in this model as compared with the Mesozoic prospectivity model, especially between the geochemical themes. However, the geological datasets do have a degree of conditional dependence and again the posterior probabilities should be thought of as relative favourabilities. The normalised probability attribute gives a much better measure of probability.

Theme	PZLITHGRD	BEDVARREC	SSAS	SSAU	PCAU	RKAS	RKAU	QVDENRC
Pzstrat	0.0000	0.8521	0.9731	1.0000	1.0000	1.0000	1.0000	1.0000
Pzlithgrd		0.0000	0.8073	0.9662	0.9687	0.9996	1.0000	0.9995
Bedvarrec			0.8612	0.8657	1.0000	0.9913	1.0000	0.0000
Ssas				0.1035	0.1432	1.0000	1.0000	0.9309
Ssau					0.0983	1.0000	0.0000	1.0000
Pcau						1.0000	0.0000	1.0000
Rkas							1.0000	1.0000
Rkau								1.0000

Table 12: Chi^2 test of conditional independence for the Paleozoic model. Those values <0.015 and in red indicate a spatial correlation between themes.

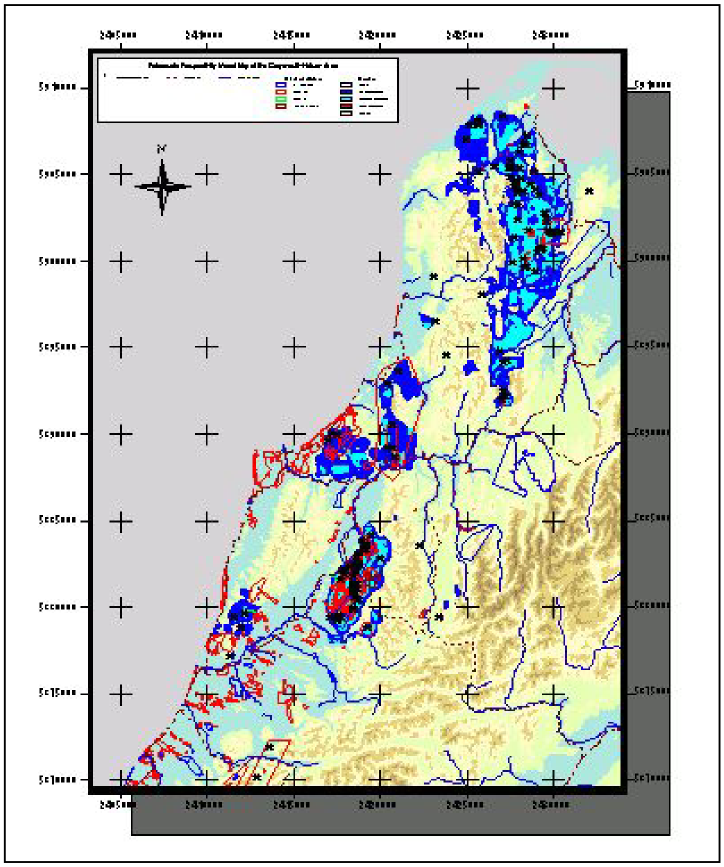

Figure 8: Paleozoic prospectivity map for the Greymouth-Nelson region.

The Paleozoic gold mineralisation prospectivity map successfully defines the historic goldfields like Reefton in the Greymouth-Nelson region, even though much of the data from the Reefton district remains on closed file due to the continuing operations at the Reefton gold mine (Figure 8). There is significant mineral potential in the Cambrian metasediments and volcanics in the Nelson area. However much of this area lies within a National Park. Two areas of Greenland Group rocks to the north and west of the Reefton deposits are worthy of follow-up investigation.

The Paleozoic Prospectivity model, like the Mesozoic prospectivity analysis, has successfully reduced the initial search area at a regional scale and focuses on the areas with similar combinations of geological and geochemical variables that have recorded gold production like the Reefton mine. Data density maps were also compared with the prospectivity maps to examine the influence of data density on the location of the areas of high prospectivity (Figure 5). The areas of highest prospectivity do correspond with the areas with better data coverage. However, there are areas of high mineral potential in areas of low data density suggesting that the geological and geochemical factors are more important indicators of an area's prospectivity. The areas with low data coverage have the potential to be prospective but at a greenfields exploration level.

The prior probability values from the prospectivity map were used to prioritise the potential for individual prospects or historic mining districts. Table 13 gives a list of historic Paleozoic gold prospects in order of priority as defined by the analysis. These are highlighted as prospect priority maps on Figure 9.

Prospect	Locality	Probability
Mataki Stream	Balloon Creek tributary	0.99093202
Lady of the Lake Mine	Boatmans Creek, Cronadun	0.98547564
Welcome Mine	Caples Creek	0.98547564
South Hopeful Mine	Boatmans Creek	0.98547564
Inglewood Mine	Burkes Ck - Murray Ck	0.98547564
Phoenix Mine	Murray Creek	0.98547564
Victoria Mine	Murray Creek	0.98547564
Band of Hope Mine	Muray Creek	0.98547564
Perseverance Mine	Murray Creek	0.98547564
Golden Fleece Mine	Burkes Ck - Murray Ck	0.98547564
Venus Mine	Murray Creek	0.98547564
No.2 Sth Keep-it-Dark	Crushington	0.98547564
Nil Desperandum Mine	Crushington	0.98547564
Keep-it-Dark Mine	Crushington	0.98547564
Energetic Mine	Murray Creek	0.98547564
Wealth of Nations Mine	Crushington	0.98547564
New Discovery	Carton Ck, Quigleys Track	0.98547564
Ulster Mine	Madman Creek, Reefton	0.98547564
Andersons-Invincible Mine	Ajax Creek, Reefton	0.98547564
Globe-Progress Mine	Globe Hill	0.98547564
Inkerman West Mine	Slab Hut Creek, Merrijigs	0.98547564
Inkerman Mine	Rainy Creek, Merrijigs	0.98547564
Rainy Ck-Supreme Mine	Rainy Creek, Merrijigs	0.98547564
Maori Gully Group	?	0.98547564
Hard-to-Find Mine	Slab Hut Creek, Merrijigs	0.98547564
Scotia Mine	Slab Hut Creek, Merrijigs	0.98547564
Gallant Mine	Slab Hut Creek, Merrijigs	0.98547564
Happy Valley Mine	Slab Hut Creek, Merrijigs	0.98547564
Sir Francis Drake Mine	Slab Hut Creek, Merrijigs	0.98547564
Golden Lead-OK Mine	OK Ck-Cumberland Ck area	0.98547564
South Blackwater Mine	Snowy River, Waiuta	0.98547564
Big River Mine	Big River	0.98547564
National Claim	Big River	0.98547564
St George Mine	St George Stm, Snowy R.	0.98547564
Bonanza Lode	Auld Creek, Reefton	0.98547564
Bastite Creek	Southwest of Cobb Reservoi	0.97350887
Tablelands area	Balloon Creek headwaters	0.96218849
Waingaro River	Waingaro River	0.96218849
Specimen Hill Mine	Little Boatmans Creek	0.96009371
Homeward Bound Mine	Little Boatmans Creek	0.96009371
Golden Arch	Italian Creek, Cronadun	0.94047546
Pactolus Mine	Pactolus Stm, Boatmans Ck	0.94047546
Argus Mine	Boatmans Creek, Cronadun	0.94047546
Hopeful Mine	Caples Ck, Boatmans Ck	0.94047546
Fiery Cross Mine	Caples Creek, Boatmans Ck	0.94047546
Just-in-Time Mine	Boatmans Creek	0.94047546
Reform Mine	Boatmans Creek	0.94047546
Lone Star Mine	Boatmans Creek	0.94047546
Eureka	Caples Ck, Boatmans Ck	0.94047546
Gladstone-Russell Mine	Russell Creek, Reefton	0.94047546
A1 Mine	A1 Creek, Merrijigs	0.94047546
Merrijigs Mine	A1 Creek, Merrijigs	0.94047546
Snowy Creek Mine	Snowy River, Waiuta	0.94047546
Homer Mine	Quartz Creek, Waiuta	0.94047546
Hurley's Leader	Greek Creek, Waiuta	0.94047546
South Big River Mine	Sunderland Ck, Big River	0.94047546
Millerton	Millerton	0.94047546

Prospect	Locality	Probability
Aorangi Mine	NW side Wakamarama Range	0.92233450
Anthill Mine	NW Wakamarama Range	0.92233450
Zealandia Mine	Middle branch, Owen River	0.88257012
Bulmer Creek	Bulmer Ck, Upper Owen R.	0.88257012
Ruby Lake Creek	nr Ruby Lake, Lockett Rang	0.85181361
Morning Star	NW side Wakamarama Range	0.83645668
Alexander Mine	Alexander River	0.81399745
Ophir Mine	Cole Ck, SE of Rockville	0.79678119
Donnelly Creek	Peel Stream tributary	0.73906159
Nuggety Creek	Rolling River, Wangapeka	0.73906159
Rolling River	Rolling River	0.73906159
Upper Snow River	Snow River	0.71228277
Slippery Knob	North of Anatoki River	0.71228277
Meter Creek, Zone B	Takaka River, Cobb area	0.68076656
Meter Creek, Zone A	meter Creek, Takaka River	0.68076656
Meter Creek	Takaka River, 300m downstr	0.68076656
Meter Creek, roadside	Meter Creek, Takaka River	0.68076656
Meter Creek, below road	Meter Creek, Takaka River	0.68076656
Meter Creek	Takaka River	0.68076656
Meter Creek	east bank Takaka River	0.68076656
Magnetite Creek	Waingaro River tributary	0.61803045
Minerva (Blackball Creek)	Minerva, Blackball Ck	0.54021217
Mundic Gully	Aorere Goldfield	0.47726490
Johnstons United Mine	East of the Aorere River	0.47726490
Phoenix Mine	Cole Ck, Aorere River	0.47726490
New Find	NW side Wakamarama Range	0.45680714
Roaring Meg Creek	Roaring meg Creek	0.37350646
Greer Creek	Waingaro River eastern tri	0.33483369
No Name Creek	Waingaro River eastern tri	0.33483369
Enterprise Mine	Western side of Owen R.	0.32038498
Maori Gully	Maori Gully trib.	0.31298451
Friday Creek	Sandhills Creek tributary	0.30029297
Hardy Ridge	Hardy Ridge	0.28716292
Kirwan's Reward Mine	Kirwans Hill	0.26833174
Cloustons Mine	Gordons Pyramid	0.26793926
Golden Ridge	NW side Wakamarama Range	0.26588474
Paradise Spur	North of Anatoki River	0.26565057
Caledonian Mine	Awarau or Larry River	0.26140030
Taffy (Croesus Knob)	Taffy,Paparoas	0.21482158
Rocky River	Aorere Goldfield	0.16499767
Portia Creek	Boulder Lake Area	0.16499767
Anatoki Range	Anatoki Range	0.15085599
Haupiri Range	Haupiri Range Southern	0.14237492
Cedar Ck (Mt Greenland)	Mt Greenland Cedar Ck	0.11625288
Parsons Ck, Boulder Lake	Boulder Lake	0.09652877
Kaituna Stream	Kaituna Stream	0.09376533
Beaconsfield Mine	Waimangaroa	0.08206589
Westport Twin Battery	Waimangaroa	0.08206589
Old Britannia Mine	Waimangaroa	0.08206589
Alpine United Mine	Irishmans Ck, Lyell Ck	0.08206589
Britannia Mine	Britannia Ck, Waimangaroa	0.08206589
Tichborne Mine	Tichborne Ck, New Creek	0.08206589
Victory Lode	New Creek, Buller River	0.08206589
Ngakawau River	Ngakawau River	0.08206589
Rough and Tumble	Tributary Mokihinui R.	0.07981942
Anatoki Bend	Anatoki River	0.05769257
Middle Wangapeka River	Wangapeka River	0.05501812

Prospect	Locality	Probability
Rocky R - Forrester Ck	Upstream of Rocky River -	0.04399012
Bray Creek	Upper Snow River	0.04399012
Old Hut Creek	Southern Anatoki River tri	0.04399012
Washbourn's Reef	Aorere Goldfield	0.04140357
Frazer Stream	Anatoki River area	0.04008652
Kea Creek	Parapara Area	0.01869177
Republic Mine	Stony Creek, Waimangaroa	0.01289543
Mt Rangitoto	Mt Rangitoto	0.01090355
Langdons Reef (Sewell Pk)	Langdon Creek	0.01090355
Red Hill Mine	Graham Ck. Aorere River	0.00836911
Golden Point Mine	Devils Creek, Reefton	0.00762625
Inkerman South Claim	Slab Hut Creek, Merrijigs	0.00762625
Exchange-Industry Mine	Cumberland Ck, Merrijigs	0.00762625
Cumberland Mine	Cumberland Ck, Merrijigs	0.00762625
North Big River Mine	Golden Lead Ck, Big River	0.00762625
Golden Treasure Mine	Murray Creek	0.00762625
Lower Calphurnia Creek	Northern trib Anatoki Rive	0.00682440
Old Hut-Colour Creek	West of Sparrow Lake	0.00682440
Rocky River	Aorere Goldfield	0.00667888
Dahls Reef	On ridge above Rocky R.	0.00667888
Beecham Creek	Aorere River tributary	0.00446370
Asbestos Creek	Takaka River, Cobb area	0.00419607
Snow River	Snow River	0.00367873
Calphurnia Ck East	Northern Tributary of	0.00287793
Blackwater North Mine	Waiuta	0.00178633
Blackwater Mine	Waiuta	0.00178633
Beilby's Reef	Southern slopes Mt Owen	0.00122915
Fletcher Creek	Aorere Goldfield	0.00119501
Blackadder Mine	Mt Baldy, Maruia	0.00074827
Donnellys Creek (Osmers)	Donnellys Ck Mine, Osmers	0.00045280
Red Queen	South Bank of Mokihinui R	0.00007512
Silvermine Creek	Karamea River western trib	0.00007512
Fenian Ck - Scorpion Ck	Fenian Range, Karamea area	0.00007288
Red Spur	Cascade River Catchment	0.00005273
No.2 South Larry's Mine	Awarau or Larry River	0.00004008
south side of Hunt Hill	Paringa	0.00000125
Zalas Battery-Beaufils Ck	Totara State Forest	0.00000018
Wheel Creek	Wheel Creek, Maruia River	0.00000018

Table 13: Paleozoic gold prospects prioritised by prior probability values from the prospectivity grid theme.

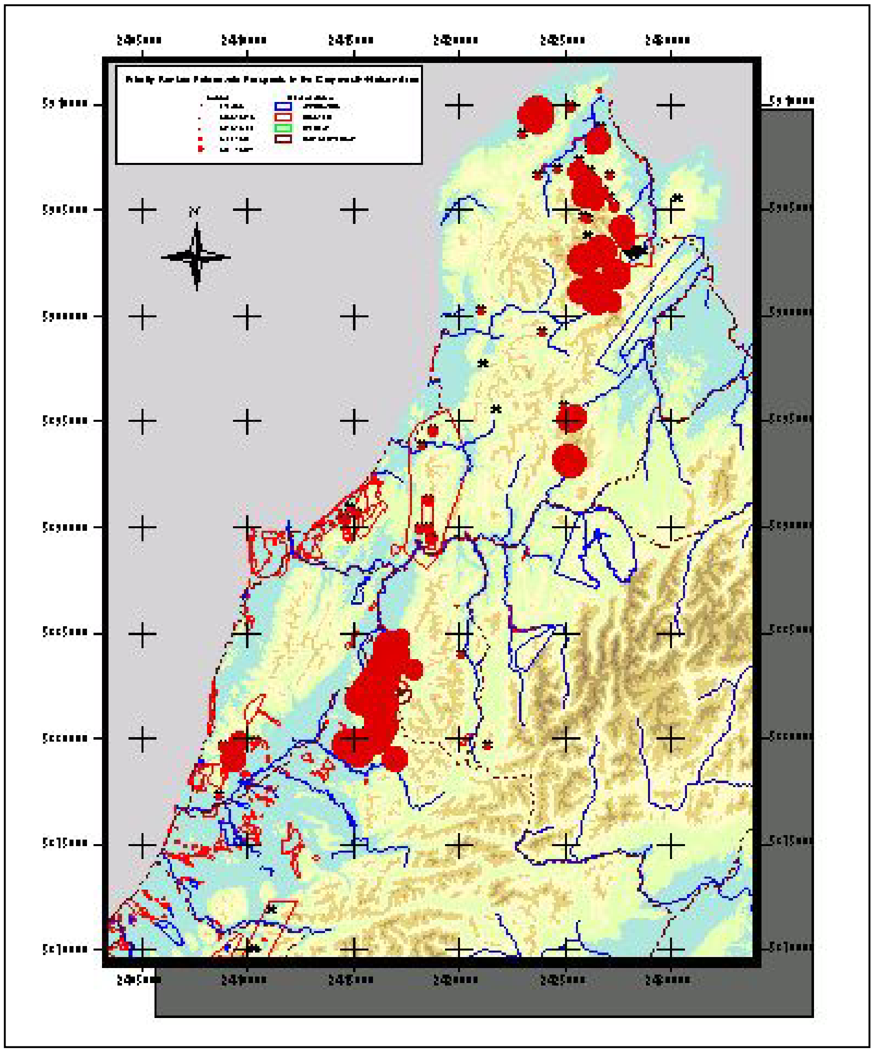

Figure 9: Prioritised Paleozoic gold prospects in the Nelson and Greymouth regions.

Geochemical prospectivity model

One of the strengths of using geochemistry in exploration is that some of the subjective bias is removed. Consequently a third model was created using only the geochemical anomaly themes, especially those with strong spatial correlation with both styles of mineralisation (Table 14). This model was also developed to test the usefulness of regional geochemistry in exploration for gold mineralisation in New Zealand, especially as this study is the first attempt at using/analysing recently compiled digital geochemical data at a regional scale. Another advantage of using geochemical data only is that conditional dependence between datasets is reduced to a minimum (Table 15).

Grid theme	Description	Variables	C	StudC
SsAs	As stream sediment samples	2	2.41	10.26
RkAu	Au rock chip samples	2	3.29	6.84
RkAs	As rock chip samples	2	2.44	9.32
PcAu	Pancon Au stream sediment samples	2	2.80	7.86
SsSb	Sb stream sediment samples	2	0.44	2.26
SsAu	Au stream sediment samples	2	1.74	7.35

Table 14: Grid themes used in the geochemical prospectivity model.

As with the Paleozoic and Mesozoic prospectivity models the geochemical model consists of a grid response theme containing the intersection of all of the input themes in a single integer theme (See attribute table Chempmap.dbf and Chempmapwoe1.dbf on the CD).

Theme	RKAu	RKAs	PCAu	SSSb	SSAu
Ssas	1.0000	0.2134	0.5663	0.8695	0.0000
Rkau		0.1722	0.8163	0.6728	0.2771
Rkas			0.7363	0.0000	0.1867
Pcau				0.0000	0.0000
Sssb					0.3794

Table 15: Chi^2 test of conditional independence for the geochemical prospectivity model. Those values <0.015 and in red indicate a spatial correlation between themes.

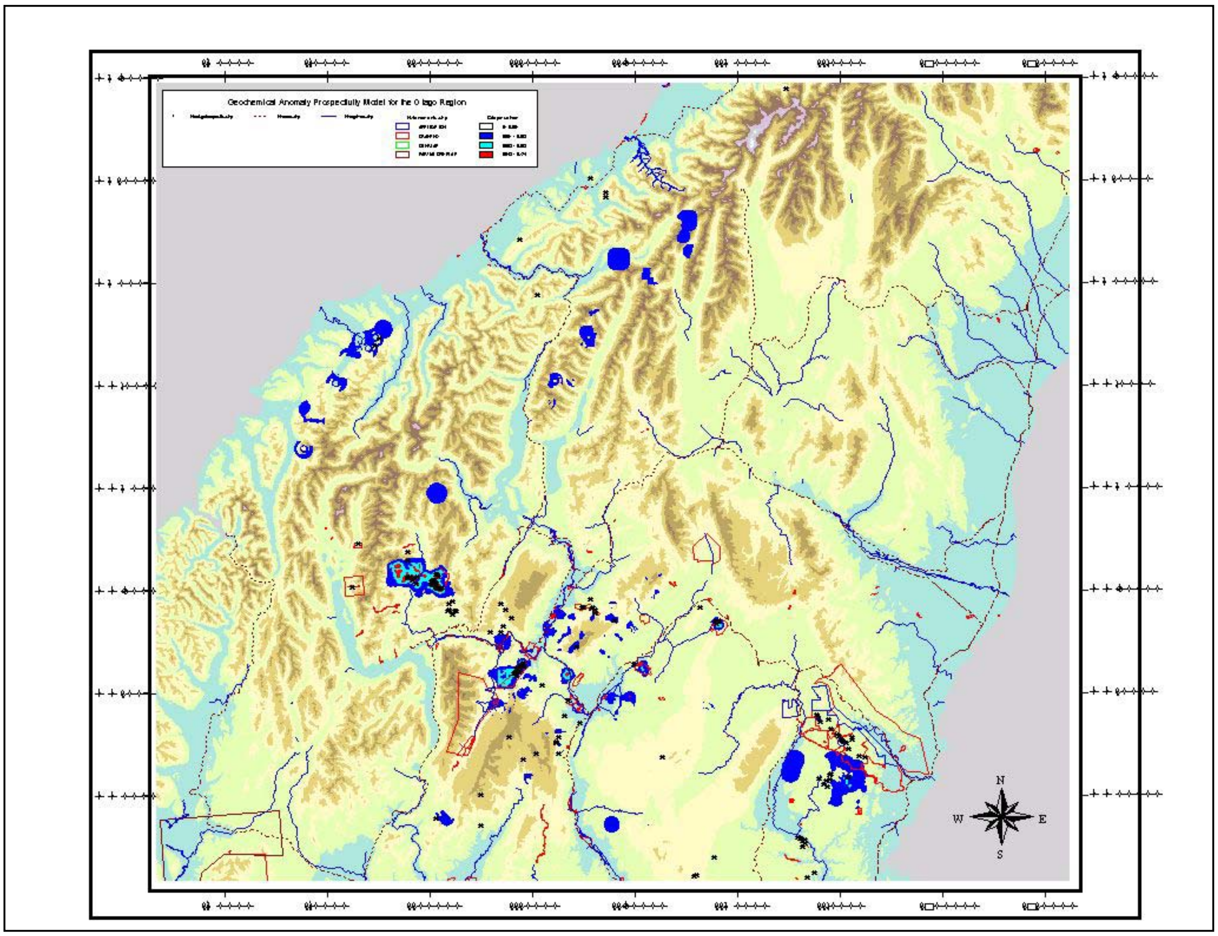

Figure 10: Geochemical prospectivity map of the Otago region.

The geochemical prospectivity maps for both the Otago and the Greymouth-Nelson regions show similar prospective areas to the other prospectivity maps (Figures 2, 3, 8, 10 and 11). However, data density has a greater control on the identification of prospective areas. Several anomalous areas in the Haast region are identified that are not present in the Mesozoic prospectivity map and similarly an area identified immediately west of Reefton was not highlighted in the Paleozoic prospectivity map. These warrant additional follow-up work. (Figures 10 and 11).

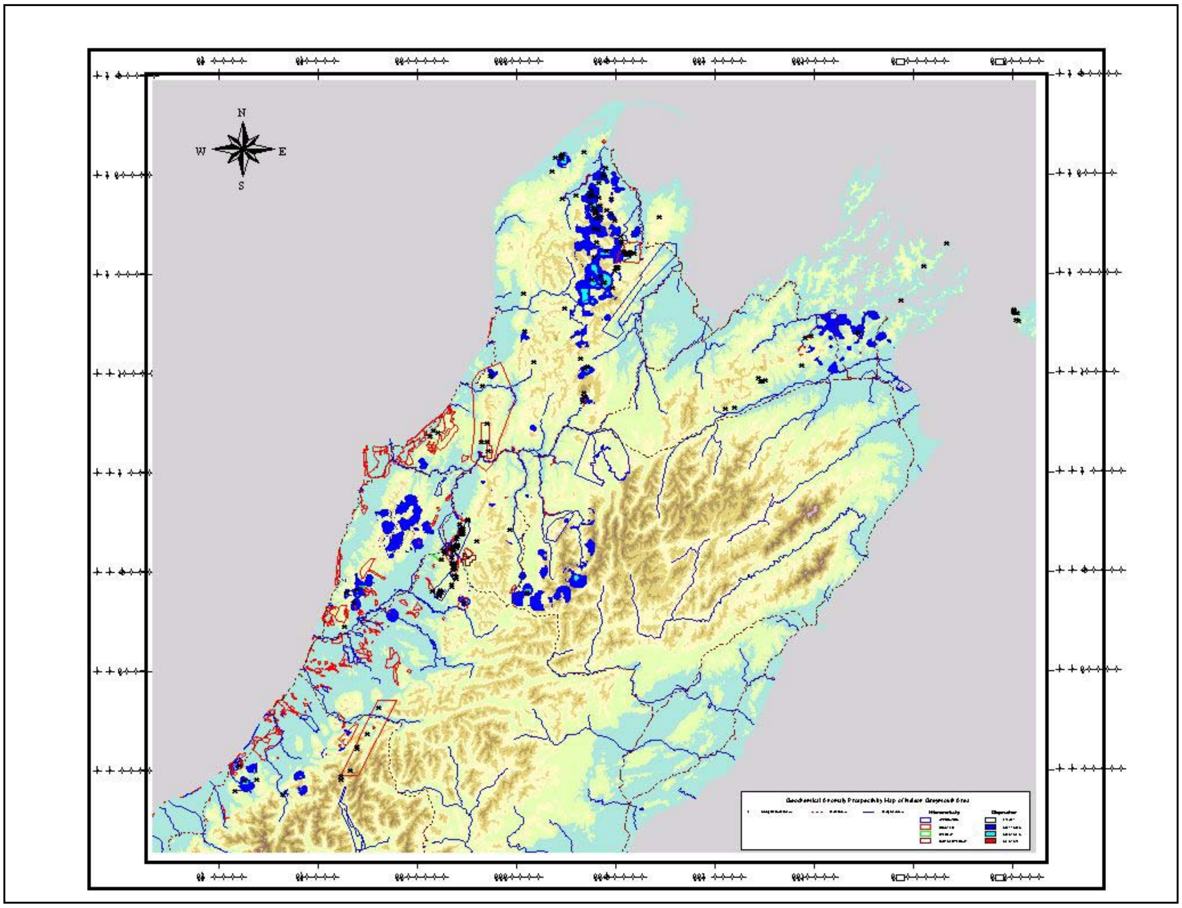

Figure 11: Geochemical prospectivity map of the Greymouth, Nelson and Marlborough regions.

The geochemical prospectivity maps provide a useful tool for reviewing geochemical datasets at a regional scale. The success of these maps in identifying areas of known mineralisation also confirms the suitability of using geochemical techniques for mesothermal gold exploration in New Zealand. Furthermore the study highlights the valuable national database that resides with GNS in digital form and Crown Minerals in paper form. It is essential that work continue on developing and managing these datasets with the aim of creating a national-scale geochemical database.

Observations and future work

The project is the first of its kind for New Zealand and one of the first to be carried out at a regional scale anywhere in the world, and as such involved a large amount of investigation and experimentation into data collection, data capture and compilation, and finally geological modelling, all to ensure that a quality product of value was produced within the parameters and budget of the project. Not only has the project been successful in highlighting prospective areas for mesothermal gold, but a key outcome of the project has also been an increased understanding of the potential of the New Zealand minerals estate by the project team at GNS and Crown Minerals, and the establishment of sound processes and procedures that can now be built upon for similar future studies. Such studies include investigation into epithermal gold, alluvial gold, and platinum mineralisation, among others.

Another key outcome from the study has been the data discovery exercise from the open-file technical reports held by Crown Minerals. Because the study was carried out at a regional scale, a large amount of detailed, prospect scale information such as drilling and soil sampling were not included. The digital capture of these data combined with more detailed geoscientific information held by GNS, for example QMAP, will add extra value to the current spatial database, confirming New Zealand as a world leader in developing and using new technologies as part of the country's knowledge economy. The provision of this information in an easily accessible and usable form is vital for the future of mineral exploration in New Zealand.

The maps generated by the prospectivity modelling consistently highlight areas of known mineralisation and generate targets where follow-up investigation is warranted. The prospectivity per unit area derived from the GIS modelling provides a measurable value that should change as new information comes to hand and, in addition to highlighting targets, can be used to measure the impact of increased exploration expenditure and assess the effectiveness of exploration investment. It is clear from this study that the South Island of New Zealand remains highly prospective for mesothermal gold mineralisation. Many of the highly prospective areas, which also contain historic mine workings, remain unpegged. This study highlights these areas, and also other areas where the potential for similar mineralisation exists with, possibly, no surface expression. The spatial analysis also highlighted the differences between Paleozoic mineralisation and Mesozoic mineralisation. Tables 3 and 4 define the most important controls on mineralisation for both styles. It is clear that geology and structure should play an important role in any exploration model and more detailed geological and structural information should be collected at a prospect scale to improve the accuracy of the models. This study also highlights the importance of geochemistry, especially for Mesozoic gold mineralisation, in identifying areas prospective for mineralisation.

As is the case with most studies, in addition to the end result of the analysis, valuable information and insight was gained during the analysis itself. This provided some important lessons and provided a focus on geological models and exploration methodologies. This is because the analysis allows the comparison of disparate data-sets and associations not easily recognisable between these data-sets. This work increased the confidence in using exploration models and techniques developed for mesothermal lode gold mineralisation in New Zealand. All three models only use a small amount of available data in an attempt to follow accepted genetic models for Mesozoic gold mineralisation and to reduce conditional independence. Users are encouraged to experiment with different geological variables based on their own exploration models. The data on the CD are provided to let explorers test ideas and exploration strategies before having to invest time and significant money in acquiring tenement packages and collecting data in the field.

Studies such as this should not be seen in the context of their end result but rather the start of a new way of making more economic and rational land management decisions. In terms of research these techniques need to be further refined to overcome problems of spatial interdependence common in geological data-sets. Other techniques such as fuzzy logic and neural network analyses should be trialled. We intend to expand this type of analysis to other deposit types and to research better ways that the statistical information produced by prospectivity modelling can be used in exploration management.

Acknowledgements

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List of Figures and Tables

Appendices

Appendix 1
GIS Data File Description

Appendix 1 Directory Structure and Metadata for Pmapsouth GIS CD

As discussed by Christie (2002) gold mesothermal gold mineralisation was subdivided into those occurrences associated with Paleozoic lithologies and structures and those occurrences associated with Mesozoic lithologies and structures. The GIS data structure has been organised using this subdivision and the metadata for files comprising the Pmapsouth GIS are described in the following sections. Folders are shown in bold and files in italics.

Grid Data:

pmapsouth\griddata **Raster Image Files in ArcView Grid File Format**

gridpmschem **Grid** **Geochemistry Prospectivity Model**

Grid of the prospectivity model run for the geochemical prospectivity model. See the section on Prospectivity modelling in the final report for a description of how this model was developed.

mzpmap **Grid** **Mesozoic Prospectivity Model**

Grid of the prospectivity model run for Mesozoic gold mineralisation. See the section on Prospectivity modelling in the final report for a description of how this model was developed.

nzgravitygrd **Grid** **South Island Gravity Map**

Grid of the regional gravity map of the South Island of New Zealand. The gravity data were not used in the analysis and the file is provided as a back ground data set.

nzsi315grd **Grid** **NW Hill-shaded DTM**

Grid of the regional Digital Terrain Model, with a 315 degree sunshade, of the South Island of New Zealand. The spot height data were not used in the analysis and the file is provided as a back ground data set.

nzsidtmgrd **Grid** **NZ South Island DTM**

Grid of the regional Digital Terrain Model of the South Island of New Zealand. The spot height data were not used in the analysis and the file is provided as a back ground data set.

pzpmap **Grid** **Palaeozoic Prospectivity Model**

Grid of the prospectivity model run for Palaeozoic gold mineralisation. See the section on Prospectivity modelling in the final report for a description of how this model was developed.

pmapsouth\griddata\info: **This folder contains files required by the grid raster files to be used in ArcView. Note ArcExplorer cannot use these files, nor can MapInfo as both GIS only use vector files. To view the raster files in either ArcExplorer or MapInfo the raster grid fields need to be converted into image files, e.g., tif, jpeg etc and rectified for the program you are using. You need the ArcView extension Spatial Analyst to manipulate or model these files in ArcView. If you want to carry out your own prospectivity models using the gridded derivative files please load the extension Arc-SDM.**

pmapsouth\griddata\pmapgrid **The grid raster files in this folder were developed as binary derivative raster files to be used for developing prospectivity models as described in the accompanying report and using the methodologies developed by Bonham-Carter et al. 1988; Bonham-Carter 1997; Agterberg et al. 1993, Partington et al., 2001. These references are provided in Pmapreport and useful references folder on the CD. You need the ArcView extension Spatial Analyst to manipulate or model these files in ArcView. If you want to carry out your own prospectivity models using the gridded derivative files please load the extension Arc-SDM.**

bedvarrec **Grid** **Bedvarrec**

Reclassified grid of the measure of relative variability of bedding measurements from the QMap qbeds point data vector file (StudC 11.6). The grid was modelled using a moving average technique and applies to Palaeozoic mineralisation only (Appendix 2).

chempmap **Grid** **Geochemistry Wof E Posterior Probability**

Grid of the unique grid response theme of the geochemical prospectivity model. See the section on Prospectivity modelling in the final report for a description of how this model was developed.

fldau **Grid** **Fldau**

Grid of cells where fold axes are buffered to 2,000m and applies to Paleozoic mineralisation only (Appendix 2). This buffer distance from the feature has the greatest spatial association (StudC 1.6) with known mineralisation.

fldaunebf **Grid** **Fldaunebf**

Grid of cells where NE trending fold axes are buffered to2,400m and applies to Paleozoic mineralisation only (Appendix 2). This buffer distance from the feature has the greatest spatial association (StudC 7.8) with known mineralisation.

fldfltint **Grid** **Fldfltint**

Grid of cells containing fold fault intersection points buffered to 2,400m and applies to Paleozoic mineralisation only (Appendix 2). This feature has the greatest spatial association (StudC 4.1) with known mineralisation.

fldsty **Grid** **Fldsty**

Grid of cells containing dominantly F2 folds and applies to Mesozoic mineralisation only (Appendix 2). This feature has the greatest spatial association (StudC 11.4) with known mineralisation.

fltauden **Grid** **Fltauden**

Grid of cells the highest density of faulting and applies to both mineralisation styles (Appendix 2). This feature has the greatest spatial association (StudC 5-11) with known mineralisation of both types.

fltauegrdbuf **Grid** **Fltauegrdbuf**

Grid of cells where E trending faults associated with mineralisation are buffered to 800m and applies to Paleozoic mineralisation only (Appendix 2). This buffer distance from the feature has the greatest spatial association (StudC 3.6) with known mineralisation.

fltmzint **Grid** **Fltmzint**

Grid of cells where N-NW fault intersections are buffered to 1,400m and applies to Mesozoic mineralisation only (Appendix 2). This buffer distance from the feature has the greatest spatial association (StudC 1.75) with known mineralisation.

fltmzne **Grid** **Fltmzne**

Grid of cells where NE trending faults are buffered to 2,600m and applies to Mesozoic mineralisation only (Appendix 2). This buffer distance from the feature has the greatest spatial association (StudC 1.7) with known mineralisation.

fltmznw **Grid** **Fltmznw**

Grid of cells where NW trending faults are buffered to 3,000m and applies to Mesozoic mineralisation only (Appendix 2). This buffer distance from the feature has the greatest spatial association (StudC 2.7) with known mineralisation.

fltnneintbf **Grid** **Fltnneintbf**

Grid of cells where N-NW fault intersections are buffered to 800m and applies to Paleozoic mineralisation only (Appendix 2). This buffer distance from the feature has the greatest spatial association (StudC 4.0) with known mineralisation.

folsty **Grid** **Folsty**

Grid of cells containing S2 foliation and applies to Mesozoic mineralisation only (Appendix 2). This feature has the greatest spatial association (StudC 11.2) with known mineralisation.

folthick **Grid** **Folthick**

Grid of cells where foliation thickness values after Mortimer (2001) are >2 and applies to Mesozoic mineralisation only (Appendix 2). This feature has the greatest spatial association (StudC 6.9) with known mineralisation.

folvarrec **Grid** **Folvarrec**

Reclassified grid of a grid raster file of the measure of relative variability of foliation measurements from the QMAP qfol point data vector file (StudC 3.1). The grid was modelled using a moving average technique and applies to Mesozoic mineralisation only (Appendix 2).

lithmz **Grid** **Lithmz**

Grid of cells containing lithologies spatially associated with Mesozoic mineralisation (Appendix 2).

mallaugrid200 **Grid** **Mallaugrid200**

Grid used to develop spatial correlations and prospectivity models for Mesozoic mineralisation.

mzdepth **Grid** **Mzdepth**

Grid of cells where petrologic and metamorphic data suggest a depth of burial of <5km (after Motimer (2000)), and applies to Mesozoic mineralisation only (Appendix 2). This buffer distance from the feature has the greatest spatial association (StudC 6.3) with known mineralisation.

mzpmap1 **Grid** **Mesozoic Wof E Posterior Probability**

Grid of the unique grid response theme of the Mesozoic prospectivity model. See the section on Prospectivity modelling in the final report for a description of how this model was developed.

nzfltgrdbuf **Grid** **Nzfltgrdbuf**

Grid of cells where there an association with regional scale faults buffered to 3,500m and applies to both styles of mineralisation (Appendix 2). This buffer distance from the feature has the greatest spatial association (StudC 8.6 for Palaeozoic mineralisation and 7.0 for Mesozoic mineralisation) with known mineralisation.

palaugrid200 **Grid** **Palaugrid200**

Grid used to develop spatial correlations and prospectivity models for Paleozoic mineralisation.

pcau **Grid** **Pcau**

Grid of cells where anomalous pan concentrate Au stream sediment samples are buffered to 1,000m and applies to both styles of mineralisation (Appendix 2). This buffer distance from the feature has the greatest spatial association (StudC 4.8 for Paleozoic mineralisation and 10.5 for Mesozoic mineralisation) with known mineralisation.

pzfldti **Grid** **Pzfldti**

Grid of cells containing the highest density of folding (fold tightness) and applies to the Palaeozoic mineralisation style only (Appendix 2). This feature has the greatest spatial association (StudC 9.9) with known mineralisation.

pzlithgrd **Grid** **Pzlithgrd**

Grid of cells containing lithologies spatially associated with Palaeozoic mineralisation (Appendix 2).

pzpmap2 **Grid** **Paleozoic Wof E Posterior Probability**

Grid of the unique grid response theme of the Paleozoic prospectivity model. See the section on Prospectivity modelling in the final report for a description of how this model was developed.

pzstrat **Grid** **Pzstrat**

Grid of cells containing stratigraphically defined sequences or groups spatially associated with Palaeozoic mineralisation (Appendix 2).

qstrain **Grid** **Qstrain**

Grid of cells containing the highest density of structural disruption (a proxy measure for high strain) based on micro and macro structural measures and applies to both mineralisation styles (Appendix 2). This feature has the greatest spatial association (StudC 15.6 for Paleozoic mineralisation and 14.5 for Mesozoic mineralisation) with both types of mineralisation. Generated by Arc-SDM - Reclassify Tool

qvdenrc **Grid** **Qvdenrc**

Grid of cells where the highest density of quartz veins have been mapped in the QMAP Qvein theme, and applies to both styles of mineralisation (Appendix 2). This feature has the greatest spatial association (StudC 8.6 for Paleozoic mineralisation and 27.0 for Mesozoic mineralisation) with known mineralisation.

rkag **Grid** **Rkag**

Grid of cells where anomalous Ag rockchip samples are buffered to 600m and applies to Mesozoic mineralisation only (Appendix 2). This buffer distance from the feature has the greatest spatial association (StudC 13.3) with known mineralisation.

rkas **Grid** **Rkas**

Grid of cells where anomalous As rockchip samples are buffered to 700m and applies to both styles of mineralisation (Appendix 2). This buffer distance from the feature has the greatest spatial association (StudC 3.8 for Paleozoic mineralisation and 14.1 for Mesozoic mineralisation) with known mineralisation.

rkau **Grid** **Rkau**

Grid of cells where anomalous Au rockchip samples are buffered to 500m and applies to both styles of mineralisation (Appendix 2). This buffer distance from the feature has the greatest spatial association (StudC 3.5 for Paleozoic mineralisation and 14.6 for Mesozoic mineralisation) with known mineralisation.

rkcu **Grid** **Rkcu**

Grid of cells where anomalous Cu rockchip samples are buffered to 700m and applies to both styles of mineralisation (Appendix 2). This buffer distance from the feature has the greatest spatial association (StudC 2.4 for Paleozoic mineralisation and 12.5 for Mesozoic mineralisation) with known mineralisation.

rkpb **Grid** **Rkpb**

Grid of cells where anomalous Pb rockchip samples are buffered to 700m and applies to both styles of mineralisation (Appendix 2). This buffer distance from the feature has the greatest spatial association (StudC 4.5 for Paleozoic mineralisation and 13.5 for Mesozoic mineralisation) with known mineralisation.

rksb **Grid** **Rksb**

Grid of cells where anomalous Sb rockchip samples are buffered to 700m and applies to Mesozoic mineralisation only (Appendix 2). This buffer distance from the feature has the greatest spatial association (StudC 11.0) with known mineralisation.

rkzn **Grid** **Rkzn**

Grid of cells where anomalous Zn rockchip samples are buffered to 1,000m and applies to both styles of mineralisation (Appendix 2). This buffer distance from the feature has the greatest spatial association (StudC 4.4 for Paleozoic mineralisation and 10.2 for Mesozoic mineralisation) with known mineralisation.

ssag **Grid** **Ssag**

Grid of cells where anomalous Ag stream sediment samples are buffered to 1,200m and applies to both styles of mineralisation (Appendix 2). This buffer distance from the feature has the greatest spatial association (StudC 4.3 for Paleozoic mineralisation and 6.1 for Mesozoic mineralisation) with known mineralisation.

ssau **Grid** **Ssau**

Grid of cells where anomalous Au stream sediment samples are buffered to 1,200m and applies to both styles of mineralisation (Appendix 2). This buffer distance from the feature has the greatest spatial association (StudC 6.9 for Paleozoic mineralisation and 4.7 for Mesozoic mineralisation) with known mineralisation.

stratumz **Grid** **StratUMz**

Grid of cells containing stratigraphically defined sequences or groups spatially associated with Mesozoic mineralisation (Appendix 2).

Tables:

These tables are required by Arc-SDM to store the results of the various prospectivity models. They also provide statistical information on probability values, correlations coefficients and an analysis on conditional independence (Refer to Bonham-Carter et al. 1988; Bonham-Carter 1997; Agterberg et al. 1993, Partington et al., 2001 for a more detailed discussion on the concepts used in spatial analysis and prospectivity modelling. These references are provided in Pmapreport and useful references folder on the CD)

pmapsouth\propectivity tables\chempmap tables

Chempmap1df-1.dbf	Probability test.
Chempmap1prb-1.dbf	Conditional independence matrix of calculated relation ship between each theme variable.
Chempmap1woe1.dbf	Spatial correlation matrix for variables comprising the model listing the W+, C and StudC values for each variable in each theme.
Chempmap1woevar1.dbf	Results of variance calculations for the Weight of evidence analysis.
Chempmap1wofe1.dbf	Prior probability, uncertainty and missing data results from the Weights of Evidence analysis. This table is joined to the Unique Conditions grid theme using the ID column in the Wofe table and the Value column in the Unique Conditions grid theme.
Chempmap1x2-1.dbf	Results of a Chi2 test for conditional independence of the data variables.

pmapsouth\propectivity tables\mzpmap tables

Mzpmap1df-1.dbf	Probability test.
Mzpmap1prb-1.dbf	Conditional independence matrix of calculated relation ship between each theme variable.
Mzpmap1woe1.dbf	Spatial correlation matrix for variables comprising the model listing the W+, C and StudC values for each variable in each theme.
Mzpmap1woevar1.dbf	Results of variance calculations for the Weight of evidence analysis.
Mzpmap1wofe1.dbf	Prior probability, uncertainty and missing data results from the Weights of Evidence analysis. This table is joined to the Unique Conditions grid theme using the ID column in the Wofe table and the Value column in the Unique Conditions grid theme.
Mzpmap1x2-1.dbf	Results of a Chi2 test for conditional independence of the data variables.

pmapsouth\propectivity tables\pzpmap tables

Pzpmap2df-1.dbf	Probability test.
Pzpmap2prb-1.dbf	Conditional independence matrix of calculated relation ship between each theme variable.
Pzpmap2woe1.dbf	Spatial correlation matrix for variables comprising the model listing the W+, C and StudC values for each variable in each theme.
Pzpmap2woevar1.dbf	Results of variance calculations for the Weight of evidence analysis.
Pzpmap2wofe1.dbf	Prior probability, uncertainty and missing data results from the Weights of Evidence analysis. This table is joined to the Unique Conditions grid theme using the ID column in the Wofe table and the Value column in the Unique Conditions grid theme.
Pzpmap2x2-1.dbf	Results of a Chi2 test for conditional independence of the data variables.

pmapsouth\propectivity tables\pmap spatial correlation tables

Numerous (370) spatial analysis correlation tables for Paleozoic and Mesozoic areas

Data descriptions:

pmapsouth\QMAP data dictionary Describes the structure and design of the QMAP GIS database.

Reports:

pmapsouth\reports

DepositReports	Deposit model report.
ProspectivityReport	Final report.

pmapsouth\reports\useful references References pertaining to mineral prospectivity spatial modelling

Software:

pmapsouth\software

Arc-SDM	Prospectivity modelling software as ArcView extension
Wofe	Prospectivity modelling software as ArcView extension

pmapsouth\src Freeware Windows menu software and locally stored project files

Vector Data:

pmapsouth\vector data **Vector point, line and polygon datasets provided for viewing in ArcExplorer, or manipulation in ArcInfo or MapInfo. The dbf data tables attached to the ArcView shape files can be viewed or analysed in Word, Excel or Access. These files should be copied as separate files before being opened by these non-GIS software.**

alluvialgolddeposits.shp **Point** **GERM Alluvial Gold Deposits**
Subset point data theme of alluvial gold deposits from the GERM database.

beddi.shp **Point** **QMAP Bedding Orientation Measurements**
QMAP subset point data theme of bedding orientation measurements.

cleav.shp **Point** **QMAP Cleavage Orientation Measurements**
QMAP subset point data theme of cleavage orientation measurements.

coast250.shp **Polygon** **NZ Coastline**
Polygon theme of the New Zealand land area from the LINZ 1:250K digital topographic dataset.

council.shp **Polygon** **Regional Councils**
Polygon theme of regional council boundaries for the South Island derived from an unofficial source: http://www.ollivier.co.nz/atlas/adminbdy/index.html

doc_consunits.shp **Polygon** **Conservation Land/National Parks**
Polygon theme of various land-use categories managed by the Department of Conservation (Doc) in New Zealand.

faultau.shp **Arc** **QMAP Faults Associated With Au**
Line theme showing the subset of faults from the QMAP fault theme associated with Paleozoic and Mesozoic gold mineralisation.

fol_thickness.shp **Polygon** **Mesozoic Foliation Thickness Map**
Polygon theme mapping the variation in foliation thickness derived from petrographic information after Mortimer (2001). This theme subdivides the Otago Schist into domains relating to the grade of metamorphism and degree of deformation.

foldau.shp **Arc** **QMAP Fold Axes Associated With Au**
QMAP subset line theme of fold axial plane surface traces axes with a spatial association with Palaeozoic and Mesozoic gold mineralisation.

foldaxes.shp **Arc** **QMAP Fold Axes**
QMAP line data theme of fold axial plane surface traces.

folded_hingy.shp **Polygon** **Mesozoic Fold Style Map**
Polygon theme mapping the variation in fold style and generation with in the Otago Schist after Mortimer (1993).

folia.shp **Point** **QMAP Foliation Orientation Measurements**
QMAP subset point data theme of foliation orientation measurements.

geosourc.shp **Polygon** **Geology Data Source**
Polygon theme outlining data sources for the geological themes in this project including geological units, faults, folds, quartz veins, metamorphism, and structural measurement data.

germmin.shp **Point** **GERM Mineral Occurrences**
Point theme subset from the GERM database of historic mineral occurrences and mineral workings, with historical production if present, for the mesothermal Au area of interest.

greenstones.shp **Polygon** **QMAP Metavolcanic Rocks**
QMAP polygon data theme mapping greenschist (metavolcanic) occurrences.

gwschist.shp **Polygon** **Mesozoic Crustal Depth Zone**
Polygon theme mapping the variation in interpreted crustal depth of the schist derived from petrographic information after Mortimer (2000). This theme subdivides the Otago Schist into domains based the structural thickness perpendicular to foliation.

hrmz.shp **Point** **Prioritised Mesozoic Au Prospects**
Gold potential of historic prospects based on the Mesozoic prospectivity model.

hrockgolddeposits.shp **Point** **GERM Hard Rock Gold Deposits**
Subset point data theme of historic hard rock gold occurrences.

hrpz.shp **Point** **Prioritised Palaeozoic Prospects**
Gold potential of historic prospects based on the Paleozoic prospectivity model.

lakes250.shp **Polygon** **NZ Lakes**
Polygon theme of New Zealand lakes derived from the LINZ 1:250K digital topographic dataset.

linea.shp **Point** **QMAP Lineation Orientation Measurements**
QMAP subset point data theme of lineation orientation measurements.

mzpmap.shp **Polygon** **Mesozoic Prospectivity Model**
This is a copy (vector file) of the prospectivity model run for Mesozoic gold mineralisation. See the section on Prospectivity modelling in the final report for a description of how this model was developed.

national_coast.shp **Polygon** **NZ Coastline**
Polygon theme of New Zealand coast and land area derived from the LINZ 1:250K digital topographic dataset.

nzbasementterranes.shp **Polygon** **NZ Basement Terranes (cover removed)**
GMNZ-derived subset polygon data theme of geological basement terranes extending offshore and with all cover rocks removed.

nzfaults.shp **Arc** **NZ 1:1M Faults**
GMNZ 1:1M line coverage of the major faults in New Zealand.

nzgeochronolgy.shp **Point** **NZ Geochronology**
GSNZ/GNS point theme of geochronological data.

nzgeology.shp **Polygon** **NZ 1:1M Geology**
GMNZ regional polygon theme geology captured from published 1972 1:1,000,000 scale map.

nzrkchm.shp **Point** **Petlab Rock Chip Geochemistry**
Subset of rockchip digital geochemical point data from the Petlab database held and managed by the Institute of Geological and Nuclear Sciences for the South Island of New Zealand. This database was used as the basis for deriving the geochemical anomaly themes used in the prospectivity modelling and provided on the CD.

nztenements.shp **Polygon** **Mineral Tenements, Granted and Under Application**
Polygon theme of applications and current prospecting permits, exploration permits and mining licences as at the beginning of August 2002.

nzterranes.shp **Polygon** **NZ Basement Terranes (onland outcrop)**
GMNZ-derived polygon theme mapping onland outcrop of the different geological basement terranes in New Zealand.

nztowns.shp **Point** **NZ Towns**
Point theme of NZ towns and suburbs derived from unofficial USGS source.

penetrative.shp **Polygon** **Mesozoic Foliation Generation Map**
Polygon theme mapping the variation in foliation derived from field mapping after Mortimer (2001). This theme subdivides the Otago Schist into domains relating to the grade of metamorphism and degree of deformation.

petlabmaj.shp **Point** **Petlab Major Element Geochemistry**
Subset of major element digital geochemical point data from the Petlab database held and managed by the Institute of Geological and Nuclear Sciences for the South Island of New Zealand. This database was not used in the prospectivity modelling and is provided on the CD as a reference dataset for more detailed investigations.

petlabtrace.shp **Point** **Petlab Trace Element Geochemistry**
Subset of trace element digital geochemical point data from the Petlab database held and managed by the Institute of Geological and Nuclear Sciences for the South Island of New Zealand. This database was used as the basis for deriving the geochemical anomaly themes used in the prospectivity modelling and provided on the CD.

pmschem.shp **Polygon** **Geochemistry Prospectivity Model**
This is a copy (vector file) of the prospectivity model run for the geochemical prospectivity model. See the section on Prospectivity modelling in the final report for a description of how this model was developed.

pzpmap.shp **Polygon** **Palaeozoic Prospectivity Model**
This is a copy (vector file) of the prospectivity model run for Palaeozoic gold mineralisation. See the section on Prospectivity modelling in the final report for a description of how this model was developed.

qbasegeo.shp **Polygon** **QMAP Basement Geology**
Polygon theme subset of QMAP basement (mostly pre-Cretaceous) geological map units for the mesothermal area of interest.

qfaults.shp **Arc** **QMAP Faults**
QMAP line data theme of faults.

qveins.shp **Arc** **QMAP Quartz Vein Data**
QMAP line data theme of quartz veins.

regchemss.shp **Point** **Petlab Stream Sediment Geochemistry**
Subset of digital geochemical point data of stream sediment samples collected by exploration companies from the Petlab database held and managed by the Institute of Geological and Nuclear Sciences for the South Island of New Zealand. This database was used as the basis for deriving the geochemical anomaly themes used in the prospectivity modelling and provided on the CD.

river250.shp **Arc** **NZ Rivers**
Line theme of NZ rivers derived from the LINZ digital topographic dataset.

rkaganombuff600m.shp **Polygon** **Ag Rock Chip Anomaly Map**
Silver rock chip anomaly polygon theme buffered to 600m, which has the greatest spatial correlation with known

mineralisation. Non anomalous samples are also buffered to the same distance. Areas not covered by either polygon have no digital data.

rkasanombuff700m.shp **Polygon** **As Rock Chip Anomaly Map**

Arsenic rock chip anomaly polygon theme buffered to 700m, which has the greatest spatial correlation with known mineralisation. Non anomalous samples are also buffered to the same distance. Areas not covered by either polygon have no digital data.

rkauanombuff500m.shp **Polygon** **Au Rock Chip Anomaly Map**

Gold rock chip anomaly polygon theme buffered to 500m, which has the greatest spatial correlation with known mineralisation. Non anomalous samples are also buffered to the same distance. Areas not covered by either polygon have no digital data.

rkcuanombuff700m.shp **Polygon** **Cu Rock Chip Anomaly Map**

Copper rock chip anomaly polygon theme buffered to 700m, which has the greatest spatial correlation with known mineralisation. Non anomalous samples are also buffered to the same distance. Areas not covered by either polygon have no digital data.

rkpbanombuff700m.shp **Polygon** **Pb Rock Chip Anomaly Map**

Lead rock chip anomaly polygon theme buffered to 700m, which has the greatest spatial correlation with known mineralisation. Non anomalous samples are also buffered to the same distance. Areas not covered by either polygon have no digital data.

rksbanombuff700m.shp **Polygon** **Sb Rock Chip Anomaly Map**

Antinomy rock chip anomaly polygon theme buffered to 700m, which has the greatest spatial correlation with known mineralisation. Non anomalous samples are also buffered to the same distance. Areas not covered by either polygon have no digital data.

rkwanombuff800m.shp **Polygon** **W Rock Chip Anomaly Map**

Tungsten rock chip anomaly polygon theme buffered to 800m, which has the greatest spatial correlation with known mineralisation. Non anomalous samples are also buffered to the same distance. Areas not covered by either polygon have no digital data.

rkznanombuff1000m.shp **Polygon** **Zn Rock Chip Anomaly Map**

Zinc rock chip anomaly polygon theme buffered to 1,000m, which has the greatest spatial correlation with known mineralisation. Non anomalous samples are also buffered to the same distance. Areas not covered by either polygon have no digital data.

roads250.shp **Arc** **NZ Roads**

Line theme of NZ major roads derived from the LINZ digital topographic dataset.

siintrusives.shp **Polygon** **QMAP Intrusive Rocks**

QMAP subset polygon data theme of intrusive geological map units.

ssaganombuff1200m.shp **Polygon** **Ag Stream Sediment Anomaly Map**

Silver stream sediment anomaly polygon theme buffered to 1,200m, which has the greatest spatial correlation with known mineralisation. Non anomalous samples are also buffered to the same distance. Areas not covered by either polygon have no digital data.

ssasanombuff1400m.shp **Polygon** **As Stream Sediment Anomaly Map**

Arsenic stream sediment anomaly polygon theme buffered to 1,400m, which has the greatest spatial correlation with known mineralisation. Non anomalous samples are also buffered to the same distance. Areas not covered by either polygon have no digital data.

ssauanombuff1200m.shp **Polygon** **Au Stream Sediment Anomaly Map**

Gold stream sediment anomaly polygon theme buffered to 1,200m, which has the greatest spatial correlation with known mineralisation. Non anomalous samples are also buffered to the same distance. Areas not covered by either polygon have no digital data.

sscuanombuff800m.shp **Polygon** **Cu Stream Sediment Anomaly Map**

Copper stream sediment anomaly polygon theme buffered to 800m, which has the greatest spatial correlation with known mineralisation. Non anomalous samples are also buffered to the same distance. Areas not covered by either polygon have no digital data.

sspbanombuff1000m.shp **Polygon** **Pb Stream Sediment Anomaly Map**

Lead stream sediment anomaly polygon theme buffered to 1,00m, which has the greatest spatial correlation with known mineralisation. Non anomalous samples are also buffered to the same distance. Areas not covered by either polygon have no digital data.

sspcauanombuff1000m.shp **Polygon** **Pan Con. Au Stream Sediment Anomaly Map**

Gold pan concentrate stream sediment anomaly polygon theme buffered to 1,000m, which has the greatest spatial correlation with known mineralisation. Non anomalous samples are also buffered to the same distance. Areas not covered by either polygon have no digital data.

sssbanombuff1600m.shp **Polygon** **Sb Stream Sediment Anomaly Map**

Antinomy stream sediment anomaly polygon theme buffered to 1,600m, which has the greatest spatial correlation with known mineralisation. Non anomalous samples are also buffered to the same distance. Areas not covered by either polygon have no digital data.

sswanombuff1800m.shp **Polygon** **W Stream Sediment Anomaly Map**

Tungsten stream sediment anomaly polygon theme buffered to 1,800m, which has the greatest spatial correlation with known mineralisation. Non anomalous samples are also buffered to the same distance. Areas not covered by either polygon have no digital data.

ssznanombuff2800m.shp **Polygon** **Zn Stream Sediment Anomaly Map**

Zinc stream sediment anomaly polygon theme buffered to 2,800m, which has the greatest spatial correlation with known mineralisation. Non anomalous samples are also buffered to the same distance. Areas not covered by either polygon have no digital data.

terrane_bdy.shp **Arc** **Mesozoic Schist Terrane Boundary**

Line theme of interpreted terrane boundary within the Otago Schist as defined by Mortimer(2000).

texturalmet.shp **Polygon** **QMAP Schist Textural Zones**

QMAP polygon theme mapping the textural variation in Mesozoic schist derived from field mapping and petrographic information after Mortimer(2000). This theme subdivides the schist into domains relating to the degree of foliation development and deformation.

topography.shp **Polygon** **NZ South Island DTM**

A copy (vector file) of the South Island DTM raster file.

workden.shp **Polygon** **Data Coverage Map**

Polygon theme of buffered geochemical, geochronological and structural points.

pmapsouth\vector data\pmap files **Folder containing point themes of historic mineral occurrences used as training data sets for the spatial analyses and prospectivity models.**

mallautraining.shp **Point** **Mesozoic Au Training Dataset**

Mesozoic mineral occurrence training data set.

pallautraining.shp **Point** **Paleozoic Au Training Dataset**

Paleozoic mineral occurrence training data set.

Missing Data

There are more than one hundred new data themes provided on this CD. However, New Zealand still lacks good regional coverage of some digital data that are taken for granted in other countries, states and territories. Additional datasets that either need to be acquired or converted from paper form into digital form include:

- High Resolution Gravity
- High resolution EM
- High Resolution DTMs
- High Resolution Radiometric data
- High Resolution Magnetic data
- Prospect-scale soil sample geochemistry
- Prospect scale drill geochemistry from all drilling methods (RAB, RC and Diamond)

Appendix 2
Results from the Spatial correlation Analysis

Appendix 2 Mesozoic Gold Deposits

Spatial Variable	Measure	Technique	ID	Area	Units	No.	W+	Ws+	W-	Ws-	C	Cs	Stud C
Internal Structure													
Structural Intensity	Strain	Grid density of cleavage+lineation+foliation	3	8,800	12,571	104	1.5	0.1	-0.7	0.1	2.2	0.2	14.5
Bedding Variance	Moving average of variability of bedding data, Measure of structural disruption/folding	Gridded data, which is then reclassified into 10 categories from low variability to high variability	2	13,571	19,387	1	0.1	1.0	-0.1	1.0	0.1	1.4	0.1
Lineation Variance	Moving average of variability of lineation data, Measure of structural disruption	Gridded data, which is then reclassified into 10 categories from low variability to high variability	None										None
Foliation Variance	Moving average of variability of foliation data, Measure of structural disruption	Gridded data, which is then reclassified into 10 categories from low variability to high variability	3	3,557	5,082	26	0.6	0.2	-0.1	0.1	0.7	0.2	3.1
Foliation style	Deformation style as a proxy for depth	Interpretation of field mapping of rock structure	S2 mainly	12,034	17,191	124	1.0	0.1	-1.2	0.2	2.2	0.2	11.3
External Regional Structure													
Distance From Crustal Faults	Crustal scale structural control	Buffered faults 20000m at 500m intervals around faults	3,500	45,559	65,084	47	1.0	0.1	-0.2	0.1	1.2	0.2	7.0
Lower Order Faults	Structural control at a local level.	Buffered faults 4000m at 200m intervals around faults using ESRI buffer tool	800	35,428	50,612	14	0.2	0.3	0.0	0.1	0.2	0.3	0.8
Lower Order Faults Associated with Au	Structural control at a local level.	Buffered faults 4000m at 200m intervals around faults within 2500 metres of known workings using ESRI buffer tool	800	9,160	13,086	16	0.4	0.3	0.0	0.1	0.5	0.3	1.8

Appendix 2 Mesozoic Gold Deposits

Spatial Variable	Measure	Technique	ID	Area	Units	No.	W+	Ws+	W-	Ws-	C	Cs	Stud C
Lower Order Fault associated with mineralisation NE-Orientation	Preferred orientation of structure	Buffered faults 4000m at 200m intervals around faults within 2500 metres of known workings using ESRI buffer tool. Select only Pz faults. Select only N-trending faults.	2,600	26,423	37,747	36	0.2	0.2	-0.2	0.2	0.4	0.3	1.7
Lower Order Fault associated with mineralisation NW-Orientation	Preferred orientation of structure	Buffered faults 4000m at 200m intervals around faults within 2500 metres of known workings using ESRI buffer tool. Select only Pz faults. Select only N-trending faults.	3,000	6,375	9,107	74	0.2	0.1	-0.4	0.2	0.6	0.2	2.7
Regional Fault Intensity	Structural control at a regional scale as determined by intensity of faulting	Fault Density maps created by creating a point every 10m along a fault then gridding the density of fault points in the theme.	2	39,959	57,084	110	1.1	0.1	-0.9	0.1	2.0	0.2	11.8
Lower Order Fault Intensity	Structural control as determined by intensity of faulting	Fault Density maps created by creating a point every 10m along a fault then gridding the density of fault points in the theme.	2	18,462	26,374	58	1.2	0.1	-0.3	0.1	1.6	0.2	9.6
N/NW Fault Intersections	Mineralisation controlled by intersecting faults.	Create point theme of fault intersections. Then buffer round these points.	1,400	2,714	3,877	12	0.5	0.3	-0.1	0.1	0.6	0.3	1.7
Fold-Fault Intersection	Mineralisation controlled by intersecting folds and faults.	Create point theme of fault intersections. Then buffer round these points.	2,600	549	785	23	2.3	0.2	-1.0	0.3	3.3	0.4	9.2
Folds	Structural control at a local level.	Buffered folds 10,000m at 200m intervals around folds within 2500 metres of known workings using ESRI buffer tool	1,400	9,517	13,596	5	0.7	0.4	0.0	0.1	0.7	0.5	1.6

Temporal

Appendix 2 Mesozoic Gold Deposits

Spatial Variable	Measure	Technique	ID	Area	Units	No.	W+	Ws+	W-	Ws-	C	Cs	Stud C
Stratigraphy	Age range.	QMAP geology.	Star Formation 1	142	203	1	1.8	1.0	0.0	0.1	1.9	1.0	1.8
Stratigraphy	Age range.	QMAP geology.	Wakamarina Quartzite 2	10	14	1	4.6	1.0	0.0	0.1	4.6	1.0	4.4
Stratigraphy	Age range.	QMAP geology.	Aspiring lithologic association 3	103	148	3	3.3	0.6	0.0	0.1	3.3	0.6	5.6
Stratigraphy	Age range.	QMAP geology.	Wanaka Lithological Association 4	2,026	2,895	13	1.8	0.3	-0.1	0.1	1.8	0.3	6.3
Stratigraphy	Age range.	QMAP geology.	Caples Group 5	8,538	12,198	36	1.3	0.2	-0.2	0.1	1.5	0.2	8.0
Stratigraphy	Age range.	QMAP geology.	Haast Schist 6	5,623	8,034	56	2.2	0.1	-0.3	0.1	2.5	0.2	15.7
Stratigraphy	Age range.	QMAP geology.	Aspiring Lithological Association 3	2,903	4,147	45	2.6	0.1	-0.3	0.1	2.9	0.2	16.9
Fold Style	Generation of structure relating to folding	Interpretation of field mapping of rock structure	Hingy F2	2,277	3,253	47	1.7	0.1	-0.3	0.1	2.0	0.2	11.4
Geology													
Rock type	Rock composition.	QMAP geology.	semischist 1	3,281	4,687	5	0.3	0.4	0.0	0.1	0.3	0.5	0.7
Rock type	Rock composition.	QMAP geology.	mylonite 2	285	408	1	1.1	1.0	0.0	0.1	1.1	1.0	1.1
Rock type	Rock composition.	QMAP geology.	greenschist 3	613	876	2	1.1	0.7	0.0	0.1	1.1	0.7	1.5
Rock type	Rock composition.	QMAP geology.	quartzite 4	110	157	1	2.1	1.0	0.0	0.1	2.1	1.0	2.1
Rock type	Rock composition.	QMAP geology.	metapelite 5	3,318	4,740	45	2.5	0.1	-0.3	0.1	2.8	0.2	16.1
Rock type	Rock composition.	QMAP geology.	schist 6	18,069	25,812	108	1.7	0.1	-0.8	0.1	2.5	0.2	16.3
Depth	Depth of burial	Interpretation of field mapping of rock structure	schist <5 km	21,534	30,763	151	0.5	0.1	-2.7	0.5	3.2	0.5	6.3

Appendix 2 Mesozoic Gold Deposits

Spatial Variable	Measure	Technique	ID	Area	Units	No.	W+	Ws+	W-	Ws-	C	Cs	Stud C
			structural level										
Textural Grade	Mapped metamorphic and structural grade, association with metamorphism	Zones interpreted from field mapping.	III	8,002	11,431	69	0.6	0.1	-0.2	0.1	0.8	0.2	5.2
Textural Grade	Mapped metamorphic and structural grade, association with metamorphism	Zones interpreted from field mapping.	IV	12,182	17,402	86	0.4	0.1	-0.2	0.1	0.6	0.1	4.0
Foliation Thickness	Mapped metamorphic and structural grade, association with metamorphism	Zones interpreted from petrographic analysis.	2	12,144	17,349	146	0.5	0.1	-2.4	0.4	2.9	0.4	6.9
Qtz Vein Density	Density of quartz veining representing possible centres of fluid flow.	Create point theme from linear quartz vein theme. Then create density map from points.	4	2,117	3,024	75	3.7	0.1	-0.6	0.1	4.3	0.2	27.0
Geochemistry													
Rock Ag	Geochemical pathfinder for gold, which has a larger geochemical signature within alteration halos around gold deposits.	Calculate anomalous values using 90 percentile to cut the data and then the 90 percentile for anomalous threshold. Buffer up to 4000m and test spatial correlation.	600	83	118	39	3.0	0.2	-1.2	0.2	4.2	0.3	13.3
SS Ag	Geochemical pathfinder for gold, which has a larger geochemical signature within alteration halos around gold deposits, especially with dispersion down rivers and streams.	Calculate anomalous values using 90 percentile to cut the data and then the 90 percentile for anomalous threshold. Buffer up to 10,000m and test spatial correlation.	1,200	1,054	1,505	28	1.1	0.2	-0.9	0.3	2.0	0.3	6.1

Appendix 2 Mesozoic Gold Deposits

Spatial Variable	Measure	Technique	ID	Area	Units	No.	W+	Ws+	W-	Ws-	C	Cs	Stud C
Rock As	Geochemical pathfinder for gold, which has a larger geochemical signature within alteration halos around gold deposits.	Calculate anomalous values using 90 percentile to cut the data and then the 90 percentile for anomalous threshold. Buffer up to 4000m and test spatial correlation.	600	157	224	49	2.6	0.2	-1.0	0.2	3.6	0.3	14.1
SS As	Geochemical pathfinder for gold, which has a larger geochemical signature within alteration halos around gold deposits, especially with dispersion down rivers and streams.	Calculate anomalous values using 90 percentile to cut the data and then the 90 percentile for anomalous threshold. Buffer up to 10,000m and test spatial correlation.	800	744	1,063	53	2.4	0.1	-0.7	0.1	3.1	0.2	15.3
Rock Au	Rock chip samples for gold	Calculate anomalous values using 90 percentile to cut the data and then the 90 percentile for anomalous threshold. Buffer up to 4000m and test spatial correlation.	400	84	121	34	3.2	0.2	-0.7	0.2	3.9	0.3	14.6
SS Pancon Au	Geochemical sample of concentrated heavy minerals from streams analysed for gold.	Buffered point data. Buffers every 200 metres over 4000 metres around each anomalous sample. This will be combined with buffers around non anomalous samples. The nonbuffered area will be missing data.	1000	748	1,069	55	1.7	0.1	-1.3	0.2	2.9	0.3	10.5

Appendix 2 Mesozoic Gold Deposits

Spatial Variable	Measure	Technique	ID	Area	Units	No.	W+	Ws+	W-	Ws-	C	Cs	Stud C
SS Au	BLEG and ordinary sieved stream sediment samples analysed for gold. Both BLEG and Sieved stream sediment samples have similar statistical distributions.	Buffered point data. Buffers every 200 metres over 4000 metres around each anomalous sample. This will be combined with buffers around non anomalous samples. The nonbuffered area will be missing data.	1,400	2,131	3,045	34	0.7	0.2	-0.5	0.2	1.2	0.3	4.7
Rock Cu	Geochemical pathfinder for gold, which has a larger geochemical signature within alteration halos around gold deposits, especially with dispersion down rivers and streams.	Calculate anomalous values using 90 percentile to cut the data and then the 90 percentile for anomalous threshold. Buffer up to 10,000m and test spatial correlation.	700	385	550	37	2.4	0.2	-0.7	0.2	3.1	0.2	12.5
SS Cu	Geochemical pathfinder for gold, which has a larger geochemical signature within alteration halos around gold deposits.	Calculate anomalous values using 90 percentile to cut the data and then the 90 percentile for anomalous threshold. Buffer up to 4000m and test spatial correlation.	800	1,130	1,615	32	1.2	0.2	-0.6	0.2	1.8	0.3	7.0
Rock Pb	Geochemical pathfinder for gold, which has a larger geochemical signature within alteration halos around gold deposits, especially with dispersion down rivers and streams.	Calculate anomalous values using 90 percentile to cut the data and then the 90 percentile for anomalous threshold. Buffer up to 10,000m and test spatial correlation.	700	443	633	41	2.4	0.2	-0.6	0.2	3.0	0.2	13.5
SS Pb	Geochemical pathfinder for gold, which has a larger geochemical signature within alteration halos around gold deposits.	Calculate anomalous values using 90 percentile to cut the data and then the 90 percentile for anomalous threshold. Buffer up to 4000m and test spatial correlation.	No Correlation	Spatial									None

Appendix 2 Mesozoic Gold Deposits

Spatial Variable	Measure	Technique	ID	Area	Units	No.	W+	Ws+	W-	Ws-	C	Cs	Stud C
Rock Sb	Geochemical pathfinder for gold, which has a larger geochemical signature within alteration halos around gold deposits, especially with dispersion down rivers and streams.	Calculate anomalous values using 90 percentile to cut the data and then the 90 percentile for anomalous threshold. Buffer up to 10,000m and test spatial correlation.	700	81	115	37	2.3	0.2	-0.8	0.2	3.0	0.3	11.0
SS Sb	Geochemical pathfinder for gold, which has a larger geochemical signature within alteration halos around gold deposits.	Calculate anomalous values using 90 percentile to cut the data and then the 90 percentile for anomalous threshold. Buffer up to 4000m and test spatial correlation.	1,600	1,629	2,327	54	0.5	0.1	-0.7	0.2	1.3	0.3	4.9
Rock W	Geochemical pathfinder for gold, which has a larger geochemical signature within alteration halos around gold deposits, especially with dispersion down rivers and streams.	Calculate anomalous values using 90 percentile to cut the data and then the 90 percentile for anomalous threshold. Buffer up to 10,000m and test spatial correlation.	No Correlation	Spatial									None
SS W	Geochemical pathfinder for gold, which has a larger geochemical signature within alteration halos around gold deposits.	Calculate anomalous values using 90 percentile to cut the data and then the 90 percentile for anomalous threshold. Buffer up to 4000m and test spatial correlation.	1,800	2,917	4,168	58	0.6	0.1	-1.1	0.3	1.8	0.3	5.7
Rock Zn	Geochemical pathfinder for gold, which has a larger geochemical signature within alteration halos around gold deposits, especially with dispersion down rivers and streams.	Calculate anomalous values using 90 percentile to cut the data and then the 90 percentile for anomalous threshold. Buffer up to 10,000m and test spatial correlation.	1000	725	1,035	35	1.9	0.2	-0.7	0.2	2.6	0.3	10.2

Appendix 2 Mesozoic Gold Deposits

Spatial Variable	Measure	Technique	ID	Area	Units	No.	W+	Ws+	W-	Ws-	C	Cs	Stud C
SS Zn	Geochemical pathfinder for gold, which has a larger geochemical signature within alteration halos around gold deposits.	Calculate anomalous values using 90 percentile to cut the data and then the 90 percentile for anomalous threshold. Buffer up to 4000m and test spatial correlation.	2800	5,450	7,786	40	0.3	0.2	-1.4	0.6	1.7	0.6	2.8
Rock Ag	Theme contains spatial area relating to anomalous geochemistry and background geochemistry.	Anomaly theme calculated by defining spatial correlation from buffered anomalous samples compared to buffered background samples.	2	83	118	39	1.4	0.2	-1.2	0.3	2.6	0.3	7.5
SS Ag	Theme contains spatial area relating to anomalous geochemistry and background geochemistry.	Anomaly theme calculated by defining spatial correlation from buffered anomalous samples compared to buffered background samples.	2	1,054	1,505	28	0.7	0.2	-0.3	0.2	1.1	0.2	4.3
Rock As	Theme contains spatial area relating to anomalous geochemistry and background geochemistry.	Anomaly theme calculated by defining spatial correlation from buffered anomalous samples compared to buffered background samples.	2	198	283	49	1.4	0.2	-1.1	0.2	2.5	0.3	8.7
SS As	Theme contains spatial area relating to anomalous geochemistry and background geochemistry.	Anomaly theme calculated by defining spatial correlation from buffered anomalous samples compared to buffered background samples.	2	1,567	2,238	66	1.0	0.1	-1.6	0.3	2.6	0.3	7.9
Rock Au	Theme contains spatial area relating to anomalous geochemistry and background geochemistry.	Anomaly theme calculated by defining spatial correlation from buffered anomalous samples compared to buffered background samples.	2	122	174	41	1.3	0.2	-2.1	0.5	3.4	0.5	6.3

Appendix 2 Mesozoic Gold Deposits

Spatial Variable	Measure	Technique	ID	Area	Units	No.	W+	Ws+	W-	Ws-	C	Cs	Stud C
SS Pancon Au	Theme contains spatial area relating to anomalous geochemistry and background geochemistry.	Anomaly theme calculated by defining spatial correlation from buffered anomalous samples compared to buffered background samples.	2	768	1,098	55	1.0	0.1	-1.9	0.4	2.9	0.4	6.8
SS Au	Theme contains spatial area relating to anomalous geochemistry and background geochemistry.	Anomaly theme calculated by defining spatial correlation from buffered anomalous samples compared to buffered background samples.	2	1,723	2,462	32	0.7	0.2	-0.9	0.3	1.7	0.4	4.7
Rock Cu	Theme contains spatial area relating to anomalous geochemistry and background geochemistry.	Anomaly theme calculated by defining spatial correlation from buffered anomalous samples compared to buffered background samples.	2	385	550	37	0.6	0.2	-0.5	0.2	1.0	0.3	4.0
SS Cu	Theme contains spatial area relating to anomalous geochemistry and background geochemistry.	Anomaly theme calculated by defining spatial correlation from buffered anomalous samples compared to buffered background samples.	2	1,130	1,615	32	1.0	0.2	-0.7	0.2	1.6	0.3	5.8
Rock Pb	Theme contains spatial area relating to anomalous geochemistry and background geochemistry.	Anomaly theme calculated by defining spatial correlation from buffered anomalous samples compared to buffered background samples.	2	386	551	39	0.7	0.2	-0.6	0.2	1.2	0.3	4.6
SS Pb	Theme contains spatial area relating to anomalous geochemistry and background geochemistry.	Anomaly theme calculated by defining spatial correlation from buffered anomalous samples compared to buffered background samples.	2	1,517	2,167	1	-2.8	1.0	0.3	0.1	-3.1	1.0	-3.0

Appendix 2 Mesozoic Gold Deposits

Spatial Variable	Measure	Technique	ID	Area	Units	No.	W+	Ws+	W-	Ws-	C	Cs	Stud C
Rock Sb	Theme contains spatial area relating to anomalous geochemistry and background geochemistry.	Anomaly theme calculated by defining spatial correlation from buffered anomalous samples compared to buffered background samples.	2	81	115	37	1.2	0.2	-0.8	0.2	2.0	0.3	6.7
SS Sb	Theme contains spatial area relating to anomalous geochemistry and background geochemistry.	Anomaly theme calculated by defining spatial correlation from buffered anomalous samples compared to buffered background samples.	2	1,629	2,327	54	0.5	0.1	-0.8	0.2	1.4	0.3	4.9
Rock W	Theme contains spatial area relating to anomalous geochemistry and background geochemistry.	Anomaly theme calculated by defining spatial correlation from buffered anomalous samples compared to buffered background samples.	2	118	168	12	-0.2	0.3	0.1	0.2	-0.2	0.3	-0.6
SS W	Theme contains spatial area relating to anomalous geochemistry and background geochemistry.	Anomaly theme calculated by defining spatial correlation from buffered anomalous samples compared to buffered background samples.	2	2,917	4,168	58	0.7	0.1	-1.0	0.2	1.6	0.3	6.0
Rock Zn	Theme contains spatial area relating to anomalous geochemistry and background geochemistry.	Anomaly theme calculated by defining spatial correlation from buffered anomalous samples compared to buffered background samples.	2	725	1,035	35	0.4	0.2	-0.3	0.2	0.7	0.2	2.7
SS Zn	Theme contains spatial area relating to anomalous geochemistry and background geochemistry.	Anomaly theme calculated by defining spatial correlation from buffered anomalous samples compared to buffered background samples.	2	5,450	7,786	40	0.2	0.2	-0.2	0.2	0.4	0.2	1.6

Appendix 2 Mesozoic Gold Deposits

Spatial Variable	Measure	Technique	ID	Area	Units	No.	W+	Ws+	W-	Ws-	C	Cs	Stud C
Alluvial Deposits	Bulk geochemical tracer	Buffer known deposits to test for a spatial correlation.	4,000	37,108	53,011	3	2.7	0.6	-0.9	0.7	3.6	0.9	3.9
Alluvial Deposits	Bulk geochemical tracer	Buffer known deposits to test for a spatial correlation.	17,000	333,971	477,102	43	0.6	0.2	-0.7	0.2	1.3	0.3	4.9

Appendix 2 Paleozoic Gold Deposits

Spatial Variable	Measure	Technique	ID	Area	Units	No.	W+	Ws+	W-	Ws-	C	Cs	Stud C
Internal Structure													
Structural Intensity	Strain	Grid density of cleavage +lineation+foliation	3	2,778	3,969	85	1.9	0.1	-1.0	0.2	2.9	0.2	15.6
Cleavage-Bedding Angle	Regional strain	Grid angle											
Bedding Variance	Moving average of variability of bedding data, Measure of structural disruption/folding	Gridded data, which is then reclassified into 10 categories from low variability to high variability	4	3,002	4,288	63	1.5	0.1	-0.5	0.1	2.0	0.2	11.6
Lineation Variance	Moving average of variability of lineation data, Measure of structural disruption	Gridded data, which is then reclassified into 10 categories from low variability to high variability	None										None
Foliation Variance	Moving average of variability of foliation data, Measure of structural disruption	Gridded data, which is then reclassified into 10 categories from low variability to high variability	3	1,644	2,349	8	-0.1	0.4	0.0	0.1	-0.2	0.4	-0.4
External Regional Structure													
Crustal Faults	Crustal scale structural control	Buffered faults 20000m at 500m intervals around faults using ESRI buffer tool	3,500	112,591	160,845	27	1.7	0.2	-0.4	0.2	2.2	0.2	8.6
Lower Order Faults	Structural control at a local level.	Buffered faults 4000m at 200m intervals around faults using ESRI buffer tool	3,400	61,424	87,748	56	-0.4	0.1	0.7	0.1	-1.2	0.2	-6.3
Lower Order Faults Associated with Au	Structural control at a local level.	Buffered faults 4000m at 200m intervals around faults within 2500 metres of known workings using ESRI buffer tool	2,200	19,182	27,402	38	-0.2	0.2	0.1	0.1	-0.2	0.2	-1.2

Appendix 2 Paleozoic Gold Deposits

Spatial Variable	Measure	Technique	ID	Area	Units	No.	W+	Ws+	W-	Ws-	C	Cs	Stud C
Lower Order Fault associated with mineralisation N-Orientation	Preferred orientation of structure	Buffered faults 4000m at 200m intervals around faults within 2500 metres of known workings using ESRI buffer tool. Select only Pz faults. Select only N-trending faults.	2,400	11,457	16,367	59	0.2	0.1	-0.1	0.1	0.3	0.2	1.6
Lower Order Fault associated with mineralisation NW-Orientation	Preferred orientation of structure	Buffered faults 4000m at 200m intervals around faults within 2500 metres of known workings using ESRI buffer tool. Select only Pz faults. Select only N-trending faults.	3,200	2,259	3,228	68	0.1	0.1	-0.3	0.2	0.4	0.3	1.7
Lower Order Fault associated with mineralisation E-Orientation	Preferred orientation of structure	Buffered faults 4000m at 200m intervals around faults within 2500 metres of known workings using ESRI buffer tool. Select only Pz faults. Select only N-trending faults.	800	188	268	9	1.2	0.3	-0.2	0.2	1.3	0.4	3.6
Regional Fault Intensity	Structural control at a regional scale as determined by intensity of faulting	Fault Density maps created by creating a point every 10m along a fault then gridding the density of fault points in the theme.	2	26,171	37,387	49	1.1	0.1	-0.8	0.2	2.0	0.2	8.0
Lower Order Fault Intensity	Structural control as determined by intensity of faulting	Fault Density maps created by creating a point every 10m along a fault then gridding the density of fault points in the theme.	2	12,467	17,810	21	1.0	0.2	-0.2	0.1	1.2	0.3	4.8
Folds	Structural control at a local level.	Buffered folds 10,000m at 200m intervals around folds within 2500 metres of known workings using ESRI buffer tool	2,000	18,148	25,925	6	0.6	0.4	0.0	0.1	0.7	0.4	1.6
Folds associated with mineralisation NE-Orientation	Preferred orientation of structure	Buffered folds 10,000m at 200m intervals around folds within 2500 metres of known workings using ESRI buffer tool. Select only Pz folds. Select only NE-trending folds.	2,400	4,669	6,670	22	1.7	0.2	-0.3	0.2	2.0	0.3	7.8
Folds associated with mineralisation NW-Orientation	Preferred orientation of structure	Buffered folds 10,000m at 200m intervals around folds within 2500 metres of known workings using ESRI buffer tool. Select only Pz folds. Select only NW-trending folds.	3,400	2,342	3,346	21	1.0	0.2	-0.3	0.2	1.3	0.3	4.9
Fold Tightness Density Map	Tightness or density of folding.	Density grid calculated from points derived from 100m split of fold axes	2	314	448	59	1.5	0.1	-1.5	0.3	3.0	0.3	9.9

Appendix 2 Paleozoic Gold Deposits

Spatial Variable	Measure	Technique	ID	Area	Units	No.	W+	Ws+	W-	Ws-	C	Cs	Stud C
		theme.											
N/NE Fault Intersections	Mineralisation controlled by intersecting faults.	Create point theme of fault intersections. Then buffer round these points.	800	2,254	3,221	7	1.5	0.4	-0.2	0.2	1.7	0.4	4.0
Fold-Fault Intersection	Mineralisation controlled by intersecting folds and faults.	Create point theme of fault intersections. Then buffer round these points.	2,400	468	669	11	1.2	0.3	-0.2	0.1	1.4	0.3	4.1
Geology													
Terrain Stratigraphy	Age range.	QMAP geology.	Buller	3,163	4,519	81	3.4	0.1	-0.8	0.1	4.2	0.2	24.9
Terrain Stratigraphy	Age range.	QMAP geology.	Takaka	1,572	2,245	50	3.6	0.1	-0.4	0.1	4.0	0.2	22.8
Sequence Stratigraphy	Age range.	QMAP geology.	Devil River Volcanics Group	167	239	9	4.1	0.3	-0.1	0.1	4.2	0.4	12.0
Sequence Stratigraphy	Age range.	QMAP geology.	Golden Bay Group	372	531	6	2.9	0.4	0.0	0.1	3.0	0.4	7.1
Sequence Stratigraphy	Age range.	QMAP geology.	Greenland Group	2,287	3,267	75	3.6	0.1	-0.7	0.1	4.4	0.2	26.0
Sequence Stratigraphy	Age range.	QMAP geology.	Haupiri Group	247	353	13	4.1	0.3	-0.1	0.1	4.2	0.3	14.3
Sequence Stratigraphy	Age range.	QMAP geology.	Mount Arthur Group	724	1,034	8	2.5	0.4	-0.1	0.1	2.6	0.4	7.1
Sequence Stratigraphy	Age range.	QMAP geology.	Patriarch Group	130	185	3	3.3	0.6	0.0	0.1	3.3	0.6	5.6
Stratigraphy	Age range.	QMAP geology.	Anatoki Formation	89	127	1	2.6	1.0	0.0	0.1	2.6	1.0	2.5
Stratigraphy	Age range.	QMAP geology.	Aorangi Mine Formation	154	220	3	3.1	0.6	0.0	0.1	3.1	0.6	5.3
Stratigraphy	Age range.	QMAP geology.	Arthur Marble 1	123	176	1	2.2	1.0	0.0	0.1	2.2	1.0	2.2
Stratigraphy	Age range.	QMAP geology.	Aspiring lithological assoc.	3,096	4,424	1	-1.0	1.0	0.0	0.1	-1.0	1.0	-1.0
Stratigraphy	Age range.	QMAP geology.	Balloon Melange	88	126	11	5.0	0.3	-0.1	0.1	5.1	0.3	15.6
Stratigraphy	Age range.	QMAP geology.	Benson Volcanics	122	174	8	4.4	0.4	-0.1	0.1	4.4	0.4	11.9

Appendix 2 Paleozoic Gold Deposits

Spatial Variable	Measure	Technique	ID	Area	Units	No.	W+	Ws+	W-	Ws-	C	Cs	Stud C
Stratigraphy	Age range.	QMAP geology.	Cobb Igneous Complex	14	20	1	4.5	1.0	0.0	0.1	4.5	1.0	4.3
Stratigraphy	Age range.	QMAP geology.	Golden Bay Group	29	41	1	3.7	1.0	0.0	0.1	3.7	1.0	3.6
Stratigraphy	Age range.	QMAP geology.	Golden Bay Schist	7	10	1	5.2	1.1	0.0	0.1	5.2	1.1	4.9
Stratigraphy	Age range.	QMAP geology.	Greenland Group	1,713	2,447	72	3.9	0.1	-0.7	0.1	4.6	0.2	27.2
Stratigraphy	Age range.	QMAP geology.	Haupiri Group	63	90	9	5.2	0.4	-0.1	0.1	5.2	0.4	14.5
Stratigraphy	Age range.	QMAP geology.	Karamea Suite	1,499	2,141	2	0.4	0.7	0.0	0.1	0.4	0.7	0.6
Stratigraphy	Age range.	QMAP geology.	Leslie/Slaty Creek Formation	58	83	1	3.0	1.0	0.0	0.1	3.0	1.0	3.0
Stratigraphy	Age range.	QMAP geology.	Patriarch/Owen Formation	35	50	2	4.2	0.7	0.0	0.1	4.2	0.7	5.8
Stratigraphy	Age range.	QMAP geology.	Roaring Lion Formation	474	678	1	0.9	1.0	0.0	0.1	0.9	1.0	0.9
Stratigraphy	Age range.	QMAP geology.	Salisbury Conglomerate	63	89	2	3.6	0.7	0.0	0.1	3.6	0.7	5.0
Stratigraphy	Age range.	QMAP geology.	Tasman Formation	85	121	1	2.6	1.0	0.0	0.1	2.6	1.0	2.6
Stratigraphy	Age range.	QMAP geology.	Thompson Formation	9	12	1	5.0	1.0	0.0	0.1	5.0	1.0	4.8
Stratigraphy	Age range.	QMAP geology.	Waingaro Schist	87	125	6	4.4	0.4	0.0	0.1	4.4	0.4	10.4
Stratigraphy	Age range.	QMAP geology.	Wangapeka/ Baldy Formation	317	453	7	3.2	0.4	0.0	0.1	3.3	0.4	8.4
Stratigraphy	Age range.	QMAP geology.	Webb Formation	100	143	2	3.1	0.7	0.0	0.1	3.1	0.7	4.4
Rock type	Rock composition.	QMAP geology.	argillite	828	1,183	14	3.0	0.3	-0.1	0.1	3.1	0.3	10.8
Rock type	Rock composition.	QMAP geology.	basalt	148	211	8	4.2	0.4	-0.1	0.1	4.2	0.4	11.4
Rock type	Rock composition.	QMAP geology.	conglomerate	110	158	2	3.0	0.7	0.0	0.1	3.0	0.7	4.3
Rock type	Rock composition.	QMAP geology.	gabbro	484	691	1	0.9	1.0	0.0	0.1	0.9	1.0	0.9

Appendix 2 Paleozoic Gold Deposits

Spatial Variable	Measure	Technique	ID	Area	Units	No.	W+	Ws+	W-	Ws-	C	Cs	Stud C
Rock type	Rock composition.	QMAP geology.	granite	4,175	5,965	2	-0.6	0.7	0.0	0.1	-0.6	0.7	-0.9
Rock type	Rock composition.	QMAP geology.	greenschist	613	876	7	2.6	0.4	0.0	0.1	2.6	0.4	6.7
Rock type	Rock composition.	QMAP geology.	limestone	347	496	1	1.2	1.0	0.0	0.1	1.2	1.0	1.2
Rock type	Rock composition.	QMAP geology.	melange	303	433	11	3.7	0.3	-0.1	0.1	3.8	0.3	12.0
Rock type	Rock composition.	QMAP geology.	sandstone	13,175	18,822	76	1.9	0.1	-0.7	0.1	2.5	0.2	15.2
Rock type	Rock composition.	QMAP geology.	schist	18,069	25,812	1	-2.8	1.0	0.1	0.1	-2.9	1.0	-2.9
Rock type	Rock composition.	QMAP geology.	conglomerate	371	530	11	3.5	0.3	-0.1	0.1	3.6	0.3	11.4
Qtz Vein Density	Density of quartz veining representing possible centres of fluid flow.	Create point theme from linear quartz vein theme. Then create density map from points.	2	478	683	57	1.4	0.1	-1.9	0.4	3.3	0.4	8.6
Geochemistry													
Rock Ag	Geochemical pathfinder for gold, which has a larger geochemical signature within alteration halos around gold deposits.	Calculate anomalous values using 90 percentile to cut the data and then the 90 percentile for anomalous threshold. Buffer up to 4000m and test spatial correlation.	No Spatial Correlation										None
SS Ag	Geochemical pathfinder for gold, which has a larger geochemical signature within alteration halos around gold deposits, especially with dispersion down rivers and streams.	Buffered point data. Buffers every 200 metres over 4000 metres around each anomalous sample. This will be combined with buffers around non anomalous samples. The nonbuffered area will be missing data.	1,200	1,054	1,505	29	0.7	0.2	-0.4	0.2	1.1	0.3	4.3
Rock As	Geochemical pathfinder for gold, which has a larger geochemical signature within alteration halos around gold deposits.	Calculate anomalous values using 90 percentile to cut the data and then the 90 percentile for anomalous threshold. Buffer up to 4000m and test spatial correlation.	700	196	280	5	1.8	0.5	-0.5	0.4	2.3	0.6	3.8
SS As	Geochemical pathfinder for gold, which has a larger geochemical signature within alteration halos around gold deposits, especially with dispersion down rivers and streams.	Buffered point data. Buffers every 200 metres over 4000 metres around each anomalous sample. This will be combined with buffers around non anomalous samples. The nonbuffered area will be missing data.	1,400	1,567	2,238	37	1.4	0.2	-0.4	0.1	1.8	0.2	8.3
Rock Au	Rock chip samples for gold	Calculate anomalous values using 90 percentile to cut the data and then the 90 percentile for anomalous threshold. Buffer up to	600	163	233	3	2.2	0.6	-0.6	0.6	2.9	0.8	3.5

Appendix 2 Paleozoic Gold Deposits

Spatial Variable	Measure	Technique	ID	Area	Units	No.	W+	Ws+	W-	Ws -	C	Cs	Stud C
		4000m and test spatial correlation.											
SS Pancon Au	Geochemical sample of concentrated heavy minerals from streams analysed for gold.	Buffered point data. Buffers every 200 metres over 4000 metres around each anomalous sample. This will be combined with buffers around non anomalous samples. The nonbuffered area will be missing data.	1,400	1,236	1,766	29	0.8	0.2	-0.5	0.2	1.3	0.3	4.8
SS Au	BLEG and ordinary sieved stream sediment samples analysed for gold. Both BLEG and Sieved stream sediment samples have similar statistical distributions.	Buffered point data. Buffers every 200 metres over 4000 metres around each anomalous sample. This will be combined with buffers around non anomalous samples. The nonbuffered area will be missing data.	1,000	1,329	1,899	33	1.2	0.2	-0.6	0.2	1.8	0.3	6.9
Rock Cu	Geochemical pathfinder for gold, which has a larger geochemical signature within alteration halos around gold deposits.	Calculate anomalous values using 90 percentile to cut the data and then the 90 percentile for anomalous threshold. Buffer up to 4000m and test spatial correlation.	2,600	3,578	5,111	27	0.3	0.2	-0.5	0.3	0.9	0.4	2.4
SS Cu	Geochemical pathfinder for gold, which has a larger geochemical signature within alteration halos around gold deposits, especially with dispersion down rivers and streams.	Buffered point data. Buffers every 200 metres over 4000 metres around each anomalous sample. This will be combined with buffers around non anomalous samples. The nonbuffered area will be missing data.	200	174	248	12	1.7	0.3	-0.1	0.1	1.8	0.3	5.7
Rock Pb	Geochemical pathfinder for gold, which has a larger geochemical signature within alteration halos around gold deposits.	Calculate anomalous values using 90 percentile to cut the data and then the 90 percentile for anomalous threshold. Buffer up to 4000m and test spatial correlation.	500	239	342	7	1.7	0.4	-0.1	0.2	1.8	0.4	4.5

Appendix 2 Paleozoic Gold Deposits

Spatial Variable	Measure	Technique	ID	Area	Units	No.	W+	Ws+	W-	Ws-	C	Cs	Stud C
SS Pb	Geochemical pathfinder for gold, which has a larger geochemical signature within alteration halos around gold deposits, especially with dispersion down rivers and streams.	Buffered point data. Buffers every 200 metres over 4000 metres around each anomalous sample. This will be combined with buffers around non anomalous samples. The nonbuffered area will be missing data.	1,000	1,517	2,167	32	0.5	0.2	-0.2	0.1	0.7	0.2	3.1
Rock Sb	Geochemical pathfinder for gold, which has a larger geochemical signature within alteration halos around gold deposits.	Calculate anomalous values using 90 percentile to cut the data and then the 90 percentile for anomalous threshold. Buffer up to 4000m and test spatial correlation.	No Spatial Correlation										None
SS Sb	Geochemical pathfinder for gold, which has a larger geochemical signature within alteration halos around gold deposits, especially with dispersion down rivers and streams.	Buffered point data. Buffers every 200 metres over 4000 metres around each anomalous sample. This will be combined with buffers around non anomalous samples. The nonbuffered area will be missing data.	No Spatial Correlation										None
Rock W	Geochemical pathfinder for gold, which has a larger geochemical signature within alteration halos around gold deposits.	Calculate anomalous values using 90 percentile to cut the data and then the 90 percentile for anomalous threshold. Buffer up to 4000m and test spatial correlation.	No Spatial Correlation										None
SS W	Geochemical pathfinder for gold, which has a larger geochemical signature within alteration halos around gold deposits, especially with dispersion down rivers and streams.	Buffered point data. Buffers every 200 metres over 4000 metres around each anomalous sample. This will be combined with buffers around non anomalous samples. The nonbuffered area will be missing data.	3000	4,999	7,141	30	0.1	0.2	-0.6	0.4	0.7	0.5	1.5
Rock Zn	Geochemical pathfinder for gold, which has a larger geochemical signature within alteration halos around gold deposits.	Calculate anomalous values using 90 percentile to cut the data and then the 90 percentile for anomalous threshold. Buffer up to 4000m and test spatial correlation.	400	132	188	5	2.0	0.5	-0.1	0.2	2.1	0.5	4.4

Appendix 2 Paleozoic Gold Deposits

Spatial Variable	Measure	Technique	ID	Area	Units	No.	W+	Ws+	W-	Ws-	C	Cs	Stud C
SS Zn	Geochemical pathfinder for gold, which has a larger geochemical signature within alteration halos around gold deposits, especially with dispersion down rivers and streams.	Buffered point data. Buffers every 200 metres over 4000 metres around each anomalous sample. This will be combined with buffers around non anomalous samples. The nonbuffered area will be missing data.	400	517	739	17	1.1	0.2	-0.2	0.1	1.3	0.3	4.6
Rock Ag	Theme contains spatial area relating to anomalous geochemistry and background geochemistry.	Anomaly theme calculated by defining spatial correlation from buffered anomalous samples compared to buffered background samples.	2	83	118	1	0.3	1.0	-0.1	0.7	0.4	1.2	0.3
SS Ag	Theme contains spatial area relating to anomalous geochemistry and background geochemistry.	Anomaly theme calculated by defining spatial correlation from buffered anomalous samples compared to buffered background samples.	2	1,054	1,505	29	1.1	0.2	-0.7	0.2	1.8	0.3	6.2
Rock As	Theme contains spatial area relating to anomalous geochemistry and background geochemistry.	Anomaly theme calculated by defining spatial correlation from buffered anomalous samples compared to buffered background samples.	2	198	283	5	1.2	0.5	-1.0	0.7	2.2	0.8	2.7
SS As	Theme contains spatial area relating to anomalous geochemistry and background geochemistry.	Anomaly theme calculated by defining spatial correlation from buffered anomalous samples compared to buffered background samples.	2	1,567	2,238	37	0.9	0.2	-1.1	0.3	2.0	0.3	5.7
Rock Au	Theme contains spatial area relating to anomalous geochemistry and background geochemistry.	Anomaly theme calculated by defining spatial correlation from buffered anomalous samples compared to buffered background samples.	No Spatial Correlation										None
SS Pancon Au	Theme contains spatial area relating to anomalous geochemistry and background geochemistry.	Anomaly theme calculated by defining spatial correlation from buffered anomalous samples compared to buffered background samples.	2	768	1,098	20	0.9	0.2	-1.2	0.4	2.1	0.5	4.1

Appendix 2 Paleozoic Gold Deposits

Spatial Variable	Measure	Technique	ID	Area	Units	No.	W+	Ws+	W-	Ws-	C	Cs	Stud C
SS Au	Theme contains spatial area relating to anomalous geochemistry and background geochemistry.	Anomaly theme calculated by defining spatial correlation from buffered anomalous samples compared to buffered background samples.	2	1,723	2,462	37	0.8	0.2	-1.3	0.4	2.1	0.4	5.5
Rock Cu	Theme contains spatial area relating to anomalous geochemistry and background geochemistry.	Anomaly theme calculated by defining spatial correlation from buffered anomalous samples compared to buffered background samples.	2	385	550	5	0.4	0.4	-0.3	0.4	0.7	0.6	1.1
SS Cu	Theme contains spatial area relating to anomalous geochemistry and background geochemistry.	Anomaly theme calculated by defining spatial correlation from buffered anomalous samples compared to buffered background samples.	2	1,130	1,615	33	1.2	0.2	-1.3	0.3	2.5	0.4	6.6
Rock Pb	Theme contains spatial area relating to anomalous geochemistry and background geochemistry.	Anomaly theme calculated by defining spatial correlation from buffered anomalous samples compared to buffered background samples.	2	386	551	7	0.7	0.4	-0.8	0.6	1.5	0.7	2.2
SS Pb	Theme contains spatial area relating to anomalous geochemistry and background geochemistry.	Anomaly theme calculated by defining spatial correlation from buffered anomalous samples compared to buffered background samples.	2	1,517	2,167	32	0.9	0.2	-0.8	0.3	1.8	0.3	5.7
Rock Sb	Theme contains spatial area relating to anomalous geochemistry and background geochemistry.	Anomaly theme calculated by defining spatial correlation from buffered anomalous samples compared to buffered background samples.	2										None
SS Sb	Theme contains spatial area relating to anomalous geochemistry and background geochemistry.	Anomaly theme calculated by defining spatial correlation from buffered anomalous samples compared to buffered background samples.	2	1,629	2,327	6	-0.9	0.4	0.4	0.2	-1.3	0.5	-2.8
Rock W	Theme contains spatial area relating to anomalous geochemistry and background geochemistry.	Anomaly theme calculated by defining spatial correlation from buffered anomalous samples compared to buffered background samples.	2										None

Appendix 2 Paleozoic Gold Deposits

Spatial Variable	Measure	Technique	ID	Area	Units	No.	W+	Ws+	W-	Ws-	C	Cs	Stud C
SS W	Theme contains spatial area relating to anomalous geochemistry and background geochemistry.	Anomaly theme calculated by defining spatial correlation from buffered anomalous samples compared to buffered background samples.	2	2,917	4,168	17	0.1	0.2	0.0	0.2	0.1	0.3	0.3
Rock Zn	Theme contains spatial area relating to anomalous geochemistry and background geochemistry.	Anomaly theme calculated by defining spatial correlation from buffered anomalous samples compared to buffered background samples.	2	725	1,035	10	0.6	0.3	-0.5	0.4	1.1	0.5	2.1
SS Zn	Theme contains spatial area relating to anomalous geochemistry and background geochemistry.	Anomaly theme calculated by defining spatial correlation from buffered anomalous samples compared to buffered background samples.	2	5,450	7,786	67	0.5	0.1	-0.7	0.2	1.2	0.2	5.2
Alluvial Deposits	Bulk geochemical tracer	Buffer known deposits to test for a spatial correlation.	11,000	695,774	993,962	63	0.2	0.1	-1.4	0.5	1.7	0.5	3.2

Appendix 3
Paleozoic Spatial Correlation Results Based on Stratigraphy

Appendix 3 Paleozoic Spatial Correlation Results Based on Stratigraphy

Variable ID	Area	Units	Number	W+	Ws+	W-	Ws-	C	Cs	Stud C
Anatoki Formation	88.9899	127.1285	1	2.6	1.0	0.0	0.1	2.6	1.0	2.5
Aorangi Mine Formation	153.9447	219.9209	3	3.1	0.6	0.0	0.1	3.1	0.6	5.3
Arthur Marble 1	122.8755	175.5364	1	2.2	1.0	0.0	0.1	2.2	1.0	2.2
Aspiring lithological assoc.	3096.4758	4423.5368	1	-1.0	1.0	0.0	0.1	-1.0	1.0	-1.0
Balloon Melange	88.3714	126.2448	11	5.0	0.3	-0.1	0.1	5.1	0.3	15.6
Benson Volcanics	121.6848	173.8354	8	4.4	0.4	-0.1	0.1	4.4	0.4	11.9
Cobb Igneous Complex	13.8067	19.7238	1	4.5	1.0	0.0	0.1	4.5	1.0	4.3
Golden Bay Group	28.6708	40.9583	1	3.7	1.0	0.0	0.1	3.7	1.0	3.6
Golden Bay Schist	7.2216	10.3166	1	5.2	1.1	0.0	0.1	5.2	1.1	4.9
Greenland Group	1712.6396	2446.628	72	3.9	0.1	-0.7	0.1	4.6	0.2	27.2
Haupiri Group	63.3311	90.4731	9	5.2	0.4	-0.1	0.1	5.2	0.4	14.5
Karamea Suite	1498.9771	2141.3958	2	0.4	0.7	0.0	0.1	0.4	0.7	0.6
Leslie/Slaty Creek Formation	57.8911	82.7016	1	3.0	1.0	0.0	0.1	3.0	1.0	3.0
Patriarch/Owen Formation	35.0754	50.1077	2	4.2	0.7	0.0	0.1	4.2	0.7	5.8
Roaring Lion Formation	474.2767	677.5381	1	0.9	1.0	0.0	0.1	0.9	1.0	0.9
Salisbury Conglomerate	62.6012	89.4303	2	3.6	0.7	0.0	0.1	3.6	0.7	5.0
Tasman Formation	85.0384	121.4834	1	2.6	1.0	0.0	0.1	2.6	1.0	2.6
Thompson Formation	8.5747	12.2496	1	5.0	1.0	0.0	0.1	5.0	1.0	4.8
Waingaro Schist	87.2005	124.5721	6	4.4	0.4	0.0	0.1	4.4	0.4	10.4
Wangapeka/Baldy Formation	317.139	453.0558	7	3.2	0.4	0.0	0.1	3.3	0.4	8.4
Webb Formation	100.3334	143.3334	2	3.1	0.7	0.0	0.1	3.1	0.7	4.4

Appendix 4

Paleozoic Spatial Correlation Results Based on Lithology

Appendix 4 Paleozoic Spatial Correlation Results Based on Lithology

Variable ID	Area	Units	Number	W+	Ws+	W-	Ws-	C	Cs	Stud C
argillite	828.3189	1183.313	14	3.0	0.3	-0.1	0.1	3.1	0.3	10.8
basalt	147.5123	210.7319	8	4.2	0.4	-0.1	0.1	4.2	0.4	11.4
conglomerate	110.4324	157.7605	2	3.0	0.7	0.0	0.1	3.0	0.7	4.3
conglomerate	371.1175	530.1678	11	3.5	0.3	-0.1	0.1	3.6	0.3	11.4
gabbro	483.7883	691.1261	1	0.9	1.0	0.0	0.1	0.9	1.0	0.9
granite	4175.15	5964.5	2	-0.6	0.7	0.0	0.1	-0.6	0.7	-0.9
greenschist	613.4484	876.3548	7	2.6	0.4	0.0	0.1	2.6	0.4	6.7
limestone	347.2371	496.0531	1	1.2	1.0	0.0	0.1	1.2	1.0	1.2
melange	302.9656	432.808	11	3.7	0.3	-0.1	0.1	3.8	0.3	12.0
sandstone	13175.11	18821.59	76	1.9	0.1	-0.7	0.1	2.5	0.2	15.2
schist	18068.62	25812.31	1	-2.8	1.0	0.1	0.1	-2.9	1.0	-2.9

Appendix 5

Mesozoic Spatial Correlation Results Based on Stratigraphy Appendix 5 Mesozoic Spatial Correlation Results Based on Stratigraphy

Variable ID	**Area**	**Units**	**Number**	**W+**	**Ws+**	**W-**	**Ws-**	**C**	**Cs**	**Stud C**
Wakamarina Quartzite	10	14	1	4.60	1.04	-0.01	0.07	4.61	1.04	4.43
Aspiring lithologic association	103	148	3	3.28	0.58	-0.02	0.07	3.29	0.59	5.60
Aspiring Lithological Associatio	2,903	4,147	45	2.64	0.15	-0.27	0.09	2.91	0.17	16.85
Haast Schist	5,623	8,034	56	2.19	0.13	-0.33	0.09	2.53	0.16	15.70
Star Formation	142	203	1	1.85	1.00	0.00	0.07	1.85	1.01	1.84
Wanaka Lithological Association	2,026	2,895	13	1.75	0.28	-0.06	0.08	1.81	0.29	6.29
Caples Group	8,538	12,198	36	1.33	0.17	-0.17	0.08	1.50	0.19	8.04
Aspiring lithological assoc.	3,096	4,424	4	0.15	0.50	0.00	0.08	0.15	0.51	0.30
Esk Head Belt	983	1,404	1	-0.09	1.00	0.00	0.07	-0.09	1.00	-0.09

Appendix 6
Mesozoic Spatial Correlation Results Based on Lithology

Appendix 6 Mesozoic Spatial Correlation Results Based on Lithology

Variable ID	Area	Units	Number	W+	Ws+	W-	Ws-	C	Cs	Stud C
metapelite	3,318	4,740	45	2.51	0.15	-0.26	0.09	2.77	0.17	16.06
quartzite	110	157	1	2.10	1.00	0.00	0.07	2.11	1.01	2.09
schist	18,069	25,812	108	1.68	0.10	-0.78	0.12	2.46	0.15	16.32
mylonite	285	408	1	1.15	1.00	0.00	0.07	1.15	1.00	1.14
greenschist	613	876	2	1.07	0.71	-0.01	0.07	1.08	0.71	1.52
semischist	3,281	4,687	5	0.31	0.45	-0.01	0.08	0.32	0.45	0.70
sandstone	13,175	18,822	12	-0.20	0.29	0.02	0.08	-0.22	0.30	-0.73
metasandstone	3,303	4,719	3	-0.21	0.58	0.00	0.07	-0.21	0.58	-0.36

Appendix 7
Geochemical Statistical Summary

Appendix 7

Data Set	Upper Cut	Total Analysed	Lower Threshold	Total Used	Total Anomalous	Average	SD	Paleozoic Training Used	Paleozoic Training Found	Paleozoic Spatial Zone (m)	Paleozoic StudC	Mesozoic Spatial Zone (m)	Mesozoic Training Used	Mesozoic Training Found	Mesozoic StudC
RK Ag	0.1 ppm	1369	0.001	1223	142	8.7	76.9	144		No Spatial Correlation	NA	600	182	39	14.1
SS Ag	1.3 ppm	9444	0.7 ppm	8282	1248	3	35.9	144	29	1,200	4.3	1,200	182	28	6.1
RK As	452 ppm	2239	50 ppm	1368	433	5581.6	25444	144	5	700	3.8	600	182	49	14.1
SS As	60 ppm	5958	40 ppm	5375	1137	120.3	518.8	144	37	1,400	8.3	800	182	53	15.3
RK Au	1000 ppb	1872	70 ppb	1685	373	5778.2	16807.3	144	3	600	3.5	400	182	34	14.6
SS Au	190 ppb	7880	40 ppb	7096											
SS Au PC	***712 ppb***	***2237***	***119.8 ppb***	***2013***	***426***	***14253.7***	***67094.4***	144	29	1,400	4.7	1,000	182	55	10.5
SS Au BLEG	*3320*	*199*	*1820 ppb*	*179*											
SS Au Sieve	*80 ppb*	*5444*	*17 ppb*	*4907*											
SS Au B&S	**100 ppb**	**5643**	**20 ppb**	**5102**	**1077**	**1543.7**	**11311.2**	144	33	1,000	6.9	1,400	182	34	4.7
RK Cu	67 ppm	2523	39 ppm	2272	500	194.3	649.4	144	27	2,600	2.4	700	182	37	12.5
SS Cu	55 ppm	15232	39.2 ppm	13719	2885	93.2	449.2	144	12	200	5.7	800	182	32	6.9
RK Pb	27 ppm	2562	20 ppm	2314	551	104.5	825.5	144	7	500	4.4	700	182	41	13.5
SS Pb	35 ppm	14512	28 ppm	13259	2725	56.7	450.7	144	32	1,000	3.1	No Spatial Correlation	182		NA
RK Sb	32 ppm	841	13 ppm	757	166	716.7	6923.6	144		No Spatial Correlation	NA	700	182	37	11.0
SS Sb	1.9 ppm	3091	0.38 ppm	2783	588	59.4	960.2	144		No Spatial Correlation	NA	1,600	182	54	4.9
RK W	365 ppm	659	19.6 ppm	593	126	6666.2	24800.6	144		No Spatial Correlation	NA	No Spatial Correlation	182		NA
SS W	34 ppm	6856	14 ppm	6183	1318	218.7	3382.8	144	30	3,000	1.4	1,800	182	58	5.7
RK Zn	110 ppm	2546	91 ppm	2303	481	154.6	336.3	144	5	400	4.4	1,000	182	35	10.2
SS Zn	110 ppm	14589	92 ppm	13165	2798	188.9	925.5	144	17	400	4.6	2,800	182	40	2.8