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OBSERVATION

The Journal of Maps: Rationale for Its Establishment and Review of Initial Operations

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INTRODUCTION

Geo-subjects have undergone a variety of challenges and changes over the last century, ranging from qualitative to quantitative and humanist to post-modernist. The one theme linking all geo-subjects together is their spatial element. They deal with space (and time), and are usually described, analysed or modelled in two or three (and higher) dimensions. This is not to say that geo-subjects deal exclusively in space, but rather that the study of spatial phenomena is often concerned with their location and interaction with other phenomena, as well as their change through time.

The visual presentation of spatial data has long been within the realms of maps and cartography. Maps form a special symbiotic relationship with geo-subjects. Although textual or numeric descriptions of data are commonplace, it is when data are mapped that effective communication of complex spatial representations can occur. For example, Tufte (2001) describes the presentational eloquence of Charles Minard's map 'Napoleon's March to Moscow'. It is not only at the communication stage that maps are invaluable; as tools of analysis they can direct and help formulate methods of study. The work of John Snow (1936) in using cartography to help understand the spatial relationships during the 1854 cholera outbreak of London is perhaps the most famous use of medical mapping.

THE RISE AND FALL OF MAPS

Geo-subjects, and mapping in general, saw widespread academic uptake through the expansion of geography and geology during the late 19th and early 20th centuries. During the early years of these subjects, the lack of data was a major stumbling block. Much research was performed expressly with the intent of collecting data, with the ancillary goals of interpreting and reporting upon them. The early geological and geographical journals (e.g. *Quarterly Journal of the Geological Society*) were often concerned with the public presentation of such data so that it could be disseminated widely. Maps were again integral to the collection, analysis and presentation of such data and were therefore published along with the written (or spoken) work. The advent of aerial photography increased the use of maps as investigative tools and saw a boom both nationally and internationally. The analysis of spatial data has been performed in a wide variety of different subjects so that it is now an integral component in the understanding of a range of different topics, including areas such as biology, business and health. This dramatic expansion in the use and understanding of spatial concepts has also helped in the development and uptake of Geographical Information Systems (GIS).

It is perhaps surprising then that computer-based mapping has been one of the major causes in the slow decline of published academic, research-based, maps, particularly during a period where data is prolific and the commercial exploitation of maps is high.

Map-based research is enjoying unparalleled success. GIS provides an elegant (and evolving) interface between the geo-researcher and their data. However, there has been a paradigm shift away from the map as a tool for analysis and visualization, whereby it is simply a spatial data model. Maps are still used as a research tool, but far less emphasis is placed upon visualization. Another cause of this malaise is the methods used in modern academic inquiry, which are often dictated by research goals and the rapid publication of results. Perhaps what has suffered most is the visualization of data as part of the overall published and archived results. Today, for example, we could go into a library and view a map of a geological field area drawn over 100 years ago, and read the presentation and discussion that this accompanied. This archive is a valuable, permanent, record of that original research. What is so worrying about the general absence of maps in current journals is that, whereas maps may well be produced as part of a research project, there is no preserved archival record. Figure 1 shows the number of fold-out material (including maps, tables and figures) published in the *Quarterly Journal of the Geological Society* (later the *Journal of the Geological Society*) in 5-year intervals from 1921 to 2001. What is striking about this figure is the dramatic drop in fold-out material after 1971 (1996 had no fold-out material). Although this is not strictly quantitative (i.e. the paper size and quality changed), it is

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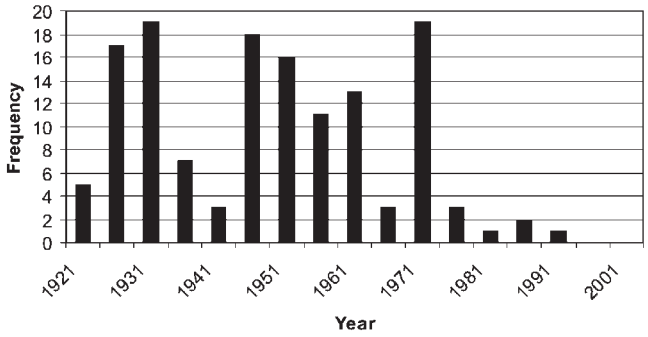

Figure 1. Frequency of fold-out material published per year (5-year intervals) for the *Quarterly Journal of the Geological Society*

indicative of the general trend in publishing oversize material.

Academic journals increasingly face falling subscriptions and rising costs. The publication and presentation of results from original research drives much of the current journal process. If there is a squeeze in the costs of production, article length, oversize format pages and colour are the elements that are invariably cut. Unfortunately, maps often fulfil the criteria of large format size and colour so that, if they do not fit on the standard printed page, they will be refused. Whereas the geological literature of the early 19th century often saw maps as the primary result from an article, with discussion as a secondary purpose, the reverse is frequently true today. The publication of a map is often not seen as a legitimate research goal in its own right. Maps are sadly an expensive addition to a published article.

DEVELOPMENT OF THE JOURNAL OF MAPS

Initial Establishment

The Journal of Maps (JoM) emerged out of the desire of myself and colleagues at the Kingston Centre for GIS (KCGIS) to publish bespoke maps. As an applied research group we collect (and map) spatial data for a variety of geographic disciplines. However, the publication of such material is difficult; a cursory survey of geography-related journals showed that map publication was uncommon and usually incurred high page costs. As a result, there is no easy, cost-effective method for publication of refereed, research-based maps.

JoM was established to redress the imbalance in map publication; the high page costs of printed maps is unavoidable and, therefore, JoM is only viable as an e-journal. This constraint presented the opportunity for us to 'self-publish', thereby by-passing the whole commercial publication process. It was at this stage that we decided JoM should be open-access, with a nominal author fee to cover running costs. From the outset, JoM was envisaged as a charity, dedicated to map publication, with secondary aims concerned with the distribution and archival of material published.

Administrative Development

Although staff at KCGIS have been involved in reviewing manuscripts, editing special issues and editing journals, we have had little experience in establishing a new title. In other words, at the outset we weren't sure of all the details that needed addressing when establishing a new journal title. If we were going to commercially print our material then a publisher would provide the publishing support necessary for establishing a new title. Indeed, the innovative open-access publishing house BioMed Central (BioMed Central, 2004) enables independent research groups to set up their own open-access journals within the BioMed Central electronic publishing system.

Our decision to develop as an independent journal, with charitable status, meant that all tasks associated with journal establishment, incorporating administrative processes and procedures, had to be completed by ourselves. The main strategic goals of JoM were formalized in October 2003, shortly followed by the development of key operational features.

Website Development

By choosing to publish electronically, it quickly became clear that Internet delivery of our material was the most cost-effective method for distribution, which meant the need for a website. We saw this as an opportunity for the journal to innovate; Internet delivery meant we could also provide Internet submission and, extending this further, Internet peer-review. As a journal with few staff and a small budget, automation of many administrative functions would allow significant savings in time for day-to-day running.

Careful consideration was given to the implementation of a peer-review process, prior to the development of the web site. Given the multi-disciplinary nature of the journal, it was clear that reviewers from a wide variety of disciplines would be needed. We considered the development of a database of expert reviewers, from many disciplines, a complex and unnecessary task. Instead, we opted to follow the method used by BioMed Central (BioMed Central, 2004), where the author lists two potential referees (that they have not co-authored with and are not at the same institution). These can be used by the editor or replaced with alternate referees. In addition, we established an editorial board, with members recruited from a variety of strongly geographical disciplines, to act as internal referees. An open peer-review system operates; referees do not remain anonymous to the author or the other referees. Not only should authors and referees be accountable for their opinions, but peer review should be used as a process for the author to improve their work and the referee to learn from the experience.

With the procedures for journal distribution, article submission and peer review in place, the development of the web site began. Initial work focused on the 'customer management' front-end, visible to all visitors. This is used to take care of user-registration, map submission and document serving. Subsequent development targeted the 'peer-review' back-end that is used by editorial staff. The back-end automates key processes of peer-review and presents subsequent results to the 'user' (e.g. referee, author) through the web site. The integrated front and back-ends maintain editorial interaction, whilst increasing efficiency. It should be stressed that the system is not fully

automated; the editor is required to step in at various administrative stages and has full control over the review of individual papers from the selection of referees through to final publication. A fully testable 'front-end' was ready in March 2004, with the full system live by May 2004.

Electronic file formats was a key issue integral to the development of the website. Although maps are the target material, authors may or may not be cartographers. Additionally, we wanted the submission process to be straightforward and flexible. Our pragmatic implementation required articles to be submitted as Microsoft Word DOC or RTF file formats, with embedded graphics; although embedded graphics are of lower quality than separate TIFF or EPS files, it considerably simplifies file processing and peer-review. If needed, better quality graphics can be requested during typesetting. Authors can produce the maps themselves in a variety of different software packages and, therefore, Adobe Acrobat® PDF was considered the only file format that could provide high quality, cross-platform, capabilities. It has the additional benefits in that simple post-processing can be performed on the PDF files and, as a print-based format, paper-based reproduction can be easily achieved. Maps and articles would subsequently be distributed as PDF files.

Other Developments

In addition to the main elements outlined above, the development of the journal required a variety of more mundane aspects to be completed. As it turned out some of these were quite significant. The journal needed to be established as a charity and have a governing document, charitable objects and trustees. In order to become a registered charity in the United Kingdom, proof of assets are required and this involved setting up a bank account, as well as a merchant account to take payment of submission fees. Operation of the web site involved purchasing commercial web space and registering with the Data Protection Agency (a formal requirement in the United Kingdom for an entity holding personal data). This all forms the unfortunate 'chattel' that comes with the freedom of being able to self-publish.

Journal Focus

The Journal of Maps is focused upon the publication of individually produced, bespoke maps, often illustrating the results of primary research, which is an area we believe is currently neglected. For a journal to develop successfully, it needs a core market, which is not over-served by other journals. As outlined above, we believe map publication is in decline and, therefore, JoM is in a market with few competitors. Two main criteria outline our publication ethos:

- publication of bespoke, quality, maps
- focus on map publication and not research articles

It goes without saying that a journal dedicated to map publication can only accept maps that are bespoke (i.e. original and not published elsewhere) and of good quality. This second, subjective criteria is central to our multi-disciplinary focus. We want to publish maps from all disciplines of all types; they can be thematic, topographic, computer drafted or hand-drawn. However the assessment of 'good quality' led us to the realization that we not only needed a Map Editor, but also cartographic referees. They form an additional layer of peer-review.

We also realized that JoM was not an appropriate place for discipline-specific research articles; these are better published in traditional subject-based journals. JoM is ideal for the publication of maps that can be referred to from a research article. As a result, we recommend articles are 1000–2000 words in length and present no data analysis or interpretation, but simply report the methods used to create the map and the context for the work.

FIRST ISSUE

With the launch of JoM in May 2004, the remainder of the year was spent reviewing material in preparation for the first issue. Other than minor teething troubles, web site operation, article review and type-setting (LaTeX is used for all article typesetting) was surprisingly straightforward and led to our first issue in January 2005. This is a good time of year to launch as it coincides (almost globally!) with the university inter-semester break and so interest in the journal was spread throughout the month, allowing us to ascertain demands upon our web server. In summary, during the first month we had over 600 registered users on the site, with 1Gb of data downloaded on the day of launch. Typical daily loads on our web server were 100–300Mb. This is very encouraging and shows considerable interest in map publication.

In the spirit of the international and inter-disciplinary ethos of JoM, the first issue has a wide variety of material from many disciplines. They are truly indicative of the broad scope of JoM and the value of mapping to a wide array of disciplines. The issue has different map types and sizes (ranging from A4 to larger than A0!), from international authors, in a variety of different fields. They incorporate disparate data sets and use a mixture of alternate software to produce their final output. The presentation of spatial data remains the single unifying theme, yet produces an amazing range of material. Whilst the fate of British Grand Prix and Jaguar F1 team hung in the balance during 2004, the significance of motor racing has never been more important to Northamptonshire (UK). Field (2005) depicts the location of race circuits and related motorsport industries in Northamptonshire, UK (size: A4, covering 5800 km^2), stressing the significance of location and industrial clustering. This thematic map could not contrast more strongly than with the topographic map of Ventura *et al.* (2005) (Figure 2), who present geomorphological mapping (size: A0) of the Somma–Vesuvius volcanic complex in Italy (covering 340 km^2). This work is based upon digital elevation models and brings together a variety of quantitative analyses to produce this interpreted map. Continuing the geological theme, a traditional structural geology map is presented by Chew (2005) (Figure 3). Extensive geological field mapping forms the basis of this map of the structural geology of Achill Beg, western Ireland (part of the Fair Head Clew Bay

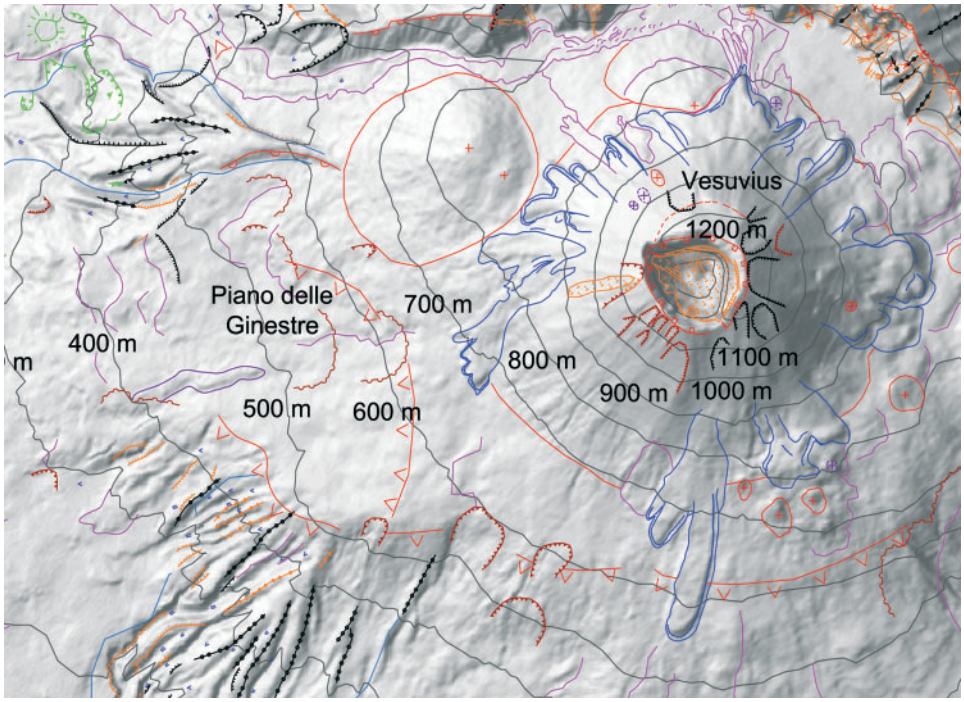

Figure 2. Extract from 'Geomorphological map of the Somma–Vesuvius volcanic complex (Italy)' (Ventura *et al.*, 2005; © *Journal of Maps*, reproduced with permission)

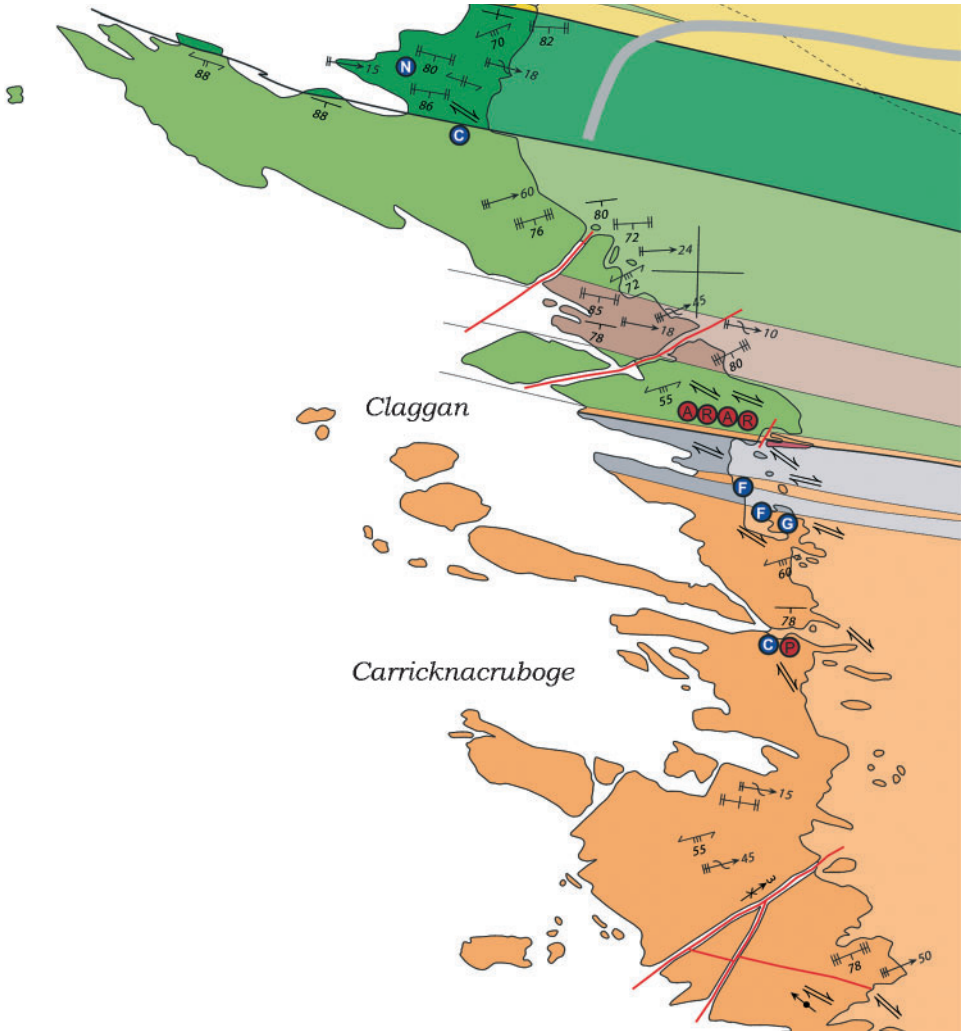

Figure 3. Extract from '1:2,500 Geological Map of South Achill Island and Achill Beg, Western Ireland' (Chew, 2005; © *Journal of Maps*, reproduced with permission)

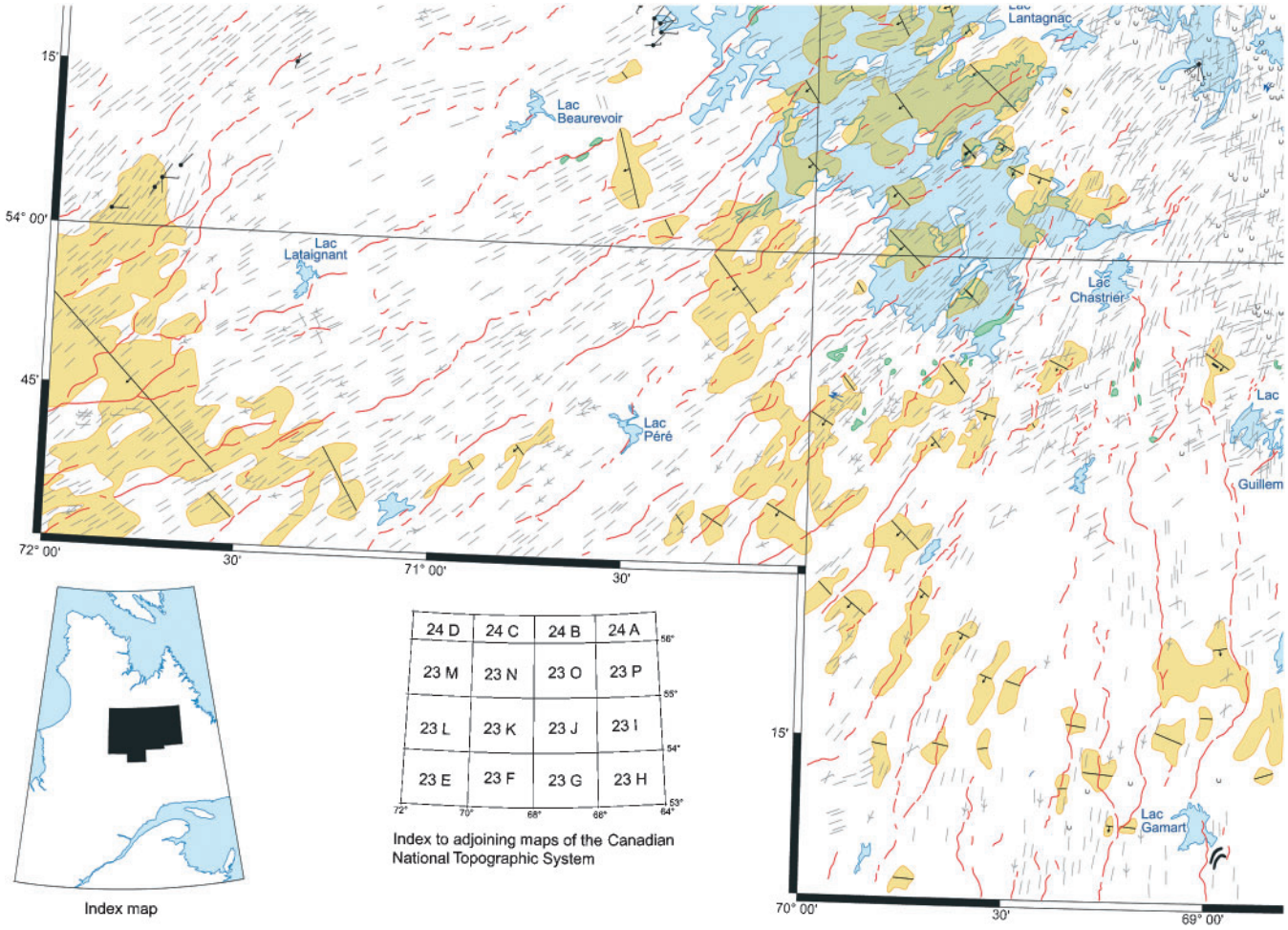

Figure 4. Extract from 'Map of the glacial geomorphology of north-central Québec-Labrador, Canada' (Jansson, 2005; © *Journal of Maps*: reproduced with permission)

line). At 1.82 × 2.57 m (covering 13.75 km^2) it is a huge map, yet all detail is presented at 12pt type!! This clearly demonstrates the power and flexibility of electronic publication; there are no edges to data stored electronically and this benefit can be passed on to the reader. Like Chew, Carrivick and Twigg (2005) use data from field mapping in their geomorphological map (size: A3) of Jökulhlaup influenced terrain in Iceland (covering 1000 km^2). This is supplemented with a photogrammetrically produced digital elevation model using GPS-based ground control collected during field work. Jansson (2005) has also produced a detailed glacial geomorphological map (Figure 4). However, this is of north-central Québec-Labrador, Canada (size: A2), covering a much larger area than Carrivick and Twigg (180,000 km^2) and is based upon stereo air photo interpretation.

As a result of the publication of this first issue, we realize that not everyone will have Internet access or will want to view maps electronically. All maps and articles are published in PDF format, and so can be printed on any printer; JoM is currently in negotiations with a large format, ink-jet based, Internet printing company to provide a mail order service. A user would simply have to pay for a map online; the print company would locate the requisite map, print and post it. We are also considering distribution via a CD–based version of the journal. It is also worth noting that the British Library now has a mandate to archive electronic material and we are in the process of lodging all material with them for archival.

SPECIAL ISSUE

The Journal of Maps presented a poster session at a conference on 'Glacial Sedimentary Processes and Products', hosted by the University of Wales, Aberystwyth (22–27 August 2005). Of the 10 maps that comprised the session, six have been published in the second issue of JoM. All are related to the conference theme, namely glacial geology and geomorphology, and are indicative of the extensive amount of mapping that is currently active within the discipline.

Hottestrand *et al.* (2006) present a map of the glacial geomorphology of the Kola Peninsula, Russia (size: A1), covering an area of over 200,000 km2 and incorporating more than 20,000 individual landforms. On a smaller scale, Stokes *et al.* (2006; size: A3; 300 km^2) and Dunlop and Clarke (2006; size: A1; 3,600 km^2) both present maps of the distribution of ribbed moraine in arctic Canada. The final three maps are all the product of both detailed field

mapping and aerial photo interpretation. Lukas and Lukas (2006; size: AZ; 1000 km^2) depict an area of recessional hummocky moraine in NW Scotland, whilst Evans *et al.* (Size: A0; 100 km^2) detail the surface geology and geomorphology of Pórisjökull, west-central Iceland. The most detailed field mapping is provided by Mitchell and Riley (2006; size: A0; 650 km^2) who present output from work first performed in the 1970s and 1980s.

COPYRIGHT CONSIDERATIONS

Perhaps the single most important issue facing map publication is that of copyright. The production of maps will commonly incorporate data from third parties and it is correct that the data producer retains full ownership of the original product. However, considerations of restrictions in base data reproduction, derived data sets and the role of national mapping agencies are proving stumbling blocks to academic map publication. The review process for JoM has highlighted some of these issues.

A map submitted to JoM by Lloyd and Greatbatch, which was reviewed and accepted for publication, could not be published due to current copyright restrictions. It depicts the results of a multi-criteria evaluation for the location of the fictional Blandings estate contained within P. G. Wodehouse novels and is based upon Ordnance Survey (OS) data. This case unfortunately highlights all three of the problems mentioned above; comments discussed in more detail below are not intended to single-out the OS, but rather highlight our experiences to date.

First, the OS is the national mapping agency of the UK and, up to 1999, was a government-funded department; since that time it has been operating as a Trading Fund (Ordnance Survey, 2005). This change of status means the agency receives no funding from central government, having to meet its costs through sales of its products (principally licensing data). Since 1999 considerable value has been added to the base data set inherited, in addition to its maintenance. Perhaps the single largest factor that separates the OS from some other national mapping agencies (e.g. United States Geological Survey) is the notion that public money has 'paid for' data collection and it should therefore be made freely available.

This leads on to the second issue of data reproduction. The higher education community has negotiated a licensing arrangement for a large quantity of OS digital data products (distributed through EDINA; http://www.edina.ac.uk), allowing extensive data access in return for a relatively small annual license fee. Data access is good for the academic community as it widens participation in digital mapping. However, it is also good for the OS as it makes their products the *de facto* standard, whilst driving research in to the use of their products. Whilst the license is relative generous with respect to the use of data in teaching, presentations and internal reports, it is less favourable with respect to academic publication (in particular electronic publication). Smith (2005) outlined restrictions placed upon the publication of OS data, with a particular focus on Internet facing, electronic, distribution. At A3, the Lloyd and Greatbatch map was not overly large, yet the OS restrictions impose a maximum printed size of approximately A5. This may be satisfactory for small illustrative samples published within a traditional A4 paper-based journal; however, most maps are at least A4 in size. As a result any maps based upon OS data are effectively unpublishable by JoM. In fact, the issue is more complex as the OS also base their restrictions upon the type of mapping being reproduced and the ground area it covers. If it is detailed base mapping (e.g. Landline®), then a smaller ground area is reproducible. So the A5 maximum size is actually a best-case scenario and might have to be considerably smaller.

This problem is actually worse than it appears, and leads to the third and final issue—that of derived data. The licensing of data illustrated above extends to data derived from the original licensed data set and is understandable for two reasons. First it may be possible to 'reverse-engineer' a derived data set back to the original digital product and, therefore, allow a third party to gain access to it. Secondly, a derived data set may be extensively based upon the original mapping and, therefore, be used to bypass any licensing arrangements.

Perhaps one of the key issues here is whether any commercial gain would be achieved from the derived data set. If mapping data is to benefit the society it serves then surely personal and academic benefit can be gained without commercial exploitation. Although it could be argued that the 'Trading Fund' status of the OS is not the most beneficial funding model for national gain from mapping products, there is no reason why this model cannot be extended to support those not commercially using their products. The end result is that the same publication restrictions apply to derived data as to the original data (i.e. maximum size A5), regardless as to the degree of derivation.

This latter point deserves further discussion as derived data sets can cover a variety of different areas. It is perhaps helpful to categorize derived data sets as either quantitative or qualitative. Quantitative data sets use the original mapping and can apply some kind of mathematical operation to quantitatively derive a second data set. A good example would be the generation of a relief shaded topographic image from a digital elevation model or the creation of a buffer zone around a river. These can be compared with qualitative data sets, where considerable subjective assessment is applied by the cartographer in generating a data set. This could be the identification of fault lines on aerial photography and subsequent digitization. The latter data set has considerable 'added value' and, although it is based upon the original mapping, only a small percentage of the informational content is used and then added to by the operator. Recognition of the source data is paramount, but extension of the licensing agreement to the new data set is not appropriate. The issue of derived data sets is becoming more important and the GRADE Project (JISC, 2005a), part of JISC's digital repositories programme (JISC, 2005b), is currently exploring these issues. As part of GRADE, Smith (2005) has provided examples in the use of geospatial data and reported upon copyright issues related to this.

Unfortunately, the Lloyd and Greatbatch map was larger than A4, and broke the 'ground area' rule and used derived data, which broke the same rules as the original data. The other maps incorporated within the first issue were based upon their own mapping or used data from mapping agencies that were less restrictive. JoM wishes to actively contribute to the debate on map data and copyright, with a view to lessening the restrictions on map publication. Hopefully, the Lloyd and Greatbatch map will be published in a future issue. Severe copyright restrictions are regrettable and we hope that over the coming years, national mapping agencies, worldwide, will be less restrictive.

Although the issue of copyright is central to the development of mapping and cartography over the next decade, there have been several highlights in data access to global data sets including the availability of Shuttle Radar Topography Mission (SRTM; Rabus *et al.*, 2003) digital elevation model data (SRTM, 2004) and the ever - increasing Global Land Cover Facility (GLCF, 2004) Landsat archive. Both of these are examples of valuable international data sets, illustrating the generally favourable open-access policies of data collected by the United States federal government.

CONCLUSIONS

Maps are an essential technique for the visualization, analysis and communication of spatial data (MacEachren, 1995; Kraak and Ormeling, 1996). Many different disciplines now understand that the spatial dimension of their data is an important factor in the study and understanding of phenomena. The last century has sadly seen a gradual erosion in the use and presentation of maps in academic journals. This is worrying, as we increasingly have research published where the authors are not permitted to present all of their data. Not only does this stop informed, open, discussion of work, but also prevents the archival of such work for future generations.

The Journal of Maps is a new inter-disciplinary online, electronic, journal that aims to provide a forum for researchers to publish their maps, whilst allowing them to maintain a research profile through the publication of research articles in traditional subject specific journals. This is achieved within the context of open peer review, where the author pays a nominal fee for submission and all materials are made freely available to the journal readership.

Perhaps the single greatest challenge over the coming years is access to data sets and the ability to publish maps (or data) derived from them. It is imperative that national mapping agencies and universities lead the geospatial community in open access initiatives. To this extent various institutions in the US (e.g. USGS, GLCF) have taken the initiative. It is perhaps indicative of the geospatial community in the UK that we saw no national high resolution digital elevation dataset that was suitable for use by Norwich Union (a commercial entity) in the development of their FLOODMAP product (Norwich Union, 2004). In order to fulfil their requirements Intermap (a Canadian company; http://www.intermap.com) acquired, processed and made available the data set. This is now a significant national resource that was not derived by any national entity.

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