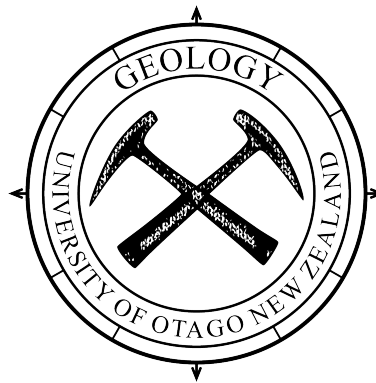


# **GEOOL 302 (or GEOOL304)**

## **Handbook 2022**



## GEOL302/304 INDEPENDENT PROJECT

**PREREQUISITES:** GEOL 251 and 252

**CO-REQUISITES:** GEOL 344

**PAPER COORDINATOR:** Steven Smith

**TEACHING STAFF:** All staff

**FORMAT:** Full year; no lectures; no laboratories.

### KEY MEETING DATES:

**First Friday of semester: 09:30**

Introduction to GEOL302/304. If you miss this meeting you will not be allowed to take GEOL302/304.

**Third Friday of semester: 09:30**

How to successfully complete a Field Risk Assessment Form (FRAF), and introduction to GetHomeSafe Mobile Phone App.

**ASSESSMENT AND DEADLINES:** (further information on each of these components is provided below).

Assessment	Weighting	Deadline
Primary data collection must be finished		<b>Friday 13<sup>th</sup> May, 5 pm</b>
Mini-conference poster session. Presentation of e.g. final mapsheet for mapping projects, scientific poster with data for lab-based projects.	30%	<b>Friday 27<sup>th</sup> May, 10 am – 12 pm</b>
Final report – electronic and hard-copy versions	70%	<b>Friday 16<sup>th</sup> September, 5 pm</b>

### PRIZES AND AWARDS:

#### Geology Department Mapsheet award

This prize is awarded to the student who is deemed to have produced the most professional geological mapsheet, and to have presented their mapsheet with knowledge and enthusiasm. This will be judged by a panel of staff during the mini-conference.

## **JD Campbell Prize in Geology – 300-level project**

Established in 1984 by a group of friends and former students of Associate Professor J.D. Campbell. The prize is awarded annually by the University Council on the recommendation of the Pro-Vice-Chancellor (Sciences), to the student presenting the best independent project for Geology at 300-level.

### **BACKGROUND REQUIREMENTS:**

Basic field skills, geological mapping skills, geological analysis in the field (e.g. stereographic analysis, sedimentary analysis), hand-specimen identification, and petrographic skills. Tertiary-level writing skills.

### **TEXTBOOKS:** these may be helpful.

Coe, A. (ed.); 2010. Geological Field Techniques. Wiley-Blackwell

Fry, N. The Field Description of Metamorphic Rocks. Wiley.

Jerram, D. & Petford, N. The Field Description of Igneous Rocks. Wiley.

Lisle, R., Brabham, P & Barnes, J. Basic Geological Mapping. Wiley.

McClay, K. Mapping of Geological Structures, Wiley.

Tucker, M.E. Sedimentary Rocks in the Field: A Practical Guide. Wiley.

### **PURPOSE:**

This paper is intended to develop a range of geological skills, including some of *stratigraphy, mapping, structural geometry, facies analysis, petrography, and library research*. The report resulting from the independent project develops abilities in *written communication and geological interpretation*.

## **GEOL 302: Marking and expectations**

**Marking criteria for written reports and graphic syntheses (e.g. map sheets) are provided at the end of this Handbook. Study the marking criteria carefully.**

**GEOL302/304 is your opportunity to demonstrate an understanding of standard analytical techniques that are used widely in academia and industry.**

**To obtain a good mark in this paper, you must demonstrate that you can apply appropriate forms of geological data collection and analysis.** At the foot of this page is a short list of standard techniques that can be used to collect, analyze and interpret the geological history, composition and structure of rocks. This list is not exhaustive, and you will be able to think of other techniques that you have already come across. Where appropriate, you are expected to use these techniques during your GEOL302/304 project.

### **For example:**

If you map an area that contains sedimentary rocks, you will be expected to apply standard techniques such as stratigraphic logging, facies analysis, grain size and paleocurrent analysis, analysis of grain compositions (and so on). If you map an area that contains sedimentary rocks and you do not apply these standard techniques, you will not receive a good mark.

If you map an area that contains deformed basement rocks, you will be expected to apply standard techniques such as structural analysis (with data presented on e.g. stereoplots), analysis of crosscutting relationships, determination of metamorphic grade, fault rock analysis (and others). If you map an area that contains deformed basement rocks and you do not apply these standard techniques, you will not receive a good mark.

The same reasoning applies for other rock types, field areas, and types of project.

Some standard geological techniques that you are expected to use, where appropriate, during your GEOL302/304 project:

- Stratigraphic logging
- Paleocurrent analysis
- Clast composition and grain size analysis
- Facies analysis
- Stereoplot presentation and analysis of structural data
- Detailed mapping and assessment of cross-cutting relationships
- Point counting of mineral abundances
- Qualitative and quantitative thin section descriptions

## **GEOL302 Independent field-based project: Timetable 2022**

Note that for GEOL304 projects the timetable will be set in consultation with your supervisor and the paper coordinator

<b>First Friday of semester: 09:30</b> Introduction to GEOL302/304. If you miss this meeting you will not be allowed to take GEOL302/304.
<b>Second Friday of semester</b>  Final date for <i>approval</i> of two initial Google Forms linked below.  Google Form 1: <a href="https://docs.google.com/forms/d/e/1FAIpQLSfaYu6lyf1FYw1h5Yli0kkaCZyFisMbAjjMK5qp64S7TYAqbA/viewform">https://docs.google.com/forms/d/e/1FAIpQLSfaYu6lyf1FYw1h5Yli0kkaCZyFisMbAjjMK5qp64S7TYAqbA/viewform</a> Google Form 2: <a href="https://docs.google.com/forms/d/e/1FAIpQLSfJgZHJ4GXLNh4c67CRz_AjbNo2dd3PWP_yfAdbhFwQxe5ng/viewform">https://docs.google.com/forms/d/e/1FAIpQLSfJgZHJ4GXLNh4c67CRz_AjbNo2dd3PWP_yfAdbhFwQxe5ng/viewform</a>
<b>Third Friday of semester: 09:30.</b> Mandatory meeting: Successfully completing a FRAF, and using the GetHome Safe App.
<b>March-April</b> Carry out field or lab work. If doing a geological mapping project, visit field area for about 1 week (Geology has a week without 300-level classes before Easter for this purpose, and Easter week is also a good time to perform field work). Arrange supervisor visit mid-way through fieldwork.
<b>Second Friday in May, 5 pm</b> Primary data collection must be finished. If you are doing a geological mapping project, your fieldwork must be completed by this date. If you are doing a lab-based project, your primary experiments and data-collection phase must be completed.
<b>Mid-May (dates to follow from Brent)</b> Training in making thin sections. Groups of 3-5 students should arrange a training time with Brent Pooley. Training is not available outside these dates. Untrained users will not be allowed in the thin section lab.
<b>Penultimate Friday of semester 1, 10 am – 12 pm (30%)</b> Presentation of final graphic synthesis (e.g. final mapsheet, scientific poster) during a mini-conference in the Geology Department. The hard-copy map will be submitted as a final product immediately after the presentations. More details at the back of the Handbook.
<b>Final day of semester 1</b> Deadline for students to send personal letters of thanks to landowners. Addressed envelopes with letters should be brought to the academic administrator. <i>Your project will not be marked as complete without this letter.</i>
<b>Friday 16<sup>th</sup> September, 5 pm (70%)</b> Deadline for submission of completed GEOL302 report. Electronic version should be submitted on Blackboard: PDF format at <30MB. Hard-copy version should be printed double-sided and soft-bound. Please fold your final map sheet or poster and insert in to a map pocket in the back of your report.
<b>Friday 16<sup>th</sup> September</b> In consultation with your supervisor, you must catalogue any <i>exemplary</i> rock specimens/thin sections/fossil samples with Dianne Nyhof. There is a form at the back of the GEOL302 Handbook for this purpose.

## Geological mapping projects: Supervision and project selection

**GEOL302/304 Project intention and supervision Google Form, to be completed and approved before the end of semester week 2:**

**<https://docs.google.com/forms/d/e/1FAIpQLSfaYu6lyf1FYw1h5YIi0kkaCZyFisMbAizMK5qp64S7TYAqbA/viewform>**

**Supervision:** Project selection is your responsibility, but should be done after consultation with potential supervisors. Be **specific** about your interests and transport limitations. You may have ideas of your own, which you are welcome to discuss with potential supervisors.

The project should involve geological mapping and more detailed field-based work (sedimentary logging, structural analysis, petrology etc). Detailed field-based work should be framed in the context of a geological map - even if that map is limited in its scope to address only the specific problem being addressed. Unless your supervisor has research funds and is agreeable, most projects will need to be within a half day round trip of Dunedin to allow supervision.

Your supervisor will be available to discuss your project work in the department and to direct you toward relevant literature. Questions on general planning and organization of the project should be referred in the first place to the project supervisor. Advice of other members of the Department whose specialist interests are relevant to aspects of your work should also be sought. After you have completed some of your own field work, you should make an appointment with your supervisor for a half-day in the field (generally the earlier the better), which allows you to give an overview of your work.

**Your supervisor is expected to provide feedback on drafts of your chapters and final report, as well as your map sheet.** Make sure that you agree a timetable for feedback with your supervisor - do not leave this to the last minute. If you send chapters/report/map sheet to your supervisor the day before the deadlines, they will not have time to provide feedback.

**Project area and scope:** This should be discussed in detail with your supervisor so that you can complete the safety and logistics form. If you are making a geological map there is no set map area and what you cover depends upon mapping scale(s). In terrain and outcrop comparable to GEOL344 training, one might map a few km<sup>2</sup> at 1:10,000 scale, or a larger area (10-20 km<sup>2</sup>) in less detail (e.g. 1:25,000). Maps in areas having good exposure and complicated geology, or maps for projects that are topic-based, or projects incorporating drill core or other subsurface samples, or projects that additionally utilize geophysical techniques, or. . . (the list is almost endless), may be much smaller. Again, there is no general area requirement.

**Time in the field.** About seven full days' fieldwork is regarded as appropriate. Less than 5 days is definitely not enough. More than 10 days is probably more than necessary.

### Alternative types of project

Some students may wish to undertake GEOL302/304 projects that do not involve geological mapping in the field. In these cases, the scope of the project will be established in consultation with a member of staff, and the content of the project will depend on those discussions. Talk to members of staff if you would prefer to do e.g., a geophysical project or a lab-based project. You will be expected to produce and present one piece of internal assessment together with the mapping students, and you will also produce a final report.

## IN THE FIELD

**Field Safety.** All the generic safety requirements for class field trips (as outlined in lab books) apply for GEOL302 project field work. Students should have already read the Department Health and Safety policy: this is available on the web (<http://www.otago.ac.nz/geology/admin-health-safety/field-procedures/index.html>). Students will not be sanctioned to carry out independent fieldwork until they have:

1. Attended the introduction to GEOL302/304 on the first Friday of semester.
2. Completed the Health and Safety Google Form and had this approved. The document must include an annotated hazard map for the field area. You must have designated the “terrain” and “remoteness” of the area and students must agree to work in the field according to the logistical requirements these determine.
3. You must set up a trusted person to whom you will report your safe return from each field day. Daily report forms are provided to help you and your trusted person report your daily field activities and to help that person decide on action in case of a problem.

**[GEOL302/304 Health & Safety Logistics Google Form, to be completed and approved before the end of semester week 2:](#)**

[https://docs.google.com/forms/d/e/1FAIpQLSfJgZHJ4GXLNh4c67CRz\\_AjbNo2dd3PWP\\_yfAdbhFwQxe5ng/viewform](https://docs.google.com/forms/d/e/1FAIpQLSfJgZHJ4GXLNh4c67CRz_AjbNo2dd3PWP_yfAdbhFwQxe5ng/viewform)

**Permission for access to land.** Students in all cases should ensure that they obtain permission to carry out their field work from the appropriate landowners, run holders and/or DOC. The following website provides some useful information: <http://www.walkingaccess.govt.nz/walking-access-mapping/>. Landowner details are accessed using the field map template on the GIS database. [Fill in a form for access to the GIS database](#). A letter of introduction for landowners in your area can be obtained from the Department. You **MUST** speak to landowners in person; entering land without permission or leaving notes is not acceptable until you have made personal contact.

**Personal and professional ethics.** Students are expected to apply high ethical standards to all aspects of their work. A short document on ethics is appended to this document. Additionally students should look at the code of ethics of the Geoscience Society of New Zealand (<http://www.gsnz.org.nz/information/rules-policies-i-4.html> scroll to bottom of page)

## GEOL302 Support facilities available to you

1. **Maps;** Following training in GEOL344, you should be able to set up, organize and print base maps from GIS that are appropriate to your mapping project. This might include topo maps, aerial photos, previous geophysical surveys, and so on. Follow the templates and guidance that you had for the GEOL344 field trips. Basemaps should be made in consultation with your supervisor. Aim to get overlapping A4 field-slips on high quality card. Additionally, you may need a paper copy that covers the whole area to draft final maps and you will need electronic copies of the maps for production of the final map sheet. If you need graph paper for field sections and logs, these are available. Help and advice is available on all aspects of GIS, graphics and illustration.
2. **Air Photos and topo maps:** All of these digital resources are available on the GIS database, or on <https://data.linz.govt.nz/data/category/aerial-photos/> Photos can be downloaded **free**. Note that these are orthophotos and cannot be used for stereoscopic viewing. If you want stereo-pairs, check the Department collections (Gn7A) and the collections at GNS.
3. **Field Equipment:** Altimeters, tape measures, spades, acid bottles, stereonets, GPS, safety beacons, etc. can be borrowed from the Geology Department where necessary. If you need it, and have a good reason to use it, we can probably find it for you, so let us know!
4. **Thin sections:** You make them, label them, cite them by GR, and hand them all in with the project. See the training dates on the timetable and make arrangements in groups of 3-5 with Brent Pooley for instructions on how to make thin sections. Untrained users will not be allowed in the thin section lab. It is not appropriate to make more than 15 thin sections (including the ones that don't work) for most projects – discuss this with your supervisor.



## PREPARING FINAL MAP SHEETS - TECHNICAL DETAILS

**Note that these are the same instructions given during GEOL344. Preparation of your final map sheet should be done in consultation with your project supervisor. Some tutorial sessions will be organized in the weeks preceding the map sheet presentation session.**

If your 302 project involves geological or geophysical mapping then you must prepare a final map sheet, in the same way that you did for GEOL344. The final map sheet shows your interpretation of the geology and should have professional production values. You must produce a final map sheet using a computer drawing package (Inkscape, Adobe Illustrator etc) or a GIS package (ArcGIS). You will produce computer-based maps in GEOL344 as training. Use your GEOL344 final map sheet and the specific and general feedback you received for this as a guide as to how to proceed.

### The final map sheet must include:

1. A title, which indicates where the mapped area is located.
2. The name of the author and the date mapping completed.
3. Location map(s) of the area (with scale). These should enable anyone to locate the working area precisely without reference to data not presented on the map (you can assume that the average person will know where New Zealand is). Redraw these maps or use the template provided in the GIS database. Do not cut and paste from the web.
4. A final, lithostratigraphic solid geology map at a scale (or scales) appropriate to summarizing the data from the areas mapped.
  - Lithostratigraphic units should be indicated by colour and letters so that the map is usable in black and white.
  - If the map(s) are drawn to emphasize solid geology you should still show the location of superficial deposits, but these should be subordinate to the solid geology. The boundaries of superficial deposits should be marked but the deposits should not normally be colored. Solid geology should normally be colored through the drift deposits.
  - If a substantial part of your work relates to the superficial deposits then you should treat superficial deposits as you would solid geology units assigning a color and symbol on your map(s), sections and GVS.
  - The map(s) should contain as much representative data (bedding, foliation, lineation etc) as is necessary to define the structure of the area. In an area of structural complexity, it may be appropriate to transfer most or all of the data from the field maps. In simple areas, where most readings are similar, fewer data need be transferred.
  - The map(s) should not generally include topographic information (breaks of slope etc).
  - The map(s) should not include locality numbers.
  - The map (s) can show where rocks are exposed (as x symbols if there is no structural reading to indicate exposure).
  - The map(s) must include a correct scale bar, N. arrow and an indication of magnetic declination.
  - The map(s) must be located with respect to national survey grids (e.g. NZGD2000 datum, NZTM projection) and/or latitude and longitude.
5. At least one cross section at the same scale as the map with no vertical exaggeration. The section must be properly located on the map. If the section is not vertical the orientation should be justified (e.g. profile plane section). In an area of more complex geology it is advisable to construct more than one cross section if you wish to properly represent the geology.
6. A generalized vertical section (GVS = stratigraphic column) that **provides the key** to lithostratigraphy on maps and cross sections. Your own formal stratigraphic names should be assigned. Any units that do not appear in the GVS (e.g. intrusive units) can be included as boxes (with colour and letters) separate to the GVS. Areas where no lithostratigraphy can be established may have a lithological key and no GVS is needed.
7. A key to all lines and symbols (lithostratigraphy covered by GVS)

### **Printing your hard-copy map sheet:**

You must print your hard-copy map sheet in time for the presentations on the last day of semester 1. You can print your map in the department, but you will not be able to do this on the morning of the presentations. Print your map at least 1 day before the presentations, so that you have time to carefully proof-check everything.

**Make sure the printed map scale is correct**, and that all other technical details are correct (e.g. N. Arrow, grid references, colours etc).

Bring your printed map sheets (unfolded) to the presentations and pin them up on the boards provided.

### **Submitting your electronic map sheet:**

The electronic version of the final map sheet must be submitted on Blackboard before 5 pm on the last day of semester 1. This version must be identical to the hard copy map that you presented earlier in the day. Map sheets must be <30MB and must be submitted in PDF or PNG format (resolution should be >300 ppi).

### **FINAL MAP SHEETS – PRESENTING YOUR WORK** (the last day of semester 1, 10 am – 12 pm.) **Electronic versions must be submitted on Blackboard by 5 pm on the same day.**

A0 poster boards will be provided for your map sheets. This is an interactive session in which you will be expected to talk to staff and other students about your map sheet and the geology of your area. You must bring your printed map sheet with you. You are also allowed to bring additional datasets that might make your discussions more interesting (e.g. additional field data, field photos, supporting information etc).

The session will begin at 10 am. Staff and other students will walk around the various poster boards and ask you questions about your project in an informal setting. One aim is to help you identify things that will be interesting for follow-up work during your project.

## GEOL302 Projects involving geophysical datasets

If your project involves the collection and analysis of geophysical datasets (*e.g.*, boomer seismic data collected on board *Polaris II*, hammer seismic refraction data, gravity data, magnetic data), assessment of your data and results will differ.

### FIELD DATA

**Additional field data** should be submitted. This should include:

- a basemap showing the extent of geophysical surveys undertaken and/or used and regions that have been mapped in the field
- details of any co-incident GPS surveying, etc. used to support the data
- paper copies of field data, with preliminary interpretations and annotations; observations/interpretations of seismic facies and/or lithostratigraphic units should be explained and justified
- preliminary analysis of data in the form of graphs, charts, or maps

The presentation of field data should also include a summary report detailing:

- the acquisition and analysis method(s)
- the justification for the positioning of data collection points or transects.

### PROJECT REPORT AND FINAL GRAPHIC SYNTHESIS

Final submissions will be assessed using rubrics and assessment schedules that are slightly modified from those used for assessing maps alone. The 10% of the mark allocated for the final map and cross sections, will also include the suitable presentation of interpreted geophysical datasets (*e.g.*, annotated seismic lines, final gravity model plots, or magnetic anomaly maps, cross sections that incorporate geophysical data into the geological model.)

Geophysical data often enable the development or enhancement of stratigraphic columns. Be sure to annotate such features appropriately: what features are inferred from geophysical data and which features are identified directly.

If appropriate, consider adding interpreted data to your final map plot to enhance its value. For example, seismic data or gravity models can be incorporated in a cross section to highlight specific stratigraphic or structural configurations. Magnetic anomalies can be plotted directly on a map.

If geophysical data are offshore, a summary map that includes both offshore and onshore areas is required with at least one cross section that includes offshore and onshore data. Appropriate map scales are worth considering. Field mapping will often be at a very different spatial scale than geophysical data collected.

The report must present both geological and geophysical data and must integrate these to present the best constrained model for the geometry, stratigraphy and geological history of the area.

## Report

Final reports should be submitted both as a single .pdf file (<30Mb) and a printed softbound version with map pocket. Final maps (or equivalents) will be folded to fit in the pocket at the back of the bound report. Reports should not exceed 10,000 words. Appendices are allowed for extensive datasets that are not appropriate for the main report. Reports should be as systematic, complete, and concise as possible. Keep observation clearly separated from interpretation. Ensure that data are used to support your interpretations. See timetable for deadline.

### SPELLING AND GRAMMAR (also see following pages)

At 300-level we are expecting high quality writing from you. In this day and age, spellcheckers and other online tools are available to help you produce a polished document, and there is absolutely no excuse for poor spelling and other mistakes. We will not look favorably on your report if it is littered with spelling mistakes. Make sure you leave enough time to thoroughly proof read your documents. A proof read does not mean a quick glance through your report – it means a close line-by-line inspection to eliminate mistakes, this may take you several hours.

## Report Structure

The report should be written with a logical and informative structure, so that the reader can easily understand:

1. Where the area is, the general geology of the region, and how your area fits into that regional geology.
2. What **you** did; i.e. make it clear what is your work and what is derived from other workers.
3. The nature and significance of **your** work, in the context of the regional geology, and also any applied geology aspects.

Most reports will have a set of chapter headings, such as those that follow. There is no unique way to structure a report, but it should follow standard scientific conventions:

- a) **Abstract.** This should be informative and specific wherever possible. It should summarise the geology of your area, with emphasis on your observations. Include **facts and numbers** wherever possible: thicknesses of units, ages from fossils, typical scale of active landslides, orientations of fold axes, etc.
- b) **Introduction and Geological Background/Previous Work.** These chapter(s) should give a regional geological introduction, with references to sources. Refer to standard articles/maps/books, not lecture notes or student theses. Describe how your area fits into the regional geology, e.g. at the 1:250 000 map scale. Say **why** you selected the area especially if you were addressing a particular geological problem. Informative regional geology maps and locality maps are **essential**.

**Chapters on “Macroscale” field observations** – the number of chapters you submit here depends on what you have done in the field, and whether or not you have chosen to focus on a specific type of geology in your project. Some examples follow, but you will likely have other chapters to submit.

- c) Description and quantification of rock units. These should be described in order from oldest to youngest. Present your field descriptions in a logical way and include as much detail and quantification as possible; for example using a top down approach. Describe map scale features (where the outcrop is) before outcrop scale features (bedding characteristics, sedimentary structures, schist segregations, contact relationships etc) before details of individual rocks (the minerals present and their textures). Separate descriptions of secondary features such as joints, weathering features and erosional characteristics from primary rock descriptions. Wherever possible, be quantitative. **Wherever possible use figures: see below**

Keep all inferences/guesses on origins separate from your observations. For example, sentences such as: “*Outcrops have cross bedding indicating the current flowed from the west*” are not acceptable in the description section. **Describe** the cross bedding: scale,

type, orientation (with measurements wherever possible). The **inference** of flow directions should come later.

- d) Structural geology. This section can include descriptions of e.g., folds, faults, and unconformities, joint sets in various rocks, landslides etc. Apportionment of material between this section and the rock descriptions can be problematic; discuss this with your supervisor if you are having trouble. **Wherever possible use figures: see below**
- e) Applied geology issues. This is not essential, but it can give a more “real world” context to your project. Results of your mapping may be of interest to a wide variety of different commercial interests. It is good practice to think of potential uses for your work, e.g.
  - (i) hazards, such as landslides, active faults, or coastal erosion
  - (ii) resources such as hard-rock gold, alluvial gold, groundwater (including springs), road/building aggregate
  - (iii) soil issues such as erosion, chemical effects from underlying rock, or loess covering.

**Chapters on “Microscale” observations** – the number of chapters you submit here depends on what you have done in the lab as follow-up work. Two examples follow, but you will likely have other chapters to submit depending on what you did in the field, and whether or not you have chosen to focus on a specific type of geology in your project.

- f) e.g. Thin section analysis: This may include a detailed petrographic description of samples that you collected in the field. Mineralogy, textures, deformation microstructures etc. Determination of metamorphic facies, shear sense, mineralization sequences.
- g) e.g. Micropaleontology to determine microfossil types, provide absolute age constraints.
- h) **Discussion/Interpretations.** This is an extremely important chapter that is always present in a scientific report. In this chapter, you need to discuss your own field observations, and provide some interpretations of the primary observations presented in previous chapters. This is where you summarize and synthesize your own observations, and interpret them in the context of what we already know about regional geology and geological processes (i.e. the literature). This chapter(s) can be organized in any way you like, but it should be logical and clearly structured. It should span the entire range of observations presented in previous chapters. Use figures whenever possible to synthesize information
- h) **Conclusions.** Give a succinct summary of your own principal observations, and how they contribute to understanding the geology of the area. Outline results from your work in any detailed study you did, and/or applied geology aspects.

- h) **References.** List all references that you have used information from, and make sure they are cited in the text appropriately. As for all scientific writing, you should only list references that are cited in the text. Most projects have at least 30 references; if you have fewer, you probably have not cited some references (this is plagiarism), or you have not done sufficient background reading. Use a **single**, consistent, complete format for listed references; journals offer good examples.
  
- i) **Acknowledgements.** Briefly thank staff and students who have been particularly helpful to you. Also thank landowners, providers of transport etc.
  
- k) **Map sheet.** This is one of the most important components of the project. Make sure you have referred to it extensively in the text, with grid references (see below) where appropriate. Given that your map (and cross section and GVS) has been drawn on a computer it is worth considering using simplified versions in the body of the report to make it much easier for the reader.

- **Using grid references and grid reference systems:**

As mentioned in the Final Map section on page 12, the map(s) itself must be located with respect to national survey grids (e.g. NZGD2000 datum, NZTM projection) and/or latitude and longitude. However, if it is necessary to refer to map localities in your report, it is often better to use a grid reference system (MapA 032 607) rather than full NZTM coordinates (1403205, 4960724). Providing full NZTM coordinates is acceptable in some situations where more precise locations are necessary or useful (e.g. a table of fossil localities). Use these resources to understand and make grid reference systems:

- <https://blogs.otago.ac.nz/si-geology/2013/09/11/grid-reference-systems-what-are-they/>
- <https://blogs.otago.ac.nz/si-geology/2013/09/11/grid-reference-systems-how-to-make-one/>

**FIGURES.** Good figures are often the difference between a good project and a poor one. Use a range of figures (maps, cross sections, field sketches, graphic logs, sketches of thin sections, stereonet, palaeo-environment reconstructions, kinematic cartoons, field and sample photos, photomicrographs etc). Make sure that the figures are well annotated - this is particularly important for photos- you won't get marks for presenting a photo album. Redraw maps- don't just cut and paste from the web. All figures must:

- Be cited in the text. The first citation should appear before the figure and should indicate why the figure is there. e.g:
  - “ Figure 3 shows the extent of the phyllite in the area...”
  - “... comprises randomly oriented interpenetrating needles of hornblende (fig. 8)
  - “.. and palaeocurrent data suggest these sediments represent a braided river system that flowed broadly from east to west as shown in fig. 14”.
- Have a caption. The caption should enable the reader to understand the figure without repeating (substantially) information in the text. Captions that might correspond to the examples listed above are:
  - “ Fig. 3. Simplified geological map of the Swinburn area.”
  - “ Fig. 8. Sketch of thin section of a metabasite unit in the Schist. Sample OU.... Collected at grid reference (.....).
  - “ Fig. 14. Palaeogeographic reconstruction for the Palaeocene from the sedimentary log data presented in section 3.1”



# Scientific writing and reports

Scientific writing has four principal aspects that need close attention:

1. **Organisation and logic.** Information must be presented in a logical way, or a reader cannot understand it. Before writing, make an outline:
  - a) Make a list of headings (topics) that you want to cover.
  - b) Put these in a logical order for presentation.
  - c) Group the headings, where possible into more than 1 tier (major headings, subheadings). Avoid more than three levels of headings.
  - d) If you are writing a draft, discuss the outline with your supervisor.
2. **Ambiguity.** Check **each sentence** for ambiguity. If there is more than one way of interpreting the sentence, add words or rewrite.
3. **Grammar.** Good grammar is **essential**. Poor grammar will be marked down or rejected. It is also harder for markers to properly assess the science through poor grammar.
4. **Spelling.** Consistent and correct spelling is essential. Persistent incorrect spelling gets penalised.

## FEEDBACK

To minimise waste of staff time, you can expect serious feedback only on Points 1 and 2 above. Points 3 and 4 are **your problem**. The following suggestions may help if you have grammar and spelling problems.

1. Get someone else to read what you have written and comment on it.
2. Read it aloud to yourself.
3. Use a word processor, e.g. Microsoft Word has spelling and grammar tools. Turn these on from “Options” (PC) or “Preferences” (Mac). **Then**, tick all boxes on what the grammar checker evaluates. (The default is nothing – thanks, Bill). If the grammar check doesn’t flag anything, it is **not** turned on. If your sentence is underlined in green, the grammar is incorrect, according to Bill Gates. If a word is underlined in red, the software dictionary doesn’t recognise it.  
**Note:** this is not foolproof, but will solve >90% of your errors.
4. Read a book or take a course on writing style.

It is extremely discourteous to staff to expect them to read work that has not had some form of checking, as outlined above. If you do not check your written work, do not be surprised if staff lose patience after 2 - 3 pages and return your work to you for rewriting.

# Environmental Care Code

## **Protect Plants and Animals**

Treat New Zealand's forest and birds with care and respect. They are unique and often rare.

## **Remove Rubbish**

Litter is unattractive, harmful to wildlife and can increase vermin and disease. Plan your visits to reduce rubbish, and carry out what you carry in.

## **Bury Toilet Waste**

In areas without toilet facilities, bury your toilet waste in a shallow hole well away from waterways, tracks, campsites and huts.

## **Keep Streams and Lakes Clean**

When cleaning and washing, take the water and wash well away from the water source. Because soaps and detergents are harmful to water life, drain used water into the soil to allow it to be filtered. If you suspect the water may be contaminated, either boil it for at least three minutes, or filter it, or chemically treat it.

## **Take Care With Fires**

Portable fuel stoves are less harmful to the environment and are more efficient than fires. If you do use a fire, keep it small, use only dead wood and make sure it is out by dousing it with water and checking the ashes before leaving.

## **Camp Carefully**

When camping, leave no trace of your visit.

## **Keep to the Track**

By keeping to the track, where one exists, you lessen the chance of damaging fragile plants.

## **Consider Others**

People visit the back-country and rural areas for many reasons. Be considerate of other visitors who also have a right to enjoy the natural environment.

## **Respect Our Cultural Heritage**

Many places in New Zealand have a spiritual and historical significance. Treat these places with consideration and respect.

## **Enjoy Your Visit**

Enjoy your outdoor experience. Take a last look before leaving an area; will the next visitor know that you have been there?

Protect the environment for your own sake, for the sake of those who come after you, and for the environment itself.

# Water Care Code

## **Find Out First**

Find out and follow the regulations governing recreational use of waterways and access. They are designed to minimise conflict between users and protect everyone's health and safety.

## **Stay on Established Tracks and Use Existing Facilities**

By using existing facilities, where these are provided, you run less chance of disturbing wildlife and damaging riverbanks and foreshores.

## **Take Care of Your Gear**

Careless use of equipment can harm wildlife and other users.

## **Remove Rubbish**

Litter is unattractive, harmful to wildlife and pollutes water. Plan your visit to reduce rubbish, and carry out what you carry in.

## **Dispose of Toilet Waste Properly**

Improper disposal of toilet waste can contaminate water, damage the environment and is culturally offensive. Use disposal facilities where provided or bury waste in a shallow hole at least 50 metres away from waterways.

## **Be Careful with Chemicals**

Use chemicals sparingly, and refuel with care. Dispose of cooking or washing water well away from the source.

## **Respect Our Cultural Heritage**

Many New Zealand waterways have special cultural, spiritual or historical values. Treat these places with consideration and respect.

## **Take Only the Food You Need**

When taking food from the sea or freshwater, don't overdo it. Sustain life in our waterways by taking only what you need and no more than the legal limit.

## **Consider Plants and Animals**

Remember we are only visitors to water environments. Other animal and plant species live there all the time.

## **Consider Other People**

Respect other visitors ... everyone has the right to enjoy the environment in safety.

# Cataloguing of specimens and fossil record forms

It is a requirement for acceptance of your project report that fossil collections, a representative set of rock specimens, and thin sections, appropriately catalogued, be lodged in the Department collection. The set of rocks and minerals should include all specimens referred to in the project report (please keep size of samples small), and additional reference material where appropriate. The fossil collections must include duplicate samples of any matrix used for micropaleontology. Fossils must be catalogued in the fossil catalogue, not the rock catalogue. Fossil record forms must also be completed for representative fossil collections (discuss this with Daphne Lee or Ewan Fordyce).

## Labeling of Samples

### SLIDES

Labeling should be done neatly in black ink and remain consistent in form with the following example:

Labels to be placed with writing the same way up, as shown	NB	30711 Rock analysis Geology Dept Otago University	-- Specimen number used in report (3 <sup>rd</sup> year students' samples will not generally be catalogued with OU numbers) -- special information
		Phonolite C. A. Tapia NZTM E1234567 N5678912 Geology Dept Otago University	-- rock type -- student name -- coordinate system Easting or Longitude Northing or Latitude

Microprobe slides, polished briquettes and crushed powders should also be handed in.

Description data is entered into a Microsoft Excel spreadsheet. Three different spreadsheets are used according to whether the specimen is a New Zealand rock, an overseas rock or a mineral; the data type instructions for New Zealand rocks are listed below. Discs and instructions for the less commonly used overseas and mineral spreadsheets are available from the Curator.

Fossil curation is supervised by Ewan Fordyce.

## DATA TYPE RULES FOR NEW ZEALAND ROCKS

Field Number	unlimited alphanumeric (this field will not be loaded into the database)
Coordinate system used	e.g. NZTM, NZMG, WGS84 (Must be recorded!)
Easting or Longitude	Number of digits to reflect precision
Northing or Latitude	Number of digits to reflect precision
Collector	Names initials and last name (e.g., J. M. Smith)
Year	4 digits: (19DD/20DD)
Slide types	1 to 4 UPPERCASE alphanumeric: a combination of <b>T</b> (thin section), <b>G</b> (grain mount), <b>P</b> (polished section), <b>B</b> (briquette)
Analysis types	1 to 7 UPPERCASE alphanumeric: Analyses performed, a combination of <b>D</b> (X-ray diffraction), <b>S</b> (sedimentology), <b>M</b> (whole rock major element chemistry), <b>T</b> (whole rock trace element chemistry), <b>G</b> (geochronology), <b>I</b> (isotopic), <b>P</b> (microprobe), <b>O</b> (other).
Proj. Stat.	1 digit: Project status: 1: Exchange 2: Other <b>3: 3<sup>rd</sup> year thesis</b> 4: 4th year thesis and DipSci 5: MSc thesis 6: PhD thesis 7: Staff research
Rock type	Standard rock classification (e.g., Sedimentary, sandstone; Volcanic, Andesite; Metamorphic, Gneiss)
Other	up to 255 alphanumeric: any other pertinent data such as Formation, description of location, interesting features etc. <b>Keep it brief and useful!</b> Don't load the database up with trivia.

## Sample curation form

In consultation with your supervisor, you must catalogue any *exemplary* rock specimens/thin sections/fossil samples with Dianne Nyhof. There is a form at the back of the GEOL302 Handbook for this purpose.

**STUDENT NAME:** .....

A representative set of exemplary rock specimens and thin sections has been satisfactorily catalogued and lodged in the Department collection.

(signed) .....

Dianne Nyhof (Curator)

Date: .....

Fossil collections, including representative samples of matrix used for micropaleontology, have been entered on the Fossil Record File, have been satisfactorily catalogued and have been lodged in the Department collection.

(signed) .....

Dianne Nyhof (Curator)

Date:.....

## **Marking descriptors for Final Map sheets – technical details**

%	Description
<b>A++ 10</b>	<b>Outstanding work</b> with professional production values. Presents a clear geological model that makes stratigraphic and geometrical sense. No omissions or technical errors. Layout of map sheet is neat and organized. Scale, grid references, north arrow etc are all correct.
<b>A+ 9</b>	<b>Excellent work</b> with near professional production values. Presents a clear geological model that makes stratigraphic and geometrical sense. May have minor omissions or errors. Scale, grid references, north arrow etc are all correct.
<b>A- 8</b>	<b>Very good work</b> with near professional production values. Presents a reasonably clear geological model that may have some elements that do not make stratigraphic or geometrical sense. May have minor omissions or errors. Scale, grid references, north arrow etc are all correct.
<b>B 7</b>	<b>Good work</b> with high production values. Presents a reasonably clear model geological that may have some elements that do not make stratigraphic or geometrical sense. May have minor omissions or errors. A less substantial piece of work. Scale, grid references, north arrow etc may have some errors.
<b>C+ 6</b>	<b>Adequate work</b> with moderate production values. Presents a reasonably clear geological model that may have some elements that do not make stratigraphic or geometrical sense. May have significant omissions or errors. Work perceived as a bit thin. Scale, grid references, north arrow etc may have some errors.
<b>C- 5</b> -	<b>Unsatisfactory work</b> (pass) with poor production values or presents a geological model with significant components that do not make stratigraphic or geometrical sense. May have significant omissions or errors. Work perceived as a bit thin. Scale, grid references, north arrow etc may have some errors.
<b>D 4</b>	<b>Deficient</b> with poor production values and presents a geological model that makes no stratigraphic or geometrical sense. May have significant omissions or errors. Perceived as a very thin piece of work.
<b>D 3</b>	<b>Very deficient</b> with very poor production values and presents a geological model that makes no stratigraphic or geometrical sense. May have significant omissions or errors. Perceived as a very thin piece of work.
<b>F 0-2</b>	<b>Totally inadequate</b> , no final map.

## Marking descriptors for Final Map sheets - presentations

Student Name : \_\_\_\_\_

Assessor Name: \_\_\_\_\_

Mark	Knowledge and understanding (20)						
	Student demonstrates a detailed understanding of the geology of their mapped area	5	4	3	2	1	Student has a poor understanding of the geology of their mapped area
	Student provides a clear introduction to mapped area (e.g. location, why chosen, main aims etc.)	5	4	3	2	1	Student does not provide a clear introduction to mapped area (e.g. location, why chosen, main aims etc.)
	Student provides a clear overview of the mapped sequence of rocks	5	4	3	2	1	Student does not provide a clear overview of the mapped sequence of rocks
	Good attempt to provide a synthesis of data and initial ideas	5	4	3	2	1	No attempt to provide a synthesis of data and initial ideas
<b>Delivery and interaction with audience (10)</b>							
	Student makes good use of the map sheet to illustrate their main points	5	4	3	2	1	Student does not make any use of the map sheet to illustrate their main points
	Relaxed delivery and interaction with audience	5	4	3	2	1	Stiff, apathetic, looks untidy, ignores audience
<b>Overall Map sheet (5) – note that technical details of map sheet will be evaluated separately</b>							
	Map sheet – overall impression is excellent	5	4	3	2	1	Map sheet – overall impression is poor
<b>“Value-added” (5)</b>							
	Additional points for dealing with questions during the presentation session.	5	4	3	2	1	
<b>= TOTAL SCORE out of 40</b>							

*Other Comments*

## 302 Final Report Marking descriptors

%	Description
A++ 95-100	<b>Outstanding work.</b> Outstanding handling of data, innovative and original, with maximum information obtained from results, whether quantitative or otherwise. Implications evaluated both in the light of other, published work & of the limitations of experimental procedures used. Where appropriate full statistical treatment employed. Awareness of how the work might develop. Clear separation of evidence and interpretation. Outstanding evaluation of relevant (and recent) literature. Professional presentation and organization. References correctly cited and presented. Information can be grasped at a glance; no duplication. Very well written. Extensive evidence of supplementary reading
A+ 90-94	<b>Excellent work.</b> As above, but with a few omissions in both treatment and interpretation of information. No evidence of over interpreting data. Some corrections, deletions & amendments are needed. Style of writing clear and perceptive. Evidence of wide supplementary reading
A 85-89 A- 80-84	<b>Very good work.</b> Handling of own information and literature excellent for the most part, but just occasionally reading more into the data than errors and/or good judgement would warrant. Clear separation of evidence and interpretation. Very good dissertation, clear and easy to read, but with occasional repetition and some inadequacy of style, leading to occasional misunderstanding. Sound evidence of supplementary reading.
B+ 75-79 B 70-74	<b>Good work.</b> On the whole data & literature handled very well, though the full implications of all the data not appreciated & some data over-enthusiastically interpreted. Clear separation of evidence and interpretation. Logical presentation. Writing style generally good, but some paragraphs obscure. Some repetition of both information and remarks. Evidence of outside reading. Can be read with pleasure and interest.
B- 65-69 C+ 60-64	<b>Adequate work</b> As above, but some of the data handled poorly, use of literature incomplete and interpretations sometimes presented as though they are evidence. Writing style not very good. Often inappropriate choice of illustrations, possibly too few, too many, too small too complex etc. Graphs and Tables not very well laid out. Repetition of ideas and information. Some outside reading.
C 55-59 C- 50-54 -	<b>Unsatisfactory work (pass)</b> Handling of results is poor, e.g. evidence incorrectly interpreted (evidence and interpretation not clearly separated), wrong statistical procedures, but, on the whole, data comprehensively presented. Little awareness of literature or of how the work might develop. Overall impression satisfactory & reasonable knowledge of major findings of the project, but presentation is poor e.g. poor choice of illustrations, graphs with too few points & bad scale, writing style unclear and repetitive, poor organization of references etc. Little sign of outside reading.
D 40-49	<b>Deficient</b> Insufficient data collected to support valid interpretations. Handling of results shows many inadequacies and a sizable portion of the data wrongly interpreted. Literature awareness is minimal. Dissertation is poorly presented, with many inadequacies, omissions and errors; difficult to ascertain all that has been discovered. However some relevant facts are correct and a large portion of the report is reasonably understandable.
D 30-39	<b>Very deficient</b> Insufficient data collected to support valid interpretations. Inadequate handling of most results in every way. The majority of the data wrongly interpreted. No literature awareness. Information mixed up & not sensibly organized, many omissions and errors. Only a few facts are correct. Painful reading and, at the end, little clear idea of major findings of the investigation.
F 0-30	<b>Totally inadequate,</b> Insufficient data collected to support valid interpretations. Totally inadequate handling of results in every way. All/nearly all data wrongly interpreted, or left uninterpreted. No literature awareness. Dissertation is very poor; approach may be all wrong. Dreadful presentation, style and grammar. Information disorganised, lack of any logical sequence of facts and ideas. Findings incoherent.