

Polishing Your Writing Skills for State Government Agency Careers

W. Steven Holbrook
Department of Geosciences
Virginia Tech

American Geosciences Institute
Geoscience Online Learning Initiative (GOLI) Webinar
June 4, 2019

Outline

- Importance of writing in geoscience careers
- Preparation of students in geoscience curricula
- Some advice on writing

Outline

- Importance of writing in geoscience careers
- Preparation of students in geoscience curricula
- Some advice on writing

The Guiding Principle of Scientific Writing:

It is the author's job to make the reader's job easy.

-Joshua Schimel, Writing Science

Importance of Writing in Geoscience Careers

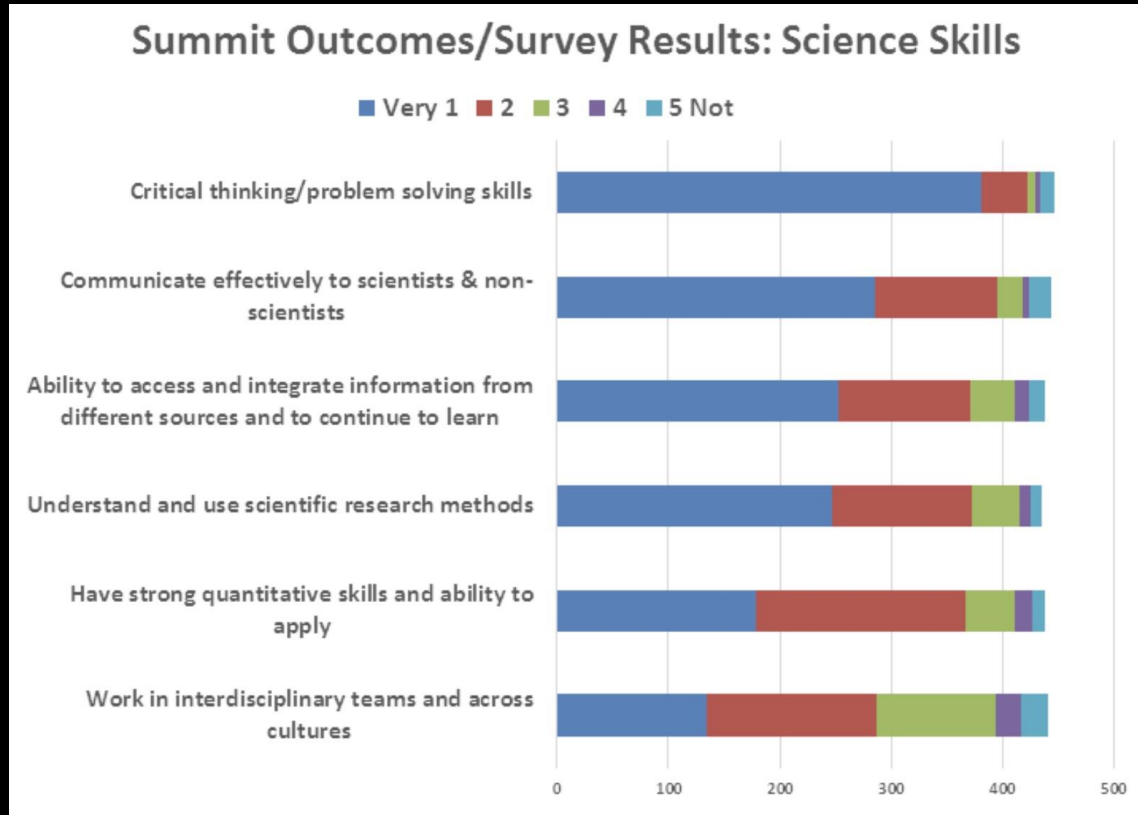
“Writing skills are hugely important in our hiring and promotion. Training people on the job to write well is a lengthy process and one I prefer to avoid – even for those who are otherwise most qualified. Poor writing equates to more hours in review and editing, delays in getting work product out the door, and of course potentially devastating cost if something that is poorly written leads to litigation.”

- Glen Bobnick, Inberg-Miller Engineers

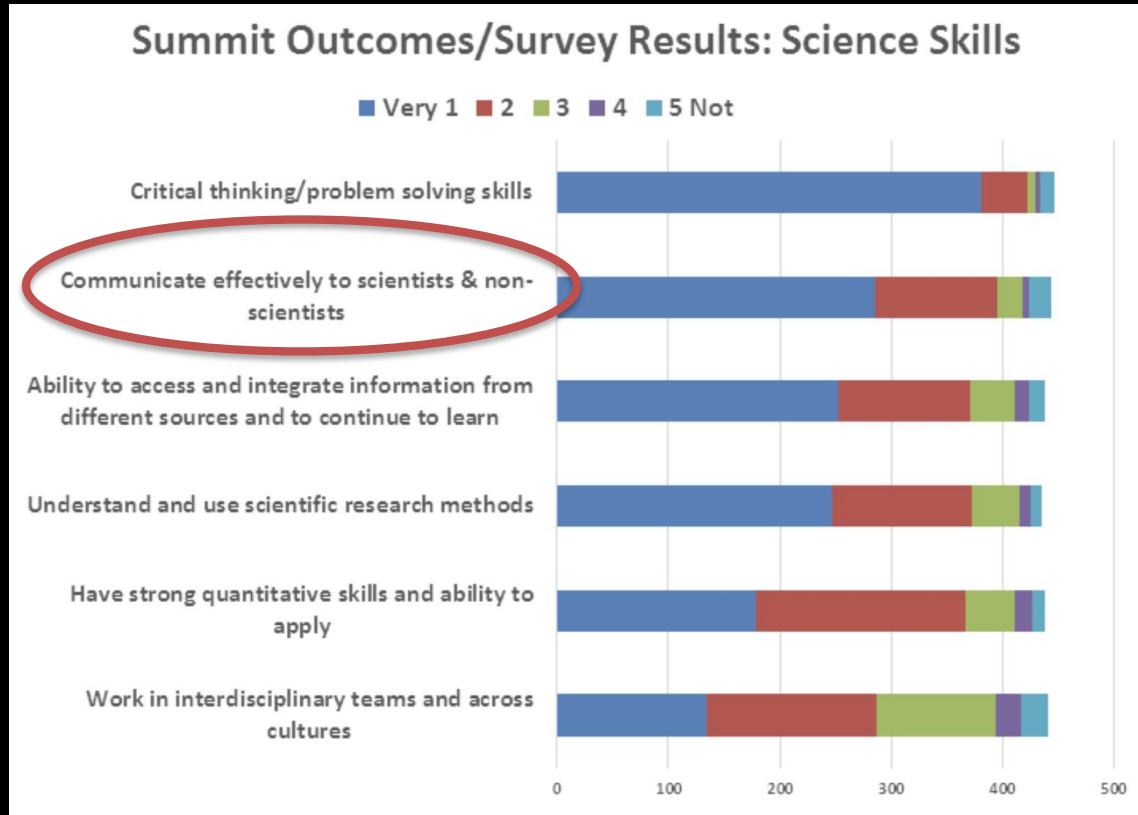
“I've seen [editors] get half way through a paper and throw it out, saying ‘if this person isn't careful enough to proofread a journal submission 3 times, I have considerable doubt about his laboratory habits.’ Your writing reflects who you are, and how you present yourself to others.”

- Joe East, United States Geological Survey

Importance of Writing in Geoscience Careers



Importance of Writing in Geoscience Careers



Importance of Writing in Geoscience Careers

Geology Faculty: n = 58
 Geology Students: n = 31
 Geology Professionals: n = 72

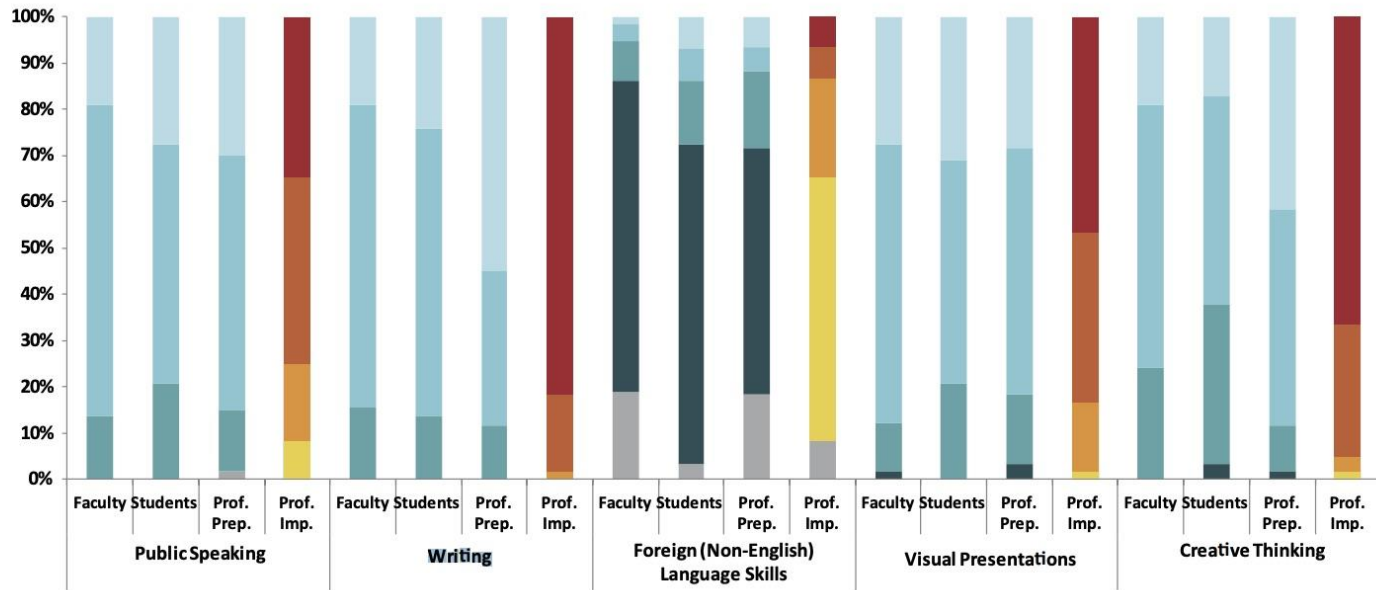
KEY Preparation:

- Extensively Prepared
- Adequately Prepared
- Somewhat Prepared
- Not Prepared
- Not Applicable/ I don't know

KEY Importance:

- Very Important
- Important
- Somewhat Important
- Not Important
- Not Applicable/ I don't know

Figure 5.1: Geology Non-Technical Skills, part 1



Importance of Writing in Geoscience Careers

Geology Faculty: n = 58
 Geology Students: n = 31
 Geology Professionals: n = 72

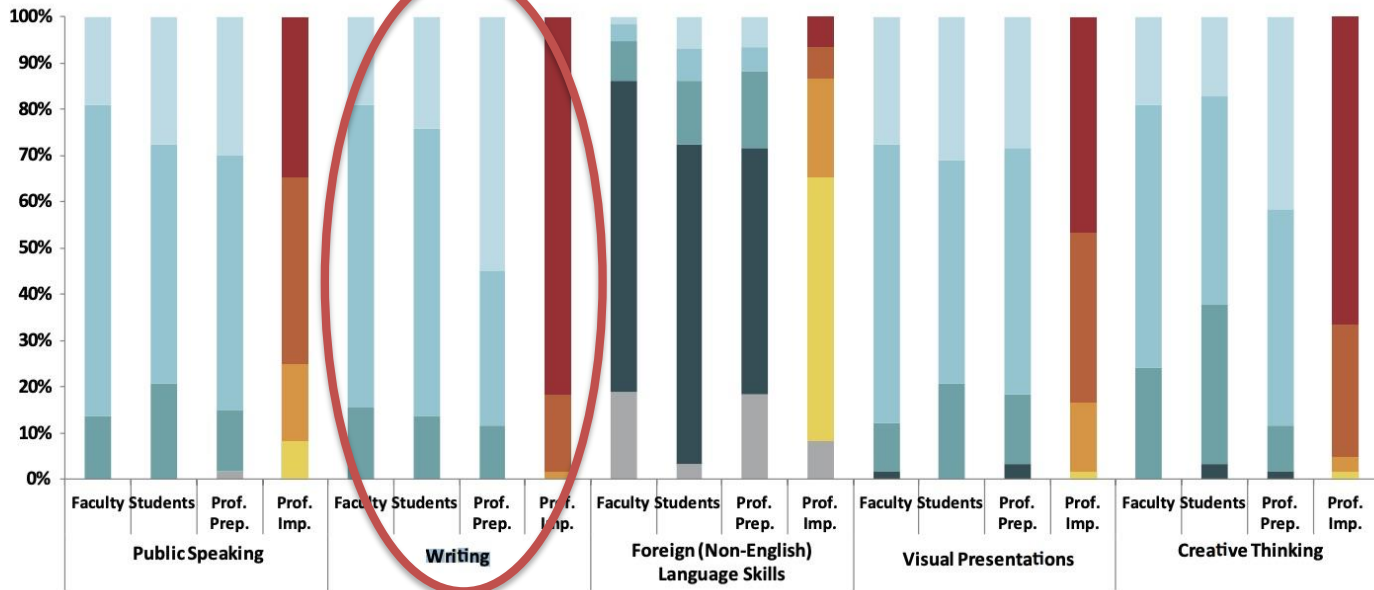
KEY Preparation:

- Extensively Prepared
- Adequately Prepared
- Somewhat Prepared
- Not Prepared
- Not Applicable/ I don't know

KEY Importance:






- Very Important
- Important
- Somewhat Important
- Not Important
- Not Applicable/ I don't know

















Figure 5.1: Geology Non-Technical Skills, part 1



VT Geosciences: Writing in the Curriculum

1. Fundamentals of Geoscience (First-Year Experience)

COMMUNICATION / GROUP PROJECT		
M 4/15	Technical Writing/Project 	Due today: Ethics and Earthquakes (see above)
W 4/17	Technical Writing/Project 	In class: Effective paragraphs assignment Due today: Draft project annotated bibliography (only the leader of this task should submit)
M 4/22	Technical Writing/Project 	In class: Effective sentences (hard copy)
W 4/24	Technical Writing/Project 	In class: Effective sentences #2 Draft fact sheets due on Fri 4/26
M 4/29	Technical Writing/Project	In class: Group review of draft fact sheet
W 5/1	Presentations/Project 	In class: Work on presentations, guidelines here In class: Work on formatting fact sheet, template placed in your team drives/google folders Draft presentation slides due on Fri 5/3
M 5/6	Practice presentations	Submit your final slides here by Tues 5 pm.
W 5/8	Last Day! Final Presentations start at 1 pm in the Museum.	Submit final fact sheet here by noon . Submit final annotated bibliography here by midnight .

-  1_Intro Tech Writing.pptx 
-  2_Writing report IMRAD introductions.pptx 
-  3_Writing steps_paragraphs.pptx 
-  4_Sentences_Complexity_CutClutter.pptx 
-  5_Sentences_ActiveVoice_Verbs.pptx 
-  6_Grammar Bootcamp.pptx 
-  11_Presentation guidelines General.pptx 
-  15_Revising_Rewriting_Peer Review.pptx 

VT Geosciences: Writing in the Curriculum

2. Writing-intensive courses

GEOS 3204 – Sedimentology/stratigraphy

GEOS 3404 – Elements of Structural Geology

GEOS 4174 – Exploration Seismology

... These are mostly term papers with feedback.

VT Geosciences: Writing in the Curriculum

3. Senior Seminar

- Multiple small exercises, not just one huge paper
 - Lots of exercises of 1-3 paragraph length
 - Longest paper is ~5 pages

VT Geosciences: Writing in the Curriculum

3. Senior Seminar

- Multiple small exercises, not just one huge paper
 - Lots of exercises of 1-3 paragraph length
 - Longest paper is ~5 pages

“The first useful concept is the idea of short assignments... We are just going to take this bird by bird. But we are going to finish this one short assignment.”

- Anne Lamott, Bird by Bird

VT Geosciences: Writing in the Curriculum

3. Senior Seminar

- Multiple small exercises, not just one huge paper
 - Lots of exercises of 1-3 paragraph length
 - Longest paper is ~5 pages
- Editing feedback – the “Red Ink Experience”

VT Geosciences: Writing in the Curriculum

3. Senior Seminar

- Multiple small exercises, not just one huge paper
 - Lots of exercises of 1-3 paragraph length
 - Longest paper is ~5 pages
- Editing feedback – the “Red Ink Experience”

“Almost all good writing begins with terrible first efforts... Start by getting something – anything – down on paper. A friend of mine says that the first draft is the down draft – you just get it down. The second draft is the up draft – you fix it up.”

- Anne Lamott, Bird by Bird

VT Geosciences: Writing in the Curriculum

3. Senior Seminar

- Multiple small exercises, not just one huge paper
 - Lots of exercises of 1-3 paragraph length
 - Longest paper is ~5 pages
- Editing feedback – the “Red Ink Experience”
- Anecdotal evidence: grammar and spelling are getting better over time, but structure/composition are not.
 - Speculation: AI-assisted writing will pose new challenges in the future.

Improving Your Writing Skills

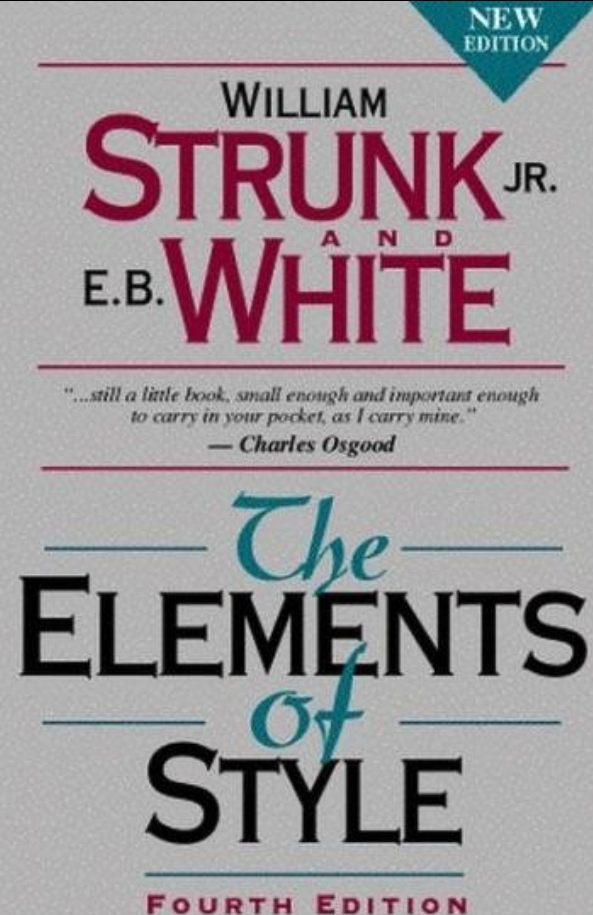
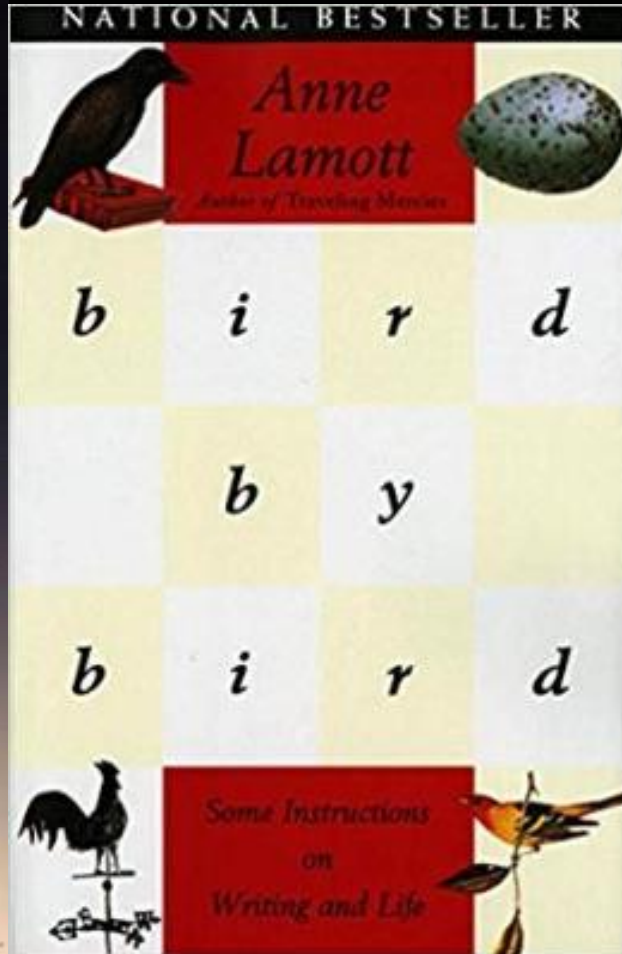
- Practice, practice, practice.
- Read (a lot), and analyze good writing as you discover it.
- Read books on (scientific) writing.
- Get feedback. (Make a review pact with a colleague, join a writing group, etc.)
- Students:
 - Take a class in technical writing.
 - Use the Writing Center

Books on Writing

JOSHUA SCHIMEL

WRITING SCIENCE

How to write papers that get cited
and proposals that get funded



Some General Writing Principles

- Identify your “rhetorical purpose.”
- Identify your audience.
- State your purpose.
- Prefer the active voice.
- Don't be afraid to use selective redundancy.
- Move from general to particular (at all levels).

Some General Writing Principles (2)

- Organize your paper so that the structure matches the purpose.
- Start with an outline, then expand the outline.
- Make the paragraph the unit of composition.
- Use linking words and ideas to ease transitions.
- Use effective topic sentences.
- Make proper use of commas – hyphens; and semi-colons.
- Trim the fat. (“Bloated writing is bad writing.” –Josh Schimel)

Identify Your Rhetorical Purpose

“Formulation of a purpose statement helps the writer set up a conscious control over what goes into his report and how it is arranged... By stating the purpose, you are providing yourself with a focus, a means of delineating the relevant material.”

*- Mathes & Stevenson, *Designing Technical Reports**

- What is your Rhetorical Purpose?
 - inform?
 - persuade?
 - instigate?
 - create interest?
 - challenge?
- A clear sense of purpose will actually help you **design** the report.
- Form Follows Function: Different writings have distinct audiences and purposes and, therefore, different form.

Identify Your Audience

*“Every communication situation involves three fundamental components: a writer, a message, and an audience. However, many report writers treat the communication situation as if there were only two components: a writer and his message... The result is a poorly designed, **ineffective** report.”*

*- Mathes & Stevenson, **Designing Technical Reports***

“You must know the intended audience and tailor the writing to them... You need to adapt your language, style, and approach to deal with different media and different audiences.”

*- Joshua Schimel, **Writing Science***

Identify Your Audience

- Ask yourself, “Who will read this?” ... and write as if you were speaking to them.
- Is your audience one person? Many people?
- Is your audience homogeneous? Technically savvy? Diverse?
- You must:
 - Supply necessary background
 - Place your study in a larger context

The Paragraph is the Unit of Composition

13. Make the paragraph the unit of composition.

“As a rule, begin each paragraph either with a sentence that suggests the topic or with a sentence that helps the transition. If a paragraph forms part of a larger composition, its relation to what precedes, or its function as a part of the whole, may need to be expressed. This can sometimes be done by a mere word or phrase (again, therefore, for the same reason) in the first sentence. Sometimes, however, it is expedient to get into the topic slowly, by way of a sentence or two of introduction or transition.”

The Paragraph is the Unit of Composition

The topic sentence should be a general statement of the subject of the upcoming paragraph.

Corollary: Avoid The Big Copout.

Never start a paragraph with:

“Figure 2 shows....”

Use Transitions

Smooth the seams between paragraphs with “linking words,” such as:

‘this’

‘these’

‘in contrast’

‘also’

‘above’

...and by repetition of key words.

Expanding Outlines

Aleutians Geology Paper — First Outline

Deep Structure of the Aleutian Island Arc and Implications for Continental Crustal Growth

Major Points:

- Provides a test of the hypothesis that volcanic arcs are the factories of continental crust
- Result: Oceanic arcs have the requisite thickness (>30 km) to build continental crust, but differ from continental crust in their composition and reflectivity structure.
- Therefore, either (1) intraoceanic arcs were not a common source of most continental crust, or (2) the bulk properties of arc crust are substantially modified during or after accretion of arc to a continental margin.
- The volume of crust created along the arc exceeds that estimated by previous workers by about a factor of 2, which may have important implications for models of continental growth through time (e.g., Reymer and Schubert, 1984).

1. Introduction

- Magmatism at island arcs may constitute a principal source of continental crust, yet relatively few well-constrained determinations of the deep structure of arcs exist.
- Paradox in "island arc" model of continental crustal growth: basaltic composition of island arc crust vs. andesitic composition of the bulk continental crust.
- Geophysical data provide key constraints on these models of continental crustal evolution, by providing comparisons of fundamental crustal properties of island arcs, accreted terranes, and continental crust.
 - In this paper we present a new seismic velocity model of the Aleutian arc.

2. Setting and Experiment

- Brief geologic history of Aleutians
- experiment design
- MCS processing described in Bangs et al.
- OBH/S processing

3. Velocity Model and Crustal Composition

- Arc; major features (describe)
- Upper crust
- Mid crust
- Lower crust

4. Discussion

- Implications for Crustal Evolution
 - Bulk crustal composition
 - Comparison to Christensen and Mooney, Morozov: The Aleutian intraoceanic arc does not resemble mature continental crust. Thus later processes must be responsible for crustal differentiation and widespread reflectivity.
- Although the thickest part of the arc occurs where the slab is at 100 km depth, the present volcanic front occurs where the slab is at only 50 km depth.
- The volume of crust created along the arc exceeds that estimated by previous workers by about a factor of 2, which may have important implications for models of continental growth through time (e.g., Reymer and Schubert, 1984).

Expanding Outlines

Aleutians Geology Paper — First Outline

Deep Structure of the Aleutian Island Arc and Implications for Continental Crustal Growth

Major Points:

- Provides a test of the hypothesis that volcanic arcs are the factories of continental crust
- Result: Oceanic arcs have the requisite thickness (>30 km) to build continental crust, but differ from continental crust in their composition and reflectivity structure.
- Therefore, either (1) intraoceanic arcs were not a common source of most continental crust, or (2) the bulk properties of arc crust are substantially modified during or after accretion of arc to a continental margin.
- The volume of crust created along the arc exceeds that estimated by previous workers by about a factor of 2, which may have important implications for models of continental growth through time (e.g., Reymer and Schubert, 1984).

1. Introduction

- Magmatism at island arcs may constitute a principal source of continental crust, yet relatively few well-constrained determinations of the deep structure of arcs exist.
- Paradox in "island arc" model of continental crustal growth: basaltic composition of island arc crust vs. andesitic composition of the bulk continental crust.
- Geophysical data provide key constraints on these models of continental crustal evolution, by providing comparisons of fundamental crustal properties of island arcs, accreted terranes, and continental crust.
- In this paper we present a new seismic velocity model of the Aleutian arc.

2. Setting and Experiment

- Brief geologic history of Aleutians
- experiment design
- MCS processing described in Bangs et al.
- OBH/S processing

3. Velocity Model and Crustal Composition

- Arc; major features (describe)
- Upper crust
- Mid crust
- Lower crust

4. Discussion

- Implications for Crustal Evolution
 - Bulk crustal composition
 - Comparison to Christensen and Mooney, Morozov: The Aleutian intraoceanic arc does not resemble mature continental crust. Thus later processes must be responsible for crustal differentiation and widespread reflectivity.
- Although the thickest part of the arc occurs where the slab is at 100 km depth, the present volcanic front occurs where the slab is at only 50 km depth.
- The volume of crust created along the arc exceeds that estimated by previous workers by about a factor of 2, which may have important implications for models of continental growth through time (e.g., Reymer and Schubert, 1984).

Expanding Outlines

Aleutians Geology Paper — First Outline

Deep Structure of the Aleutian Island Arc and Implications for Continental Crustal Growth

Major Points:

- Provides a test of the hypothesis that volcanic arcs are the factories of continental crust
- Result: Oceanic arcs have the requisite thickness (>30 km) to build continental crust, but differ from continental crust in their composition and reflectivity structure.
- Therefore, either (1) intraoceanic arcs were not a common source of most continental crust, or (2) the bulk properties of arc crust are substantially modified during or after accretion of arc to a continental margin
- The volume of crust created along the arc exceeds that estimated by previous workers by about a factor of 2, which may have important implications for models of continental growth through time (e.g., Reymer and Schubert, 1984).

1. Introduction

- Magmatism at island arcs may constitute a principal source of continental crust, yet relatively few well-constrained determinations of the deep structure of arcs exist.
- Paradox in "island arc" model of continental crustal growth: basaltic composition of island arc crust vs. andesitic composition of the bulk continental crust.
- Geophysical data provide key constraints on these models of continental crustal evolution, by providing comparisons of fundamental crustal properties of island arcs, accreted terranes, and continental crust.

2. Setting and Experiment

- Brief geologic history of Aleutians
- experiment design
- MCS processing described in Bangs et al.
- OBH/S processing

3. Velocity Model and Crustal Composition

- Arc; major features (describe)
- Upper crust
- Mid crust
- Lower crust

4. Discussion

- Implications for Crustal Evolution
 - Bulk crustal composition
 - Comparison to Christensen and Mooney, Morozov: The Aleutian intraoceanic arc does not resemble mature continental crust. Thus later processes must be responsible for crustal differentiation and widespread reflectivity.
- Although the thickest part of the arc occurs where the slab is at 100 km depth, the present volcanic front occurs where the slab is at only 50 km depth.
- The volume of crust created along the arc exceeds that estimated by previous workers by about a factor of 2, which may have important implications for models of continental growth through time (e.g., Reymer and Schubert, 1984).

Aleutians Geology Paper — Long Outline

Deep Structure of the Aleutian Island Arc and Implications for Continental Crustal Growth

1. Introduction

¶ Magmatism at intraoceanic, or island, arcs may constitute a principal source of continental crust, especially during the Phanerozoic (refs, Dewey, 1981; Kay?; Weaver/Tarney?). Yet relatively few well-constrained determinations of the deep structure of arcs exist.

- note recent controversy: Stein and Hofmann (1994) suggest that, based on evidence for episodic crustal growth, most of continental crust may have formed during MOMO (mantle overturn and major orogenies) episodes in which whole-mantle convection dominated.
- Their model suggests that arc magmatism only contributes a relatively small proportion of continental crust, formed during quiescent two-layer convection episodes. The bulk of continental crust would have formed by plume volcanism (LIPs, underplating, rifted margins?) during MOMO episodes.
- Thus it is important to know whether arcs provide a viable model for formation of continental crust. One way is to measure their geophysical structure and compare with present-day continental crust.

¶ The suggested basaltic composition of island arc crust (refs), compared to the more silicic, andesitic composition of the bulk continental crust, constitutes an apparent paradox in the "island arc" model of continental crustal growth (refs).

- delamination of mafic/ultramafic lower crust has been proposed as a possible solution to this paradox.
- Alternatively, Kelemen (1995?) has proposed that island arc crust may consist largely of high Mg# andesites.

Conciseness: Make Every Word Tell

I would have written a shorter letter, but I did not have the time.

-Blaise Pascal

Conciseness: Make Every Word Tell

I would have written a shorter letter, but I did not have the time.

-Blaise Pascal

“Writing is easy. All you have to do is cross out the wrong words.”

- Mark Twain

Conciseness: Make Every Word Tell

I would have written a shorter letter, but I did not have the time.

-Blaise Pascal

“Writing is easy. All you have to do is cross out the wrong words.”

- Mark Twain

Omit Needless Words – *Strunk and White*

Vigorous writing is concise. A sentence should contain no unnecessary words, a paragraph no unnecessary sentences, for the same reason that a drawing should have no unnecessary lines and a machine no unnecessary parts. This requires not that the writer make all his sentences short, or that he avoid all detail and treat his subjects only in outline, but that every word tell.

Conciseness: Make Every Word Tell

I would have written a shorter letter, but I did not have the time.

-Blaise Pascal

“Writing is easy. All you have to do is cross out the wrong words.”

- Mark Twain

Omit Needless Words – *Strunk and White*

Vigorous writing is concise. A sentence should contain no unnecessary words, a paragraph no unnecessary sentences, for the same reason that a drawing should have no unnecessary lines and a machine no unnecessary parts. This requires not that the writer make all his sentences short, or that he avoid all detail and treat his subjects only in outline, but that every word tell.

Conciseness: Make Every Word Tell

I would have written a shorter letter, but I did not have the time.

-Blaise Pascal

“Writing is easy. All you have to do is cross out the wrong words.”

- Mark Twain

“Give every mark or line authority and make sure it serves a purpose. Try to use only the marks you need.”

- Kit White, 101 Things to Learn in Art School

The Lard Factor

A measure of bloat in writing.

$$LF = \frac{(O-R)}{O}$$

LF = Lard Factor

O = # of words in original

R = # of words in revised

*The LF is a measure of extraneous verbiage in a sentence. You can achieve a substantial gain in brevity and clarity in your writing by eliminating unneeded words.
[28 words]*

The Lard Factor

A measure of bloat in writing.

$$LF = \frac{(O-R)}{O}$$

LF = Lard Factor

O = # of words in original

R = # of words in revised

The LF is a measure of extraneous verbiage in a sentence. You can achieve a substantial gain in brevity and clarity in your writing by eliminating unneeded words.
[28 words]

Or, better said:

The LF measures unnecessary words; eliminate them, and your writing will be concise and clear.
[15 words]

(LF = 13/28 = 46%)

Cutting Out the Lard

Examples

There is one place along the line where quite substantial relief of the Moho appears to be present. [18 words]

Cutting Out the Lard

Examples

There is one place along the line where quite substantial relief of the Moho appears to be present. [18 words]

Cutting Out the Lard

Examples

There is one place along the line where quite substantial relief of the Moho appears to be present. [18 words]

Moho relief occurs at one place on the line. [9 words, LF=50%]

Cutting Out the Lard

Examples

There is one place along the line where quite substantial relief of the Moho appears to be present. [18 words]

Moho relief occurs at one place on the line. [9 words, LF=50%]

Assessment of the applicability of sequence stratigraphic concepts relies on the number of sequences satisfying the conditions set forth by well-accepted models. [23 words]

Cutting Out the Lard

Examples

There is one place along the line where quite substantial relief of the Moho appears to be present. [18 words]

Moho relief occurs at one place on the line. [9 words, LF=50%]

*Assessment **of** the applicability **of** sequence stratigraphic concepts relies **on** the number **of** sequences satisfying the conditions set forth **by** well-accepted models. [23 words]*

Cutting Out the Lard

Examples

There is one place along the line where quite substantial relief of the Moho appears to be present. [18 words]

Moho relief occurs at one place on the line. [9 words, LF=50%]

Assessment of the applicability of sequence stratigraphic concepts relies on the number of sequences satisfying the conditions set forth by well-accepted models. [23 words]

We assessed the number of sequences that satisfy two well-accepted models. [12 words, LF=48%]

Summary

AGI website: What Skills Do I Need to Start a Geoscience Career?

“COMMUNICATION, communication, communication. ...Honestly, at my job I spend most of the day communicating with customers... learning how to explain technical information to a lay person is really important, and that’s something you don’t learn in undergrad.” - Carrie Suffern, National Weather Service, Sterling, VA

“Written and verbal communication are important because every project that we do results in a written report. ... Ultimately, your job is to convince people that your findings are correct. So the ability to communicate clearly and concisely is very important. The biggest challenge has been to find people who are good writers.” - Mike Lawless, Draper Aden Associates, Blacksburg, VA

Summary

- Writing is important – embrace the fact, as a scientist, you are a professional writer!
- Good writers are not born, they are made.