

## **Credit Where Credit's Due: developing authorship strategies at the Journal of Maps**

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### **INTRODUCTION**

As organizations seek to professionalize the workplace, they are increasingly under pressure to both enhance the skills base of their staff and subsequently measure the value that each individual contributes to the performance of the organization. As a result, it is common for many staff to undergo an annual appraisal of their performance, measured against the criteria for their position. Within academic and research institutions the publication of the outputs of work are considered the primary method of dissemination and is a key measure of “performance” as it is easy to quantify. Whilst, at its simplest, this can be calculated as the number of publications produced by an individual, such a measure is fairly crude in that it does not take into account the authorship position or the “quality” of the publication outlet. It is also possible to measure the “impact” of a publication through the number of citations it receives, although this does not necessarily equate to the quality or significance of the work. Outputs such as maps, databases and digital models that do not conform to these usual academic measures are less easy to measure using performance indicators. Authorship is also difficult to quantify for work that is not directly related to the academic content of a publication; for example cartographers and database programmers are integral to the production of a geological map yet may receive no formal credit for their input. This paper briefly reviews the processes for crediting input to published research and survey work, highlighting some of the deficiencies that this introduces. This forms the basis for describing strategies introduced at the Journal of Maps to provide a greater level of flexibility and granularity in allocating authorship credit. This is illustrated using the British Geological Survey's (BGS) 1:625,000 Bedrock Geology Map of the United Kingdom as an example.

## AUTHORSHIP CREDIT

The publication of research forms a primary method of dissemination for many academically related professions, including geological mapping. High status journals are generally regarded as the output of highest esteem and these form a permanent archive that can be accessed by future academics. Figure 1 shows an example of title information at the top of an article (Smith and others, 2006), noting the affiliations of individual authors. This provides appropriate credit and it is general practice for the “lead” author to be listed first, with decreasing input to the publication reflected by the authorship position.



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# Geomorphological mapping of glacial landforms from remotely sensed data: An evaluation of the principal data sources and an assessment of their quality

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Figure 1. A typical journal article with title, authors and affiliations (Smith and others, 2006).

The impact of an item of published work is quantifiable through the number of citations it receives and this simple metric can be used to measure its “quality”. Indeed the usefulness of the citations metric forms the basis for an assessment of the quality of individual journals known as the “Impact Factor” (Thomson Reuters, 2009) which calculates the *average* number of citations over a two year period. This has been extended to individuals through a self-subscription system (ResearcherID, 2009) where a range of metrics are displayed. Within the United Kingdom, the Higher Education Funding Council for England (HEFCE), which funds teaching and research at universities, is reviewing the use of citation metrics in rating the quality of research in individual research departments (HEFCE, 2009).

The performance of individual employees can therefore in part be quantified based upon the number of authored publications and number of citations, and can further take into account authorship position and impact factor of the individual journal. If citation metrics are to be used as performance indicators then it becomes increasingly important for individuals to receive credit for all “work done”; however, there is no formal or generally accepted procedure for ascertaining who should be listed as author on a publication. In fact the opposite situation, that of “gift authorship” (Williamson, 2002), is a known problem particularly in academic institutes where a head of department may be named as an author

regardless of whether or not they have had input to the research and subsequent publication. For research where many have been involved, possibly over a number of years, the general practice is to name all “workers” on resulting papers; is that the right approach? Figure 2 displays title information for Heipke and others (2007) which not only lists 22 individual authors, but the entire HRSC Co-Investigator Team. This is commonly used by centrally funded science teams but raises the following query: what is an author? Is it the person(s) who writes the paper or writes a section? Someone who edits the paper or perhaps was just involved in the project? What about data or map production? These are difficult questions to answer and demonstrate that authorship “rights” are contentious and will remain so if authorship is used as a measure of performance. As a result of this problem, “Acknowledgements” have long been used as an informal method for recognizing the input of individuals to a project (Figure 3); however because this is an informal means of recognition, it does not convey any measurable credit. It should be noted that within the Natural Environment Research Council (NERC; the parent body of BGS) maps, databases, 3D models, and other outputs that are innovative or require high level technical input are recognized and given equal status to papers within the appraisal and promotion processes. However these outputs are not easily included into more widely accepted citation indexes and may therefore have no credibility outside of NERC.



## Evaluating planetary digital terrain models—The HRSC DTM test

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Figure 2. A example of the use of multiple authors as a means of recognizing input to a project (Heipke and others, 2007).

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Figure 3. The use of acknowledgements for providing informal credit (Smith and others, 2009).

Within academic publishing, maps are a non-standard publication that fall outside the traditional “manuscript”, incorporating input from many individuals. In such instances how do we ascertain the input of those involved? How do we provide appropriate credit? For paper maps, authorship is usually given in the title box, but that may only include the chief surveyor for the mapped area, or the Executive Director of the organisation, or it could include all who had scientific and cartographic input to the map. For the BGS, guidelines are provided but they have been applied variably such that for some maps all contributors including database experts, aerial photo interpreters and cartographers are listed in the title box, on others the chief surveyor, director, and cartographer are listed, whereas on others the cartographer’s name is put in the opposite corner of the map to the main title. As well as being an inconsistent presentation of main “authors” and contributors, it is not clear how the credit for the map generation is spread among all contributors. Furthermore, the situation is complicated when “Sheet Explanations” and memoirs are published, as they may not relate to a single map.

For digital maps, geographical information system (GIS) data layers, and digital 3D models, which are now increasingly the output of a survey or geological research project, there seem to be no rules as to how authorship is credited and presented and how that credit might be used as a measure of performance to align with current academic practices. In a GIS dataset the attributes of each map feature contain information about that feature and could also contain authorship details, or perhaps more appropriately the metadata could contain author/contributor details; therefore an agreed and recognized structure needs to be established. However, feature-level authorship remains aspirational with current common practice concerned with product-level data. Metadata could also be used to provide author details for digital models and other datasets that replace or complement printed maps as output.

Currently, national and international spatial data metadata standards, such as GEMINI 2, ISO 19115:2003, e-GMS, and INSPIRE, all include a category for creator, originator, or responsible party that are approximately equal, and also suggest that an organization or job title rather than an individual should be named, with a view to identifying legal responsibility rather than attributing the work. For GIS datasets, which includes digital map data, BGS adheres to the ISO 19115 metadata standard requiring that the creator be recorded as “The name of an organization or individual that developed the data set”. It is not BGS standard practice, however, to name all those who might be involved in creating a map or GIS dataset and it is very recent practice to have other than high-level discovery metadata at all. For individual paper maps metadata has never been provided, instead this is created for a map series, with no named cartographers.

## AUTHORSHIP STRATEGIES

At the Journal of Maps (JoM) several strategies have been implemented in order to provide alternative, measurable, methods of formal credit on journal articles. These include the use of map authors, “secondary” authors, and the publication (and citation) of data. Regrettably these are not currently counted as a formal citation by Thomson Reuters Web of Knowledge. This may impede wide recognition of map, data, and modeled output as citable publications; alternatively, this recognition could be encouraged as part of a widening of citation index application. These different strategies are discussed in more detail in the following sections.

Whilst the primary citable output for the JoM remains the article that accompanies the published map it is important to note that within institutional settings the (academic) author(s) of the article may be entirely different from the map, even though they together comprise a single publication. The latter can incorporate field workers, cartographers, graphic designers and database programmers. In such instances it is appropriate to cite the map separately, for example:

Floyd, J.D., Addison, R., Reay, D., Leslie, A.G., Pharaoh, T.C., Myers, A.H., Turner, P., Arbon, J.W., and Cooke, I.C., British Geological Survey 2009 Map, *in* Smith, A., A new edition of the bedrock geology map of the United Kingdom: Journal of Maps, v. 2009, p. 232-252.

Secondary authors form a second “tier” of authorship and provide the means of recognizing significant input to a project without necessarily assigning the status of a full author (and separate from those not directly involved in map production). Figure 4 illustrates an example of a title page from the JoM listing both primary and secondary authors. This provides credit for “work done”, formally notes an individual’s affiliation, and can be cited separately. In this example, the secondary author would be cited as:

Harrison, S.K., 2008, Secondary Author, *in* Smith, M.J., Knight, J., and Field, K.S., Glacial striae observations for Ireland compiled from historic records: Journal of Maps, v. 2008, p. 378-398.



## Glacial striae observations for Ireland compiled from historic records

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Figure 4. The use of secondary authors in a published article in the Journal of Maps.

The JoM has been publishing data *with* journal articles since its launch in 2005 (Smith, M.J., 2009). This enables the data to accompany the article and maximises “immediacy” which is of significant benefit to the reader. However, it has limited functionality because the data remains embedded within the published PDF. It also means that the PDF does not meet the PDF/A standard, which is designed for the long-term preservation of electronic print materials (NDIIP, 2009). The JoM requires that data deposited within the PDF must conform to one of several data formats selected for being openly published and well supported; this is intended to maximise the archival potential of the data for future users. Within the context of citation metrics, data forms a section within the published article and should be cited separately, as shown below:

Dunlop, P., Data, *in* Dunlop, P., and Clark, C.D., 2006, The Distribution of Ribbed Moraines in the Lac Naococane Region, Central Quebec, Canada: Journal of Maps, v. 2006, p. 59-70.

A further solution for map publication currently under review is the publication of map editions; where an author wishes to update a map based upon the correction of mistakes or the addition of new knowledge, this can be published as a new edition. This also allows the updating of primary and secondary authors, providing an opportunity for those involved in the production of a new edition to receive appropriate credit. Within this context it is worth noting that PDFs are a very flexible publishing medium that allow the incorporation of single and multiple map sheets, audio, video and 3D models, as well as direct hyperlinking out of the document.

## CASE STUDY: BGS 1:625K BEDROCK GEOLOGY

Development, production and publication of the 1:625,000 scale series of national bedrock geology maps for the UK has been a prolonged and complex process to which many staff from multiple fields of expertise have provided input, but no single author could easily be established. The BGS has been in existence since 1835, and therefore many staff since its inception have contributed to the national UK maps that have been compiled from their (generally) more detailed work. The 1:625K national map has been compiled from tiles that were published at a variety of scales over a 175 year period. The staff inputs to each component map tile can include a vast range of expertise including geologists (field mappers, stratigraphers, engineering geologists, structural geologists, remote sensing geologists), geomorphologists, geochemists, geochronologists, geophysicists, paleontologists, cartographers, programmers, 3D modelers, lab technicians, database compilers, and project managers. If we consider that many hundreds of staff have been directly and indirectly involved in the map production since 1835, the question is now asked, how can we give credit where it is due? Below we discuss authorship credit related to the 2001 (4<sup>th</sup> edition) in comparison to the 2007 (5<sup>th</sup> edition) and the digital DiGMapGB versions that are available for download from the BGS (<http://www.bgs.ac.uk>).

The title box for the 4<sup>th</sup> edition acknowledges publication by the then-Executive Director with the statement “*Published 2001, David A Falvey PhD, Executive Director, British Geological Survey*”, but no credit is given to geologists, cartographers or others involved in production of the map. The development of the 5<sup>th</sup> edition involved coordination and approval of proposed updates to the map data, which was managed by three people; a geologist with an overview for Scotland, a geologist with an overview for England and Wales, and the digital map manager who ensured that standard procedures were followed and that development of map face data and marginalia followed procedures similar to “usual” digital map compilation. The digital map manager also interfaced with the cartography team for which there were lead data capture and map design personnel, coordinating the input of others. A team of geologists developed a key for the geology, to be used in the map legend. This had input from a range of personnel and was approved by the Chief Geologists for England, Scotland, and Wales (not authors but people who had significant scientific input to the outcome). The title box on the southern sheet of the 5<sup>th</sup> edition (2007) carries 12 named credits (listed below and shown in Figure 5), whilst the northern sheet has 13 named credits:

- 2 geologists credited with geological interpretation and map compilation
- 1 geologist who produced the geological cross-sections
- 1 geologist who supplied deep geology information
- 2 cartographers who prepared the data
- 2 cartographers who undertook the cartography
- 1 project manager
- 1 Programme Manager
- 1 Director
- The BGS Executive Director.

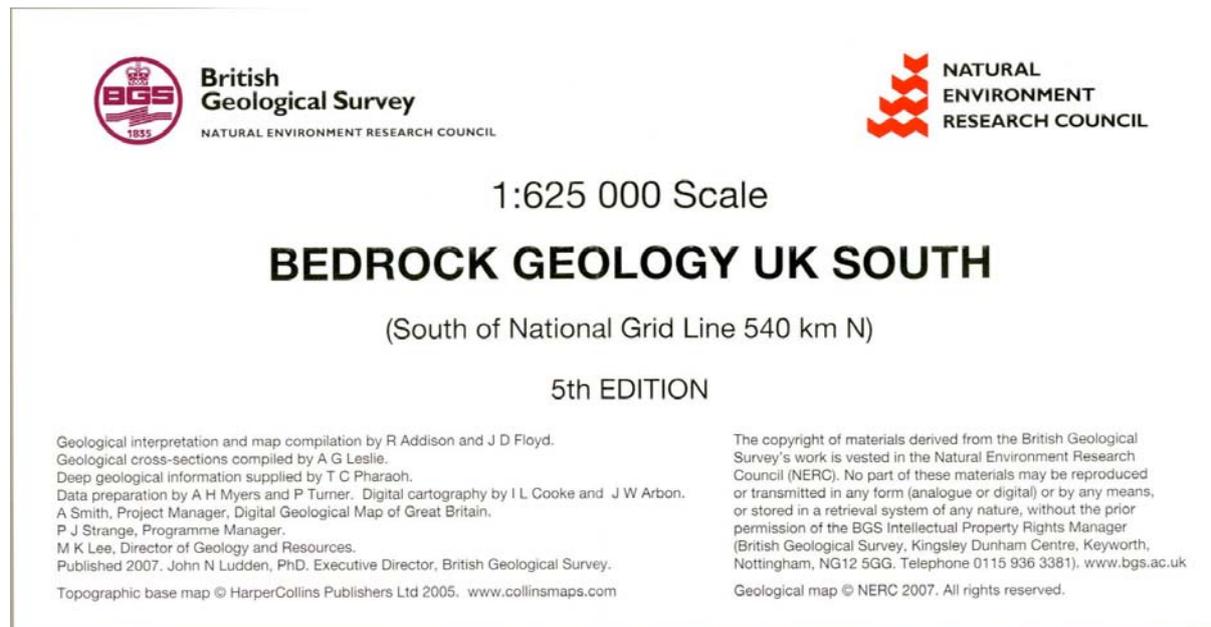


Figure 5. BGS map title box with all contributors named (British Geological Survey 1:625,000 Scale Bedrock Geology UK South, 5<sup>th</sup> Edition).

Copies of the paper maps can be ordered online whilst the 'raw' digital data can be downloaded in a variety of GIS formats from the BGS website. At the time of writing, the GIS digital data does not include credits, however the map will soon also be published in PDF format on the BGS website and will carry the same credits as the 5<sup>th</sup> edition, while the PDF metadata will include additional authorship details. The map (Floyd and others, 2009) and article (Smith, A., 2009) has also been published in the Journal of Maps.

It is seen as a very positive development that between the 2001 and 2007 versions the number of BGS staff credited with input to the published paper maps has increased from 1 to 12 for the southern map and to 13 for the northern map. This is clearly a huge improvement. However the question still needs to be asked; is this enough, or is there a realistic way to credit the role of other staff who contributed to the map or its predecessors? The four options available for crediting input to the maps are:

1. return to the format where only the Executive Director is acknowledged;
2. include a 'catch-all' credit statement thanking all current and past staff who may have had an input;
3. attempt to list all staff who have contributed to previous maps, and the current version (possibly by using the secondary authorship approach being pioneered in the JoM);
4. use the edition or versioning approach mentioned above to ensure that, from the most recent version onward, we credit the main compilers and cartographers at the very least?

Option 1 is a step backwards in terms of providing credit where it is due, and is therefore not considered further. A brief statement acknowledging that the map is the culmination of many years of survey and research (as noted in Option 2) is certainly viable whereas the third option (i.e. listing all staff) is unrealistic. It therefore seems that the system currently employed by BGS, where credit is given per edition (Option 4), along with a 'catch all' statement (Option 2) is the most favourable option for the published 1:625K maps.

As listed above, credit can be given to data compilers as well as those who create a final (digital) map product. When databases, 3D models, etc. have been created prior to map

production and the map is derived from those datasets, secondary credit could go to the “authors” of the original data from which a map is compiled. Currently this is not standard practice in BGS and perhaps not in most mapping organizations.

## **CONCLUSIONS**

There has been an increasing move within organizations to professionalize the workplace and measure the “value” or “contributions” of individuals as part of an internal appraisal system. Within research and academic institutions this may involve listing the number of publications an individual has accumulated, in addition to the number of citations and authorship position. For map outputs, the citation, and inclusion of all contributors, is currently poorly defined. Authorship credit for paper maps has varied according to era, organizational practices and product type, both within BGS and other mapping agencies. Where an individual has provided significant input to a product, whether it is a database, map, model or paper, a mechanism needs to be provided by organizations and journals to recognize that input. Most maps, databases and GIS layers carry significant metadata that lists information such as the originator of the data, therefore ways must be found to recognize and name that input systematically when the results are published in the variety of formats that are now available.

Current metadata standards for spatial data are not designed to credit authorship of maps or other data outputs; they are aimed at enabling better understanding of the output itself and its origins, not its originator. The Journal of Maps provides a citable route and publishing format through which maps can be published and authors formally credited. The JoM has adopted a range of innovative citation standards including secondary authors, data authors and map authors, which could be adopted more widely. The challenge to follow will therefore be for academic and other bodies to recognise the significance of maps, 3D models, and other datasets in the same way as for written papers and reports.

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