

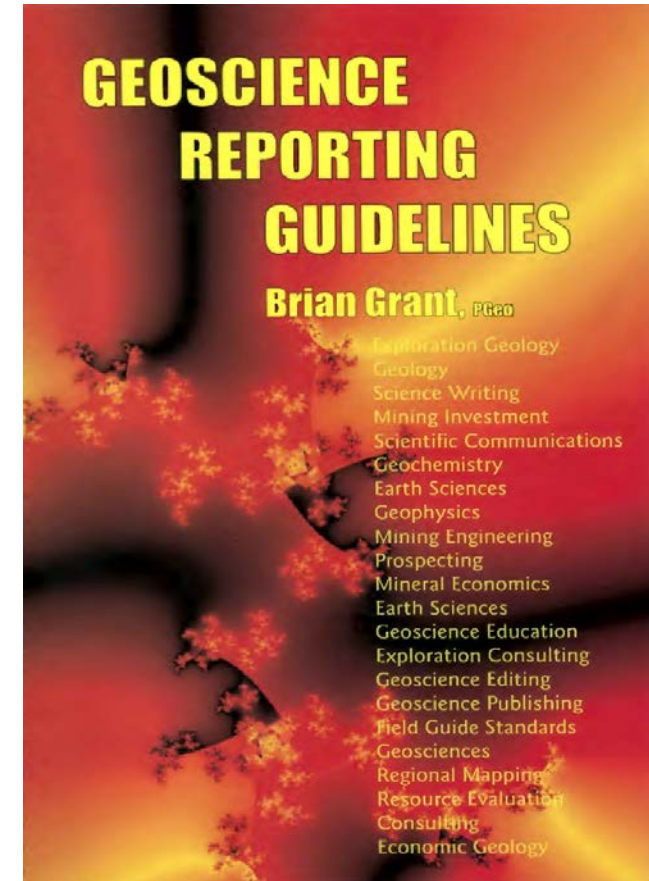
Technical Writing

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RnD Technical

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Geoscience Reporting Guidelines (GRG)

- Used by Canadian geological surveys
- Covers specialist reports such as university theses, NI43-101 reports, mineral-property evaluations and feasibility studies
- **Recommended reading:** p. 1–14, 62–65, 137–187 and 209–254
- Last five chapters resolve specific questions



Saskatchewan Geological Survey Style Guide

- Use with *Geoscience Reporting Guidelines*
- Use Chapters 1 to 6 for general guidance
- Use Appendices 1–4 and 7 (Prepositions, Hyphenation, Abbreviations and Symbols, Spelling Conventions, and Reference Style Examples) for specific questions
- PDF available from Publications Saskatchewan website:
<http://www.publications.gov.sk.ca/details.cfm?p=86830>



Work-back schedule

- Ensure you allow enough time for completion of analytical work
- Maybe it shows you should have begun last month?
- If so—and you haven't yet begun—discuss with your advisor

Scope too broad?

- A topic that seemed focused when you chose it might turn out to be too broad when you start (N. Barlow, pers. comm., 2016)
- If you're uncertain, discuss with your advisor
- BUT narrowing the scope is not a solution for starting late

Outline

- Prepare at start of project and modify as needed
- Include notes
- Expand as research progresses
- Use OneNote or Word Outline
- Ensure that data lead to interpretation, not vice versa
- Early chapters/sections can be written in any order

Typical thesis headings (Grant, 2003):

Abstract

Acknowledgments

Introduction and thesis definition

Location, previous work

Literature review

Methods and approach

Data

Evaluation and results

Discussion and conclusions

Plagiarism

Plagiarism is the representation of another's words, ideas, or information as if they were your own. (Grant, 2003; emphasis added)

- Serious academic offence with severe penalties
- Easy to detect and prove thanks to the Internet and software such as Turnitin®
- If in doubt, discuss with your advisor

Citations and References

- Since you can't plagiarize, you must cite the sources
- *Geoscience Reporting Guidelines* covers citations and references thoroughly, but follow format in Canadian Journal of Earth Sciences (https://instruct.uwo.ca/earth-sci/089g/cjes_instruct_e.pdf)
- Each reference cited in the text, tables, figures and appendices must be in the list, and each reference in the list must be cited in the text
- An 'in press' reference must have been accepted for publication; if it hasn't, delete it from the reference list and cited it as 'work in progress'

Copyright

Giving credit to the copyright owner or the author does not constitute license [sic] to reproduce material without written permission (Grant, 2003)

- Neither legal nor ethical to make a few minor changes to an illustration to avoid getting copyright permission
- You must obtain copyright permission for anything that requires it before your thesis is submitted for review
- If in doubt, discuss with your advisor

Clear and concise

The purpose of scientific and technical writing is to convey information to the reader as clearly and concisely as possible. (Grant, 2003)

Subsequent slides will elaborate on the points in this slide and the next.

- Remember the **purpose** of your document, the **message** you're trying to convey and the demographics of your intended **audience** (Sifrer, pers. comm., 2016)
- Use tables and figures
- Plots of data are more meaningful than tables
- Avoid run-on and long sentences

Clear and concise (cont.)

- Use active voice
- Use present and past verb tenses properly
- Avoid clutter, jargon, redundant words and misused words
- Minimize the number of adjectives preceding a noun
- Use 'Canadian' English spelling
- Define all uncommon abbreviations on first use
- Put as much of your data as possible in appendices

Purpose, message and audience

- **Purpose** is provide complete documentation of your thesis project for posterity
- **Message** should be that you had a clear goal, you did the research and wrote up the results to the best of your ability, and you therefore deserve to pass the course and graduate
- **Audience**, in the short term, is your thesis advisory committee and, in the longer term, anyone who might be interested in what you've done

Tables and figures

- A picture really can be worth a thousand words
- Keep them easy to read and show only what is required
- Ensure that a photo hasn't been flipped left to right or top to bottom
- Ensure consistency between tables or figures and the text (e.g., Table 5, sample 67A; Gem Lake in Figure 2)
- *Geoscience Reporting Guidelines* has an excellent chapter on preparing illustrations (p. 167–188)

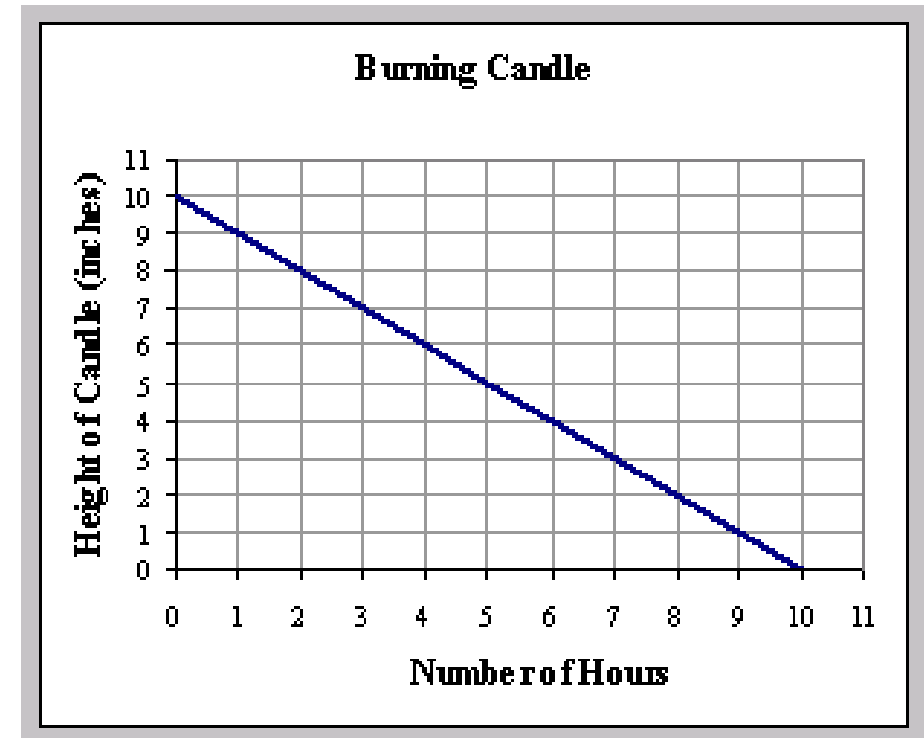
Tables versus graphs

- A graph can show a relationship better than a table can

Burning Candle	
Number of hours candle burns (x)	Height of candle in inches (y)
0	10
1	9
2	8
3	7
4	6
5	5
6	4
7	3
8	2
9	1
10	0

Independent variable in first column and on x axis.

Dependent variable in second column and on y axis.



Avoid run-on sentences

- **Run-on sentence:** two or more independent clauses (complete sentences) that are joined without appropriate punctuation or a conjunction (Wikipedia, 2016)

The rocks were badly weathered we could not get a fresh sample.

Either conjunction (so, since) establishes the intended cause-and-effect relationship between the clauses:

The rocks were badly weathered, **so** we could not get a fresh sample.

Since ~~the~~ the rocks were badly weathered, we could not get a fresh sample.

Avoid long sentences

- **Long sentence:** might be grammatically correct, but the length can make it difficult to understand

Use active rather than passive voice

The passive voice affects how a reader understands your argument and content and prevents clear understanding of what you are conveying. (Sigel, 2009)

Be particularly wary of writing abstracts in the passive voice—this is a strong signal to the reader that the research and results are probably boring and not worth further consideration. (Grant, 2004)

Replace	With
It was reported by Jones that...	Jones reported that...
The advice of my advisor is appreciated	I appreciate the advice of my advisor

Use present and past tenses properly

- Not addressed in either *Geoscience Reporting Guidelines* or the *SGS Style Guide*
- Use present tense for descriptions:
the rocks are granitic
- Use past tense for all previous work, even if it was done last year:
Hawking et al. (2015) concluded that...
(in part because they may have changed their conclusion since then)

Use parallel structures

- Every item in a list must match in function (i.e., be a word, phrase, clause or sentence); list is parallel if each item completes the sentence begun by the introduction to the list (“The rock is”):

The rock is equigranular to slightly quartz megacrystic, recrystallized, and with about 5% combined biotite and chloritized biotite (1–3 mm).

- Edits indicated are required to make the list items parallel (by removing the non-parallel one from the list in this case):

The rock is equigranular to slightly quartz megacrystic, **and** recrystallized, and ~~with~~ **comprises** about 5% combined biotite and chloritized biotite (1–3 mm).

Avoid clutter

- **Clutter:** using more words than necessary

Replace	With
due to the fact that	because
for the purpose of	for, to
in a number of cases	often
in the vicinity of	near
it should be noted that	note [or nothing]
the great majority of	most
it is intuitively obvious that	I don't really know, and I hope you don't either

Avoid jargon

- **Jargon:** using modified or invented words that sound ‘scholarly’

Replace	With
granites	granite (unless referring to two discrete types or occurrences)
volcanics, sulphides	volcanic rocks, sulphide minerals
interdigitate	interfinger
methodology	method(s)
orientate	orient
skarnification	skarn formation

Avoid redundant words

- **Redundant words:** adjacent words that have the same meaning

Replace	With
age dating	dating, radiometric dating
completely surrounded	surrounded
end result	result
immediately adjacent	adjacent
in close proximity	close, near
personal opinion	opinion
relative proportions	proportions
surface exposure	exposure

Avoid misused words

- **aerial/areal:** 'aerial' pertains to the air (e.g., aerial photography), whereas 'areal' pertains to area, as in areal reconnaissance (Grant, 2003)
- **comprise, compose, consist, constitute:** Comprise means 'consist of, contain', whereas compose means 'constitute, make up'. Thus, the whole comprises or consists of its parts, but the parts compose, constitute or make up the whole

“The rock comprises mainly quartz, feldspar and biotite” or “chalcopyrite and pentlandite constitute the majority of the ore minerals in the deposit” are correct, **BUT** “the rock is comprised of quartz, feldspar and biotite” is grammatically incorrect

Avoid misused words (cont.)

- **lithology/lithologies:** The definition of 'lithology' in the *AGI Glossary of Geology* (American Geosciences Institute, 2011) is
 - a) The description of rocks, especially in hand specimen and outcrop, on the basis of such characteristics as colour, mineralogical composition, and grain size....*
 - b) The physical character of a rock."*

Therefore, the use of 'lithologies' as a synonym for 'rock types' or 'sediment types' is incorrect, as in:

...unique geological descriptors are then manually assigned to 1 of 25 primary lithology codes. All ~~lithologies~~ rock types in the working database are populated using the 25 primary lithology codes.

Avoid misused words (cont.)

- **over:** The preposition 'over', whose primary meaning is "above, in or to a position higher than" (Barber, 2004), is often incorrectly used in place of 'during', 'more than' and 'throughout'. It is used incorrectly three times in the following sentence:

~~Over~~During the past half century, climate change has resulted in temperature increases of ~~over~~more than 0.1°/decade ~~over~~throughout much of Canada.
- **geological/geologic:** *Although both are used, the preference in Canada is for 'geological' because that's what's used by all our geological surveys (and the United States Geological Survey) in their names*

Minimize number of adjectives preceding nouns

- Trying to describe a rock or sediment type in a single sentence can result in as many as 20 words, including compound adjectives (consisting of two or more words, **in red**), modifying a noun (**in bold**)

- The record-holder (19 words):

The section is dominated by **medium- to thick-bedded, fine- to medium-grained, locally coarse-grained, moderately well sorted**, subangular to subrounded, volcanic lithic **arenite to wacke**, intercalated with thin-bedded siltstone to mudstone.

reads much better when some of the modifiers are placed after the noun:

The section is dominated by medium- to thick-bedded, fine- to medium-grained volcanic lithic arenite to wacke that is locally coarse grained, moderately well sorted, subangular to subrounded and intercalated with thin-bedded siltstone to mudstone.

Minimize number of adjectives preceding nouns (cont.)

- The runner-up (16 words):

Drillcore from two holes that intersected an **at least three hundred metres long, several metres thick, massive to disseminated, stratabound and stratiform** sulphide **layer** was examined.

benefits from the same treatment:

Drillcore was examined from two holes that intersected a massive to disseminated, stratabound and stratiform sulphide layer at least 300 m long and several metres thick.

Mineral assemblages

- Mineral assemblages are often unclear ('±' symbol in the following refers to all minerals that follow it [in red], not just clinopyroxene):

Units of orthogneiss consist of assemblages including quartz-plagioclase-finely perthitic microcline-biotite-magnetite, ± **clinopyroxene, orthopyroxene, garnet, titanite, monazite, zircon**, and in mafic to intermediate compositions, amphibole.

reads better with the '±' symbol preceding each mineral in the assemblage:

Units of orthogneiss consist of assemblages including quartz, plagioclase, finely perthitic microcline, biotite, magnetite, ±clinopyroxene±orthopyroxene±garnet±titanite±monazite±zircon and, in mafic to intermediate compositions, ±amphibole.

Hyphenation

- One of the most difficult issues in technical writing and editing
- Compound adjectives should generally be hyphenated when they precede the noun they modify if there's a chance of confusion
- How much hyphenation is required?
- Sometimes easier to rewrite the sentence, as in the following examples:

Hyphenation (cont.)

- The long, complex compound adjectives (in red) in the sentence:

The Eden Lake carbonatite complex is a **syenite-monzonite-alkali granite dominated, upper-mantle/lower-crust derived** alkaline complex that is exposed over an area greater than 30 km².

cannot be hyphenated properly, so the sentence must be rewritten as:

The Eden Lake carbonatite complex is an alkaline complex, exposed over an area greater than 30 km², that is derived from the upper mantle–lower crust and dominated by syenite, monzonite and alkali granite.

or, by splitting it into two sentences, as:

The Eden Lake carbonatite complex is an alkaline complex that is derived from the upper mantle–lower crust and dominated by syenite, monzonite and alkali granite. It is exposed over an area greater than 30 km².

Hyphenation (cont.)

Original	Revision
basinward-thickening, southwestern-sloping wedge	wedge that slopes southwest and thickens toward the basin
Fe-Ti oxide bearing cumulate gabbronorite	cumulate gabbronorite containing Fe and Ti oxides
345° to 350°-trending foliation	foliation trending 345–350°
pre Trans-Hudson aged zircon	zircon of pre–Trans-Hudson age
garnet-staurolite (+ vein kyanite)-bearing pelite	pelite containing garnet-staurolite (+ vein kyanite)
electrical resistivity array measurement system development for gas hydrate dissociation monitoring	development of an electrical-resistivity-array measurement system for monitoring of gas-hydrate dissociation

Hyphenation (cont.)

Original	Revision
AR digestion/ICP-MS	aqua-regia digestion followed by inductively coupled plasma–mass spectrometry
upper amphibolite to granulite facies grade rocks	rocks of upper-amphibolite to granulite facies ('grade' not needed in addition to 'facies')
to force conservation of Al during simulated aluminosilicate-mineral weathering reactions	to force conservation of Al during reactions that simulated aluminosilicate-mineral weathering
mineralization 0.2 g/t Au equivalent outline	outline of mineralization grading 0.2 g/t Au equivalent
post high grade metamorphism cooling	cooling that postdates high-grade metamorphism

Hyphenation (cont.)

- If sentence cannot be rewritten, use hyphens (and dashes when one part of the compound adjective is already a compound)

Original	Revision
pre 1.8 Ga granitic rocks	pre–1.8 Ga granitic rocks
Doig-Montney hybrid gas-shale/tight gas reservoir	Doig-Montney hybrid shale-gas–tight-gas reservoir
aqua regia digestion atomic absorption spectrometry	aqua-regia digestion followed by atomic-absorption spectrometry

Spelling and word usage

- ‘Canadian’ English spelling is a mix of British and American. Like the British, we use ‘colour’ rather than ‘color’, ‘centre’ rather than ‘center’, ‘metre’ rather than ‘meter’ when referring to the SI unit of measure (but ‘meter’ when referring to an instrument for measuring). Like the Americans, we prefer ‘analyze’ to ‘analyse’
- Authority for Canadian English is the *Canadian Oxford Dictionary, Second Edition* (Barber, 2004)
- Appendix 4 of the *SGS Style Guide* is an extensive (19-page) list of geoscience and related terms collected during the past 15 years

Spelling and word usage (from SGS Style Guide)

country rock (synonymous with 'wall rock')

co-worker

crag-and-tail (pl. 'crag-and-tail features', **not** 'crag-and-tails')

criss-cross, criss-crossing

criticize, criticizing

cross-bed, cross-bedded

cross-border (adj.)

cross-correlate, cross-correlation

crosscut, crosscutting (**not** 'cross-cutting')

crossfault, crossflow, crossfold

cross-laminae, cross-lamination, cross-laminated

crossline

cross pile

crossplanar

deglacial, deglaciation, deglaciations, late-deglacial

de-ice

de-ionize

delignification

delimit

demagnetize, demagnetization

demethanization

dendrochronology, dendrochronological

dendroclimatology, dendroclimatic

de-oil

dependant (n.; "He is dependant on his uncle for his income.")

dependent (adj.; "The outcome is dependent on the number of participants.")

depocentre, depozone

Abbreviations

- Define all uncommon abbreviations (e.g., LA-MC-ICP-MS) on first use
- Mineral abbreviations follow:
Whitney, D.L. and Evans, B.W. (2010): Abbreviations for names of rock-forming minerals; American Mineralogist, v. 95, p. 185–187.
- Appendix 3 of *SGS Style Guide* is an extensive (14-page) list of geoscience abbreviations, collected during the past 15 years

Abbreviations (from SGS Style Guide)

LC	liquid chromatography
LE	licence exception
LiDAR	light detection and ranging
LILE(s)	large-ion lithophile element(s)
line-km	line-kilometre(s)
LIP(s)	large igneous province(s)
LL	laterolog
LNG	liquefied natural gas
<i>loc. cit.</i>	* (<i>loco citato</i>) in the place cited [requires a publication and page reference]
log	logarithm
LOI	loss-on-ignition
long.	* longitude [use only in parenthetical text, figures, tables, maps or mineral deposit descriptions]
LPG	liquefied petroleum gas
LREE(s)	light rare earth element(s) [La, Ce, Pr, Nd, Sm; see 'HREE(s)', 'MREE(s)']
LSD	* legal subdivision [used to describe location relative to the Township and Range grid of the Dominion Land Survey system (e.g., LSD 11-7-39-2W3M)]
Ltd.	* Limited [only abbreviated when part of a company name]

Self-editing

- Wait at least a week after writing a section before editing it
- Arrange with a geoscience classmate to edit each other's thesis
- Read text aloud, ideally to someone else (N. Barlow, pers. comm., 2016) who need not have a geoscience background
- Apply the KISS principle (T. Sifrer, pers. comm., 2016):
- Your advisory committee must be able to understand your reasoning

Check during any edit

- Spelling and grammar (DO NOT trust Word's utilities)
- Consistent terminology (e.g., Fuzzy Lake granite/granitic complex/intrusion/intrusive complex were all used for same body of rock)
- Each reference cited (in text, tables and figures) is in the reference list, and each reference in the list is cited in the text
- If a figure or table is said to show something, ensure that it does (Dufour, pers. comm., 2016)
- Validity of numbers (e.g., decimal point in the right place); check against lab data sheets if in doubt

Editorial test (1)

- What's wrong with the geology in this sentence?

The Pense Formation, with its four, classical, upward-fining black shale, bioturbated shale and sandstone, and terminal sandstone cycles, above a basal black shale and sandstone on an erosional surface, is a faithful replica of Price's (1963) type Pense Formation at the Sohio Canadian Devonian Pense 14 6-17-22W2 well, 50 km to the south-southeast.

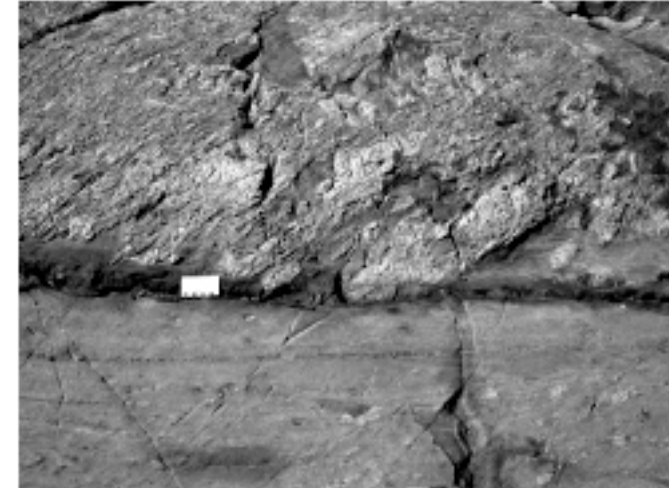
My comment:

Author's response:

Editorial test (2)

- Identify the inconsistency between this caption and photo.

Figure GS-X7-4c: In situ–brecciated rhyolite of the Tower member in contact with overlying, finely laminated mafic tuff.



My comment:

Author's response:

Format

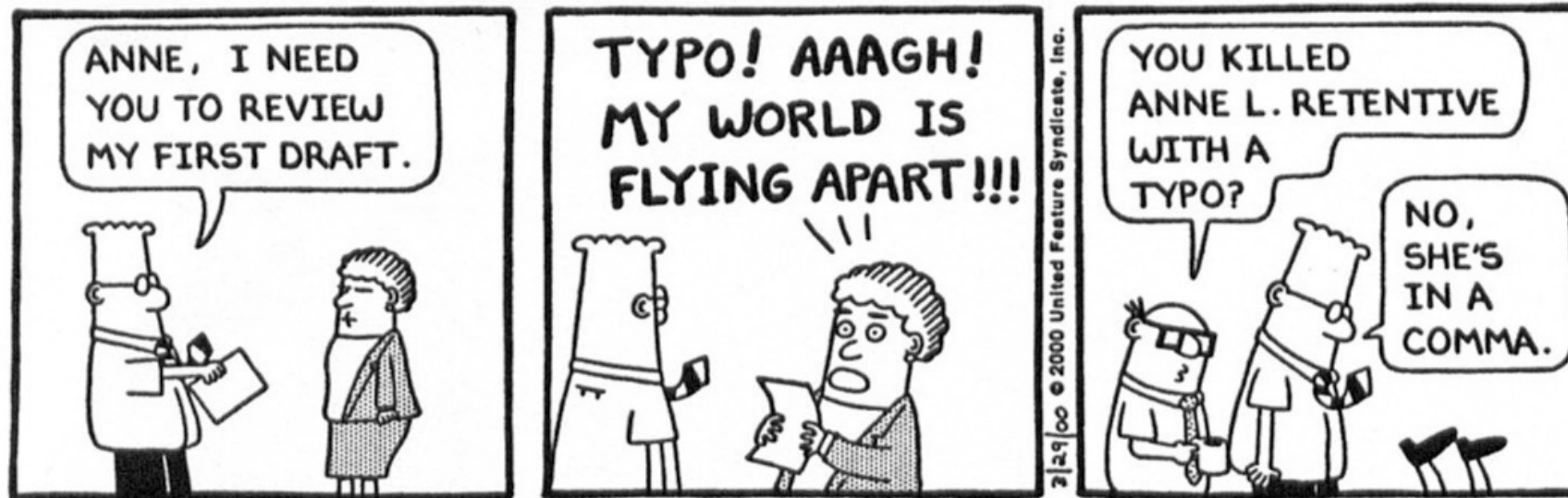
- No university-wide format specifications for theses, but Barry will provide the set that he prepared
- Easier to follow format specs from the outline stage than to reformat your thesis the night before it's due

Do and don't

Do	Don't
Prepare a work-back schedule	Ignore an indication that you might not have enough time
Revise the scope if too broad	Try to do it all
Prepare an outline early in the project	Ignore the outline until it's time to start writing
Write clearly and concisely, and edit carefully using <i>Geoscience Reporting Guidelines</i> and the appendices in the <i>SGS Style Guide</i>	Submit a thesis that looks like it's been written by committee (i.e., "batch written") because your committee might think that it was
Give due credit to others for their words, ideas and information	Plagiarize or fail to obtain copyright permission
Put as much of your data as possible in appendices	Include data that are irrelevant

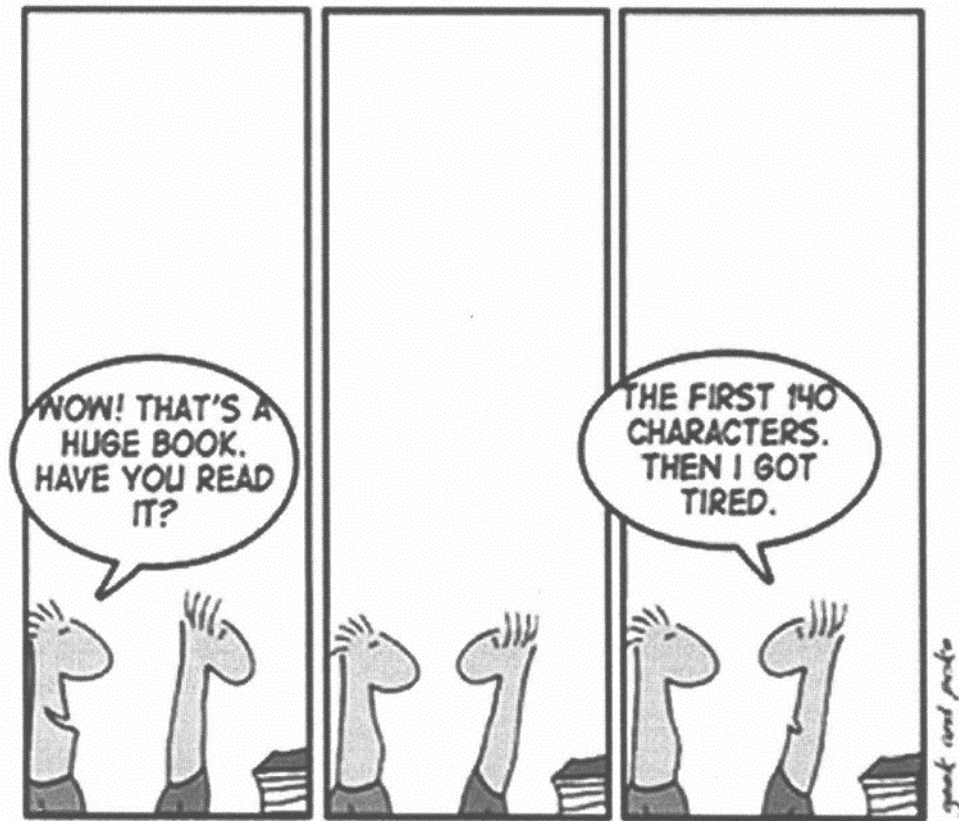
Editors like humour too—even when it's at our own expense!

- Geoscience editing is a subdiscipline of geoscience
- Good way to make a living in a field with few qualified practitioners—and we're eligible for P.Geo. registration



Good luck with your thesis!

Eight Steps to More Concise Writing



References

Barber, K. (2004): Canadian Oxford Dictionary, Second Edition; Oxford University Press, Toronto, Ontario, 1830 p.

Grant, B. 2003: Geoscience Reporting Guidelines; D.B. Grant, Victoria, British Columbia, 346 p. (distributed by Prospectors and Developers Association of Canada and Geological Association of Canada).

Metcalfe, J.E. and Astle, C. (1993): Correct English; Clarion, Tadworth, Great Britain, 320 p.

Sigel, T. (2009): How passive voice weakens your scholarly argument; Journal of Management Development, v. 28, no. 5, p. 478–480.

Wikipedia (2016): Run-on sentence; Wikipedia, the free encyclopedia, URL <https://en.wikipedia.org/wiki/Run-on_sentence>.