

## Editorial

# Some general advice for writing a scientific paper

### 1. Introduction

Every journal has a format for outlay, headings, references and so on. It is always a good idea to prepare your paper in the exact format of the relevant journal before submitting it. Editors tend to be unimpressed if you are not even prepared to take this trouble and reviewers usually are unsympathetic towards such authors. Some high class journals like Science, Nature or Geology have extremely strict rules for the format of submission and their electronic submission system filters automatically all submissions that do not follow these rules. Such journals also have a simpler structure of publications and limited page and reference numbers, which makes writing more difficult. They deal with a very high number of submissions and no time can be wasted on format problems. It is thus essential to know and to follow the rules in every detail.

*Before you decide on the journal to which you want to submit, study its latest issues and see if your contribution will fit the general concept and policy. Study the guidelines for the authors and decide what type of publication will best suit your purpose.*

The Journal of African Earth Sciences (JAES) is both a regional publication, covering an entire continent plus the Middle Eastern countries, and a general earth science journal. This means that papers intended for this journal should be of interest to a broad audience of geological scientists, and not too specialized and not only of local interest within one country. Narrowly specialized papers should be sent to pertinent specialist journals, and manuscripts dealing with subjects of local interest should be sent to localized journals, often specific to a particular country. In this context it is also important that unusual methods, geological settings not generally known, or unusual terminology, for example, be properly explained for the general reader not necessarily specialized within such a field.

Below we detail some general points on writing a scientific paper:

- (1) Express yourself precisely and be informative – i.e., do not lose your reader before he/she gets to the main argument, which is what really counts! Always stay on track of a theme, a model, an interpretation, etc. Use words to express your exact meaning – this is science – vague and misty concepts should be reserved for that novel you are all going to write in your old age. Use simple language and do not think that big or unfamiliar words will impress anybody. If you use an uncommon or generally unfamiliar scientific word, describe its meaning briefly for those less educated than yourself.
- (2) Use short paragraphs – say about 2–4 per A-4 typed page, and remember a paragraph must have at least two sentences and a common statement or subject. Bear in mind that a typed page on a normal PC is much less than a journal page – as a general rule, about 2–3 typed pages = one journal page.
- (3) Use short rather than long sentences – a long sentence starts to become prominent after about 3–4 lines! You can always break a sentence into two related parts by using a semicolon (;) between them.
- (4) Do not split infinitives – e.g., “I do not this sentence like” – “do not like” is the active verb section and “sentence” is a noun. Good editors can normally spot a split infinitive at about 50 m, with their bifocals on.
- (5) When writing a thesis (M.Sc. or Ph.D.), one tends to write in the assumption that your reader is an idiot (in some universities, this applies), thereby demonstrating your grasp of all the nuances and complexities within your chosen field. A paper is written in the opposite assumption, that your reader is fairly well versed in his/her science. Thus, long explanations of well known principles, facts, theories, etc., should be avoided at all costs. However, local geology and concepts must be explained in a way understandable to any reader not familiar with the detailed stratigraphy or geography.

- (6) If your descriptions or discussions get too long and complicated, then good figures and good tables can take care of a lot of complex details. Figures and tables should be large enough to be reduced, have uniform symbols and lettering and a coherent layout. Very large data bases can be referred to in your paper as being available directly from the author, without their actually appearing in print in the journal.
- (7) Do not use or introduce new and atypical terminology if you are not writing a technical paper. Introduction of new stratigraphic groups, formations and members must be exactly explained, including their limitations and should always be well justified, and must be suggested as proposals open to discussion. As a rule, national committees for stratigraphy are responsible for official stratigraphic subdivisions, which must fit much broader concepts than your paper might treat. Equally the introduction of uncommon terminology to underline the importance of your data and conclusions rather leads to confusion of the reader. Terms like “superbasins”, “superoceans”, “mega-continent”, “mega-elements”, “hyper-sequences” lack clear definition and should be avoided. A glossary of geology normally offers enough sound and well established alternatives.
- (8) Have your text thoroughly reviewed by an experienced author of your choice first and if you have such a co-author of your work, let him/her teach you how to get published. If English is not a language you are comfortable with, get someone who has the relevant expertise to correct your English – no good international journal will be prepared to send a paper out for review where the language usage is not easily comprehensible and where the paper is not relatively easy to read. For the JAES, covering a large area of diverse languages, this is equally important.
- (9) Always maintain a measure of humility – nothing is that sure in geology, so use words like “possibly”, “likely”, “suggests”, “it is proposed that”, etc. Do not get too dogmatic but stand up for your results and try to make firm decisions and interpretations wherever possible.
- (10) *The most important and golden rule for any scientific writing, paper or thesis, is to separate facts from interpretation. You always first give all the relevant data and facts, before starting any interpretation. It is absolutely fatal to interweave facts and interpretation thereof. The general order is very simple: facts, interpretation, discussion of both.*

And overall remember: the word “data” is a plural one!

## 2. Structure of a typical paper

Almost all scientific papers, in any discipline (as well as M.Sc. and Ph.D. theses also) are structured along the same basic lines, into:

Abstract  
 Introduction  
 General geology and previous work  
 Methods  
 Data/descriptive section (normally the longest)  
 Interpretation  
 Discussion  
 Conclusions  
 Acknowledgements  
 References  
 Figures and captions/tables

*The abstract.* This is the *last* part of the paper you write and it is a short summary (many journals specify c. 300 words as a limit) of your major facts, findings, interpretations, discussion and the significance of your work in the broader picture of geoscience. It is intended for the reader (and citer of your work) who thinks that he or she does not have the time nor detailed interest to read your whole paper. With the abstract you try to persuade such folk to read your work thoroughly. It must be a coherent whole and is meant to be read without reference to the paper at all, and to make the reader inquisitive as to your data and their interpretation. Keywords, often listed below the abstract in a paper, are really for classification purposes in data bases of references and for searching for them on the www.

*The introduction.* Very often this is the most critical and the most difficult part of a paper to write. This you learn with experience – inexperienced authors tend to think this is the least important part of the paper. The introduction must firstly make some general statements (a paragraph or two) of the problem(s)/aspects of geology you will be dealing with, as part of the larger earth science itself, thus it tells the reader why your work is most important. Once this first background is provided, you then go on to say what you intend doing in the paper, and why, and how this fits into your opening paragraphs on the general problem. The introduction is to put the reader into the picture and to give him/her the correct perspective for understanding your own work. It is really the justification of why your paper should be published at all; editors looking at new incoming papers tend to read the abstract and introduction and then will already have formed a very strong opinion of your paper’s merits or demerits. The general geological setting should not form part of the Introduction. For the JAES, the aim of the paper should fit either within a broader African – Middle Eastern context (i.e., be of interest

to African/Middle Eastern earth scientists), or even be of global relevance. Length: 1–2 pages.

*General geology and previous work.* This firstly puts the reader into the general picture as regards the topics in geology being addressed and the significance of your work within that framework. Next, the general geological setting is given, and what major contributions and/or viewpoints/models previous workers have already produced. The worst thing to do here is to lose your reader with over-long explanations of things like petrography, stratigraphy, age determinations, or of long rambling descriptions of what's already been done. Desired length should be 1–3 pages. If a lot of detail is needed here, use tables, maps, cross-sections, etc. Any section on general geology must also give geographic location details, as well as a regional geological map showing where your study area slots in, plus a relevant stratigraphic column as well. From all this information, the reader should be able to locate your data or sampling site exactly and to recognise the general geological context.

*Methods.* If your method is not a new one and a main subject of your research, these should be very brief and should enable the reader to understand your methodology so he/she can judge your results within that known perspective. If the methods are standard ones (which is normally the case), just refer to a standard reference work that first established them – do not give long unnecessary explanations of what is already available in the literature. The entire paper so far should not be more, on average, than about 5–6 typed pages.

*Data/descriptive section.* This is where your new scientific data get presented, within the context already established in earlier parts of the paper. Normal things included here are detailed field maps and geological cross-sections, geochemical analyses, palaeocurrent data, sedimentary facies and facies associations, contact relationships, petrographic or palaeontologic results, structural data and so on. Use should be made of summary tables and figures wherever possible. No reader wants to read pages and pages of descriptions of thin sections, geochemical data, etc. Keep the reader's interest! All factual data, your own and that of previous workers in the subject matter/study area must be given before the end of this section in the paper, and no interpretation should yet have been given. There is only one exception to this important general rule, already stated previously. An example of this would be where, for instance, a certain set of sedimentary structures and rock types would imply a typical set of genetic processes, a certain fossil assemblage a specific age, or, where a certain petrographic composition and geochemical character would strongly suggest a certain petrogenetic history and tectonic setting. Such, first-order interpretations can be made in the descriptive section, but only where they are well established, almost axiomatic in the literature

and knowledge field and where certain standard reference works can be referred to.

*Interpretation.* Apart from the Introduction, this is the other hard part of the paper! Here, you have to first interpret your own data and findings, build a well argued, justified scientific model based on your data and the knowledge from previous workers in your area. This model should be built up logically, step-by-step, and must be constrained by all your own detailed data and the geological setting.

*Discussion.* Here, you should also consider alternative explanations of the same data sets interpreted previously, argue their merits, and compare them to your chosen model. In some cases it may not be viable to pick a specific interpretation; then, give them all and argue all their relative merits. Once you have gone this far, you should consider your models in the light of previous ideas and interpretations, compare them, note differences and similarities, and make some statement as to the possible significance of your new work. You should also, in this section, build the perspective from your own study area or chosen small geological field, and consider how they relate to broader study areas or larger fields. In the Discussion, one may also take the interpretations and models further, into a larger context, which might include ideas and speculations beyond the immediate purpose of the paper.

*Conclusions.* This is not just a summary of the paper – far from it! These should be the end-arguments and findings that flow from the previous, discussion section. In other words, in the discussion section, you argue pro's and con's, you consider alternatives and so on, but in the conclusions, you arrive at some final statements, reflecting the flow of logic of the whole paper. A common error is to assume that the conclusions and the abstract are about the same thing – definitely not! The conclusions will normally not be readable or at least fully comprehensible without having read the whole paper, whereas the abstract is designed to be read on its own, in lieu of the whole paper. Conclusions should be short – preferably a typed page or less.

*Acknowledgements.* These are politically important. If space is available, here you thank, briefly(!), sources of funding, of data other than your own, people who have performed analyses, folk who may have helped you with field work, advice, etc. If you want to get further funding put your funding agency in front! Remember those people who did the work (e.g., the student) and take them out of the acknowledgements and into the authorship list.

*References.* Each journal has its own house style, so use it even if you hate it! These should be done carefully for accuracy, and are also important, because people wanting to follow up your work will want to read some of these relevant papers. Check that all references cited

in the paper are in the list and vice versa, and remember those pesky, forgotten references you may have used in figures, figure captions or table captions also. As in the acknowledgements, you do not want to forget any important author, also for political reasons. Fairness towards your colleagues requires primarily that you cite original work and those who pioneered research on the subjects you refer to. References to overviews do not substitute for original work and you might, by chance, just leave out a critical paper by your reviewer! Within many of the African and Middle Eastern countries from which the JAES draws most of its authors, there is a distinct lack of library and electronic reference sources, and consequently, often out-of-date sources are quoted and more modern views ignored. Although this is a difficult hindrance to overcome, authors should do their best to do so.

*Figures and tables.* Figures should have scales and legends. Lettering must be clear and uniform in all figures, figures should not be too cluttered and must be easy to read and comprehend. Remember that a journal will almost always radically reduce your figure, necessitating larger letter sizes in the originals. Aesthetic value is important in figures. Tables, similarly should be able to convey their message without losing readers. If very extensive data are being used, it is fairly common for an author to state that full data are available from the author directly, and then only to summarise these data in tables, figures, etc. Some good journals offer the publication of supplementary data on the www. As with reference resources, many African – Middle Eastern authors struggle to obtain modern drafting software; figures drawn by hand or with stenciled writing are generally unacceptable in a journal such as the JAES.

### 3. Conclusions

Of course, the above considerations are by no means universal and should be re-evaluated from case to case. Nevertheless they can serve as a guideline to publishing and should be of practical use especially to those not so experienced in these matters. When trying to follow the above step-by-step you will certainly realise that some does not apply to your specific case or that some information we have given is not sufficient. At the end of the writing procedure, let your colleagues help you and let them read and correct your manuscript. It is important that this is done by experienced scientists, because scien-

tific expression differs from the use of daily language. Even if you are a native speaker of English, have someone else of like ability examine your way of expression; is it short but precise enough and have you really organized your paper in a conclusive and understandable way? Have you conveyed your message to the reader, even if he/she knew nothing about the local geology before reading your paper?

Finally the most important message is probably also the most difficult to follow: if deadlines for your publication are set, plan and follow your work schedule in a way that allows you to put everything in a drawer when it is finished and ready, for at least a week. If there are no deadlines for your manuscript you should do this with each manuscript for a fortnight. The text must be locked away for long enough to appear as new to you when you read it again. Each manuscript is like a French cheese: after a long process of fabrication out of the best ingredients, it still needs some time for a maturation process. After having not touched it for a week or two you will be surprised how many new small and larger flaws and problems you will discover in a text regarded as perfect on the day it was locked in that dark drawer. You will now be able to rectify these defects easily and improve your manuscript considerably.

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