WRITING YOUR FIRST PROPOSAL

WHY ARE PROPOSALS NEEDED?

Proposals are commonly used at the beginning of a project to outline the need and approach for a potential task or area of research. They are used when you want to pitch an idea (for example, drill here) or garner support from interested parties and/or funding agencies, and they are commonly required for students entering an MS or PhD program.

An effective scientific proposal serves the needs of both the proposal writer and the proposal evaluator. For the writer, it provides impetus to review a scientific area, to evaluate possible approaches to answering a scientific question, to frame a sales pitch, and to give an opportunity for feedback on both the topic and the evaluator's expectations. For the evaluator, it creates confidence in the proposed project and methods and allows the evaluator to obtain support for the project from his or her superiors, such as the company CEO, a university graduate studies committee, or board members. Finally, a proposal allows everyone involved to have a written record of an idea, the proposed methods, the likely outcome, and the expectations for the project.

WHAT DOES A PROPOSAL CONTAIN?

In most cases there are specific guidelines or formulae that you should follow when writing your proposal. The evaluators are expecting the format to be correct, and many will outright reject your proposal if it is not. Therefore, follow the guidelines, back up your computer, double-check that you followed the guidelines, back up your computer again, and repeat. It would be a shame to spend lots of time on a proposal that is rejected because it did not follow the guidelines or that was lost due to computer issues.

If guidelines are not available from your evaluator, a helpful approach is to look at other successful proposals and evaluate the different approaches (ask your peers or consult the Web). If all else fails, then follow a generic outline along the lines of a manuscript for which the data are yet to be collected: Title, Introduction, Methods, and Expected Results. Larger proposals may require a budget and budget justification, and these will be the topic of another column.

Title

An appealing title convinces someone to read your proposal, and it is arguably the most important step in writing your proposal. It should describe the work clearly in a short, self-contained sentence. Aim to balance both the big picture and the specific study, without overselling your proposed work and without sounding technical and tedious. Some authors suggest that the best titles include words from the following three categories: (1) problem, (2) data domain, and (3) solution. Candidate titles are created using words from each category, so from the example shown in Table 1, the following title may be derived: "Lowering greenhouse gases from coal plant pollution using subsurface storage of carbon dioxide."

Table 1 EXAMPLE OF CONSTRUCTING A TITLE USING THREE CATEGORIES

PROBLEM	DOMAIN	SOLUTION
Atmospheric CO_2	Carbon credits	Sequestration in aquifers
Coal plant pollution	Greenhouse gases	Subsurface storage
	Climate change	CO_2 stored as bicarbonate

Introduction

The introduction puts the study into context, identifies knowledge gaps, and shows why the proposed work is important (typically called "significance"). The goal of the introduction is to highlight the substance and significance of your work and how your new approach will contribute in a meaningful way to the area of study. Generally, the introduction includes a targeted literature review to support your statements. A common mistake is to include excessive details that do not help the reader understand why your project is important, so use this section to outline compelling and testable hypotheses that are the logical next step given the background literature. In the final paragraph, state the aims of the study and how you will evaluate the positive and negative outcomes. Be careful not to overstate the importance of your proposed project. Rather, highlight the specifics on why your approach is novel and the concrete benefits resulting from the research.

Some authors successfully illustrate their approach using a schematic figure showing the state-of-the-art knowledge and how their study will address an unknown question. Using the example above, the author may show the carbon cycle, including the flux from coal plant pollution and the possible contribution of subsurface storage.

To help you write your introduction, think about these focus questions:

What do you plan to do? What questions did you want to answer? (Goals or compelling hypotheses)

What are the reasons for the questions being asked in the first place? (Review of theories and research relevant to the problem)

How will your research solve the problem? (Your approach)

Methods

The goal of this section is to show how the proposed research will solve the problem in an appropriate and rigorous manner. Be simple, clear, informative, and logical in your description of the methods. Reassure the reader that you have chosen methods that are appropriate for answering the proposed question by referring to other studies. Sometimes some pilot data can provide the most convincing case for a particularly novel approach or question.

Many authors find it best to write from the perspective of describing the methods to someone else so that they could replicate them. State the materials and methods used in the study without excessive detail. For instance, simply stating that you "dug a hole 1 m deep" is better than "Frank used a round, long-handled shovel to dig a big hole." Figures may assist you in communicating your methods, and you should use simple subheadings where appropriate; for example: Major element analysis, Trace element analysis, and Isotopic analysis.

Some focus questions for the methods include:

Where will you do the study? (Location)

When? (Timeline)

How will you do the study? (Analytical methods and funding, if applicable)

Why are your methods appropriate? (Justification of methods)

Are there any other special considerations/conditions?

Tips for writing a successful proposal

Understand your subject at a basic level before you begin

- Does your proposal pass the "neighbor" test? i.e. Can you talk to your neighbor over the fence and convince them your project is a good idea?
- Can you draw a cartoon showing how your project answers a question?

Avoid common pitfalls

- Poor organization, disjointed writing, and typographical errors
- Failure to provide research context and to provide a compelling argument
- Incomplete, excessive, and/or unfocused literature review
- Poor description of methodology, boundary conditions, and timeline
- Proposal incomprehensible to a scientist in a different field
- Proposal includes work that you do not ever intend to do

Don't forget the sales pitch

You'll get more constructive advice and better support if you convince your evaluators that you know what you are doing and that your problem is an important (and even urgent) one. Provide as much evidence for progress as possible, and indicate you have thought through the possible outcomes and what they might mean for your conclusions. If you can't convince your neighbor that this is a significant problem, then you need to rethink your pitch.

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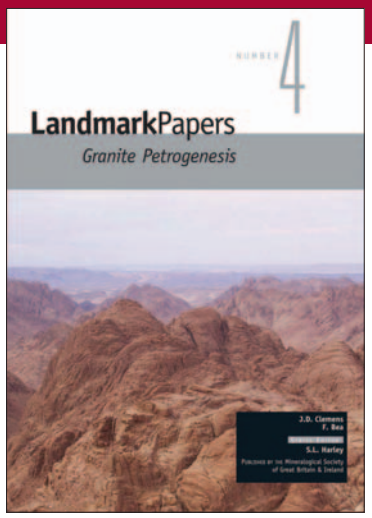
GRANITES AND GRANITES



*Granite Petrogenesis** is the fourth publication in the Mineralogical Society of Great Britain and Ireland's Landmark Papers series. The purpose of the series is "to allow students and others to read for themselves, in the original form, how some of the giants in the field set down their ideas." The 20 papers were selected by John Clemens, of the University of Stellenbosch, South Africa, and Fernando Bea, of the University of Granada, Spain, and appear as facsimile copies of the originals. Each paper, plus an introduction to the paper by Clemens and Bea (usually of one page or less), constitutes a chapter. The introductions put the chosen papers into a historical context, provide a summary, and justify the choice as a "landmark."

The papers are grouped into four sections: the origins of granitic magmas; field relations, magma transport and emplacement; typology and magmatic evolution; melt compositions, experimental petrology and economic potential. This scheme does not work well. The papers are often hard to classify, and a systematic reader will find concepts appearing before they have been introduced. For example, the I- and S-type classification of granites is introduced in chapter 11, although the terms are used in chapters 6, 7 and 10. Scientific landmarks are waypoints on a journey in time into an untravelled world. The high ground is recognized only when we see that it stands above the foothills. I would have preferred to read the papers by date of publication, and I've arranged my comments below in this way.

Sins of omission are easy to suggest, as I do below, but the literature on granite is vast and I'm sure most granite experts would find great difficulty in selecting their personal "landmarks." Simon Harley (the series editor) notes in his foreword that the first published evidence that granite formed from molten material intruded into pre-existing rocks is usually ascribed to James Hutton's (1794) *Observations on Granite*, but Clemens and Bea did not include any text from Hutton. Some extracts would have been my choice as a first landmark.

Chapter 1, by R. W. Bunsen (of burner fame) (1861), is reproduced in German with an English translation. Bunsen introduced the concept of eutectic crystallization and also the idea that silicate liquids were solutions. The next paper historically (chapter 15) is by R. W. Goranson (1932). Goranson heated a natural granite with variable amounts of water in sealed platinum capsules and concluded that "at 700 ± 50 °C and under a water vapor pressure of 1000 bars Stone Mountain granite will become, except for hematite, completely liquid. The melt will have 6.5% water in solution." Few works in experimental petrology have had so many ramifications across so many fields.

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* Clemens JC, Bea F (eds) Granite Petrogenesis. Mineralogical Society Landmark Papers Volume 4, 343 pages, ISBN 978-0-903056-30-4, £32.00, member price: £18.00

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Expected Results

To demonstrate competency, it is helpful to show preliminary results that indicate how your study will answer the question posed. If this is not possible, then you may consider showing the results of similar studies, indicating how your study will build on that previous work. It also increases the evaluator's confidence in your project if you can suggest strategies for overcoming potential problems with your approach (e.g. alternate experimental methods) that you can reasonably foresee.

TABLE 2 ANALOGIES BETWEEN WRITING A PROPOSAL AND RIDING A BIKE

Writing a proposal	Riding a bike
Make sure that you are eligible	Make sure that the bike works
Follow any guidelines	Follow the road rules
Good proposals take time to mature	Competent riding takes time to learn
Decide on a compelling reason to propose the study	Decide on your destination
Decide on your approach and write an outline	Decide on your route
Anticipate potential obstacles and address them	Take supplies and avoid problem areas
Start writing!	Leave on your trip!
Keep it simple, limit sidetracks	Just ride the bike, stay on the path
Take breaks	Take breaks
Include figures	Take photos of your trip
Hastily written proposals may get rejected	Hasty bike riders may crash

OTHER CONSIDERATIONS

Pay close attention to your writing, and make sure that you have checked for typographical, spelling, and grammar errors. Try to use mostly nouns and verbs, and avoid excessive superlatives, adjectives, and adverbs that produce complex, jargon-filled text that is difficult to read and understand. To see if you have done well, ask an educated person outside your field to read your proposal and then tell you what your proposal involves and why you are proposing the project. Figures and tables greatly help your reader to understand the material, so try to include them in your proposal. Follow standard rules for citing the literature and for listing the references. Finally, you might like to think about the analogies between writing a proposal and riding a bicycle (TABLE 2).

WHAT IS NEXT?

Remember that a proposal is just that: proposed or potential work. Science, by its very nature, rarely follows the progression envisaged initially. Don't forget to be flexible after the proposal, but if you have to make major changes to the research project, it is worth meeting with your evaluators again to discuss, adapt, and forge a new path.

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RESOURCES FOR WRITING PROPOSALS

Cryer P (2006) The Research Student's Guide to Success, 3rd edition. Open University Press, 269 pp

Day RA, Gastel B (2006) How to Write and Publish a Scientific Paper, 6th edition. Greenwood Press, 302 pp

Peters RL (1997) Getting What You Came For: The Smart Student's Guide to Earning an M.A. or a Ph.D. Noonday, 399 pp