Date : 31/05/2007

Creating unique geological maps: international resources and services that shape undergraduate projects

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Meeting:	**110 Geography and Map Libraries**
Simultaneous Interpretation:	No

WORLD LIBRARY AND INFORMATION CONGRESS: 73RD IFLA GENERAL CONFERENCE AND COUNCIL
19-23 August 2007, Durban, South Africa
http://www.ifla.org/iv/ifla73/index.htm

Abstract

An undergraduate studying Earth Sciences at the University of Cambridge has to produce a piece of work in their third year that results in the production of a geological map. Many students choose project locations overseas including African countries such as South Africa and Namibia. During the course of project work, resources and services in both Cambridge and African Libraries are made use of. The specific nature of what each service can offer is explored and suggestions made for future collaboration.

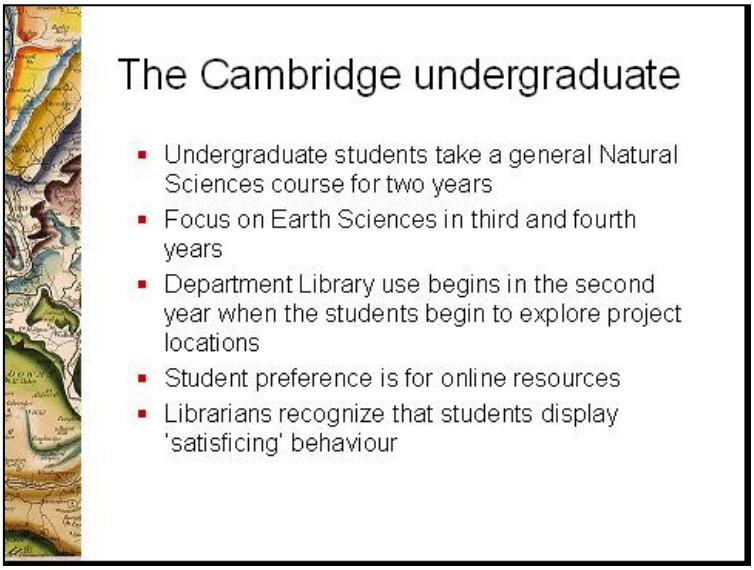
One of the essential components of the project that the student must produce is a geological map. The maps produced from these African locations are, to all intents and purposes, completely unique in that no other maps have previously been published at the same scale. There are implications in producing such a unique resource that have, by and large, been un-recognized by the library services. Issues for collection management such as copyright and image management are discussed and proposals for how these maps might be retained more permanently are put forward.

Introduction

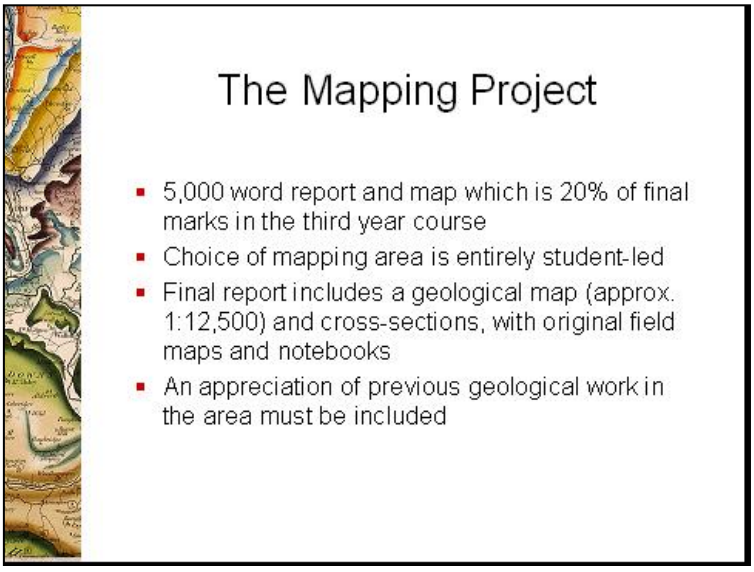
It is a pleasure to take part in IFLA here in Durban. I would like to thank the Geography and Map Section of IFLA for giving me the opportunity to talk to you during this conference, under the theme ‘ Mapping Africa’.

In my presentation I will be looking at a specific set of undergraduates who are specializing in studying Earth Sciences at the University of Cambridge. In particular I will be focusing on the piece of independent work that they must all complete which ultimately will result in a geological map. These maps are unique in that the scale at which the work is done does not exist in published form anywhere else. The students use resources and services of Libraries in both the UK and Africa. I will be presenting a number of examples of the maps and related work of the students and make some comments on what seems to me to be an underappreciated resource and suggestions for the way forward.

Background to an undergraduate degree in Cambridge



In the course of their time at Cambridge, the typical science undergraduate has an initial broad-based coverage of the sciences with scope in their second year to begin the specialization process. They can still keep their options open at this stage and it is only when they elect to specialize in Earth Sciences for their third year, and often a fourth year, that they begin to use the Library facilities in the Department of Earth Sciences. Science students will spend more time reading journal articles than text books. It is therefore not surprising that their preference is for online resources as most of the journals they need are available in this format. Students typically display 'satisficing' behaviour i.e. they will find out just enough to satisfy their current needs – this of course has implications for their projects abroad.



As part of the third year course the students are required to submit a report based on a field project that they will have undertaken in the summer vacation between their second and third years. The field project documents the geology of an area that has been researched and chosen by the students themselves. The Cambridge course is distinctive in this regard in that most other institutions will assign students to an area that has, in many instances, been vetted already by specialist staff. It is this very crucial aspect of the decision making process at Cambridge that leads to students mapping in areas which are not always well covered by published maps, thus leading to the 'unique' geological map. I will expand on this unique element in a few minutes.

The student undertakes geological mapping, constructs cross-sections and stratigraphic logs, and collects other relevant field data. The 5000 word report due in early January must comprise relevant figures, photographs and analyses, and be accompanied by a geological map and at least one cross-section. Clearly, an appreciation of previous geological work in the area is necessary as is the critical ability to assess how it compares with the observations made.

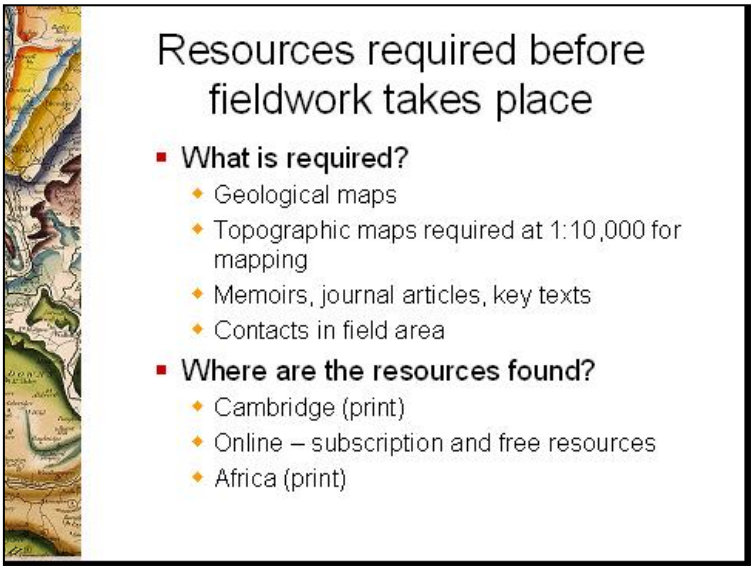
By the time the students reach the stage of planning and executing fieldwork and producing an independently-constructed geological map they will have mastered a variety of skills in their first two years. These skills include:

1. They will be able to read, and graphically present and summarize, geological information in map form
2. They will have attended supervised field trips where mapping in groups takes place in order to practice mapping skills
3. They will have acquired data analysis skills
4. Some basic concepts of project management and team skills will be taught

5. They are instructed in the use of software such as Endnote software for bibliographic referencing, ARC-GIS or Corel Draw for the production of maps; and Microsoft Office or alternatives such as Open Office, or Serif's packages for report writing. There is an expectation that they will be relatively computer literate but experience has shown that this is not always the case.

In terms of library use - both in Cambridge and abroad - there are two key aspects for the student to consider: Resources and Services. Each of these will be looked at in turn followed by some examples of mapping in South Africa and Namibia and, finally, a consideration of the implications of the production of these maps and how we might make more of this unrecognized resource.

Resources



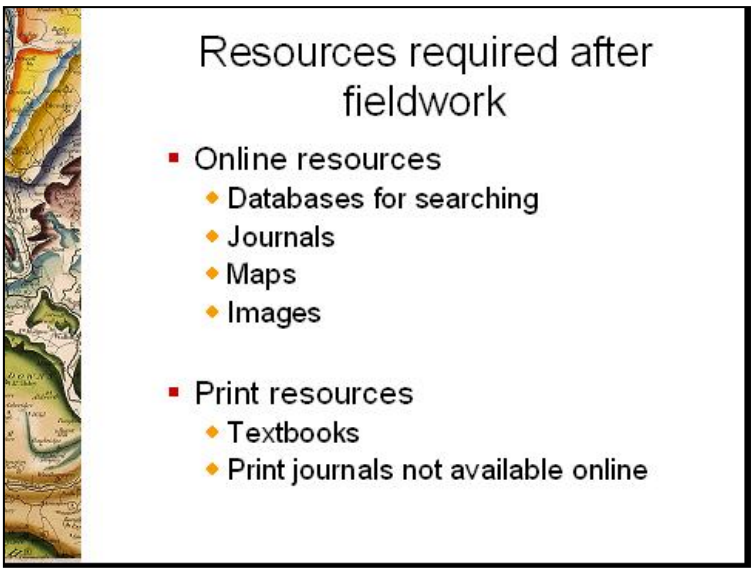
It is perhaps an obvious statement to say that 'no-one has everything' but that is the first lesson that the student must learn and take on board. The resources required before the field mapping takes place includes:

- Geological maps at the largest scale possible to ascertain whether the selected area will provide sufficient 'interesting' geology and exposure
- Ideally topographic maps at a scale of 1:10,000 to produce the field slips that the students will need to map the geology
- General texts and key articles for background reading and reference describing the geology of the area
- Obtaining local academic contacts in the area.

In all instances the Cambridge Earth Sciences Library and the teaching faculty can provide some level of provision of these resources and, in particular, will generally be able to provide the student with sufficient geological information – both in maps, key texts and older Geological Survey Reports, Bulletins and Memoirs of the areas in order for the decision to be made. The students also make use of the internet to assist their decisions, using for example Google Earth (http://earth.google.com/), Visible Earth (http://visibleearth.nasa.gov/) and Intute's satellite images (http://www.intute.ac.uk/sciences/worldguide/satellite.html). The Library has a key role to play in channeling their internet searching for maps and images via a Digital Map Library set up exclusively for the students in exploring mapping project possibilities. Links are provided for 'quality' resources for world regions, highlighting areas that have free online resources provided.

However, a key factor in the projects that have taken place in South Africa and Namibia recently has been the usefulness of the local African resources. Of particular note are the 1:10,000 topographic maps. These are often acquired very easily and cheaply in the relevant country, much more so than in the UK. Frequently, the more recent memoirs, bulletins and reports of specific geological surveys, which are often no longer sent to the acquisitions librarian in Cambridge, are available in the African geological survey libraries, along with tremendous goodwill on the part of the library staff there in assisting the undergraduates.

Clearly the local academic contact in Africa is crucial, although this is not something that the Cambridge Earth Sciences Library has much influence over. However, during skills sessions for these students related to using resources for mapping projects, advice from Library staff for consulting appropriate teaching staff with an interest in the project region can be very helpful.

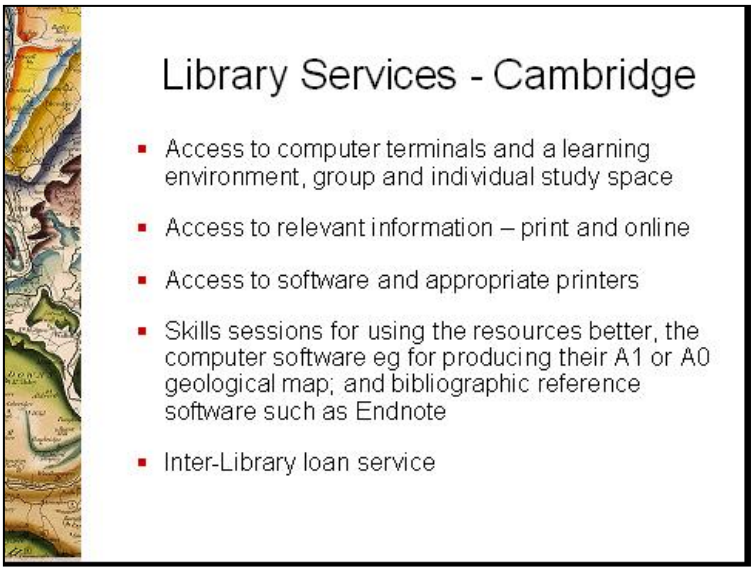


After their field mapping abroad, the student returns to Cambridge. They turn, more or less exclusively, to the Earth Sciences Library for online and print resources needed for geological information, resources to assist in the analyses required, and general research skills. The ability to access databases such as Web of Science via the Athens authentication system in the UK for citation searching is promoted through skills sessions in the Library, as well as looking at key subject-specific resources.

Library Services - Africa

Assistance, by means of essential help and local knowledge, by Library Services in Africa is vital. The student may need to acquire information in the field when greater understanding of the geology is required, and this is a crucial aspect leading to success or otherwise of a mapping project. Occasional access to the internet and computers to allow remote searching on databases and necessary liaison with Cambridge contacts is helpful although not essential - most students if really stuck can find an internet café somewhere, but the offer of assistance from the services in Africa is invaluable. Often communication with Cambridge department members is problematic in the summer months due to their own fieldwork. To help with this the Library staff in Cambridge will field as many queries as possible but cannot always undertake to deal with all situations. After the fieldwork is completed, links have been forged such that further contact regularly takes place. For example, a link with the University of Cape Town has enabled regular groups of students to plan mapping projects in South Africa in the Laingsburg area.

Library Services - Cambridge

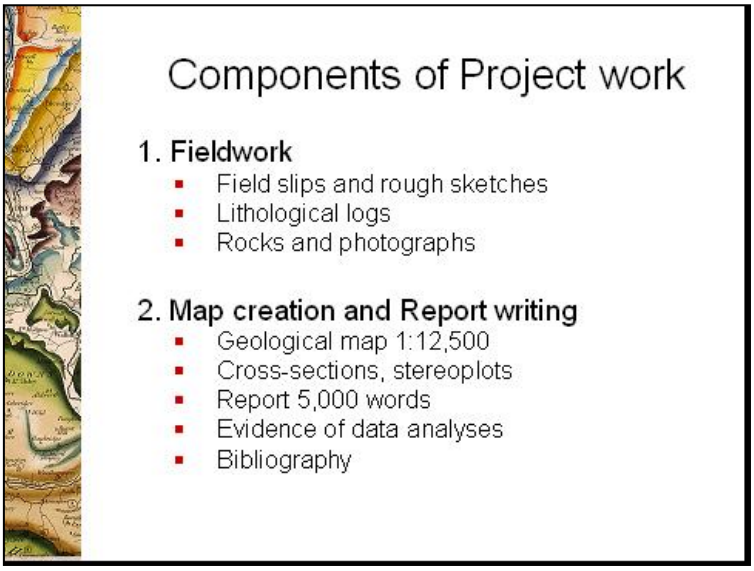


In Cambridge the services that the Library provides help the student in conducting post-field work analyses and report writing, using the skills acquired that have already been mentioned. These services will include:

- Access to computer terminals and a learning environment, group and individual study space. Lending of laptops, projectors, ARC-GIS keys,
- Access to relevant information - print and online - and to an appropriate reference enquiry service,
- Access to software and appropriate hardware such as scanners and printers,
- Skills sessions for improving resource use, the computer software and plotter for producing their A1 or A0 geological map, and bibliographic reference software such as Endnote,
- An Inter-Library Loan service for material that cannot be found in Cambridge but is in the British Library.

The provision of resources and services from both Cambridge and the African countries is not planned or organized in a coherent way. In some respects the student has some understanding of what they can find in Cambridge, but there is an inevitable learning curve along the way. The realization that they should have photocopied that key article before going abroad; the time that they have taken in the UK trying to track down appropriate scale maps without realizing how easily they would be available in Africa – this is the type of information that staff in the Earth Sciences Library have gradually acquired and use relevant skills sessions to inform students

Components of the Project

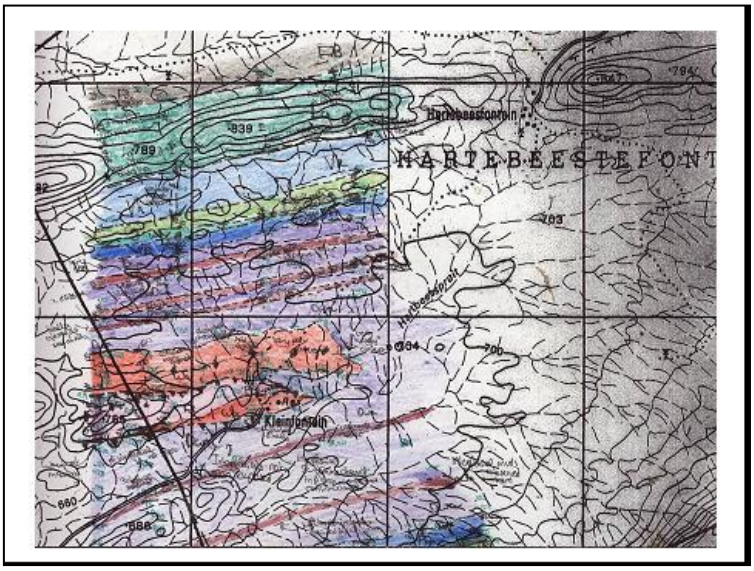


By the time the student hands in their report they will have used a multiplicity of resources and services in both Cambridge and Africa to achieve the stated aims and objectives of the task. The project is duly handed in with great relief and the results known in June after the examination marking for that year.

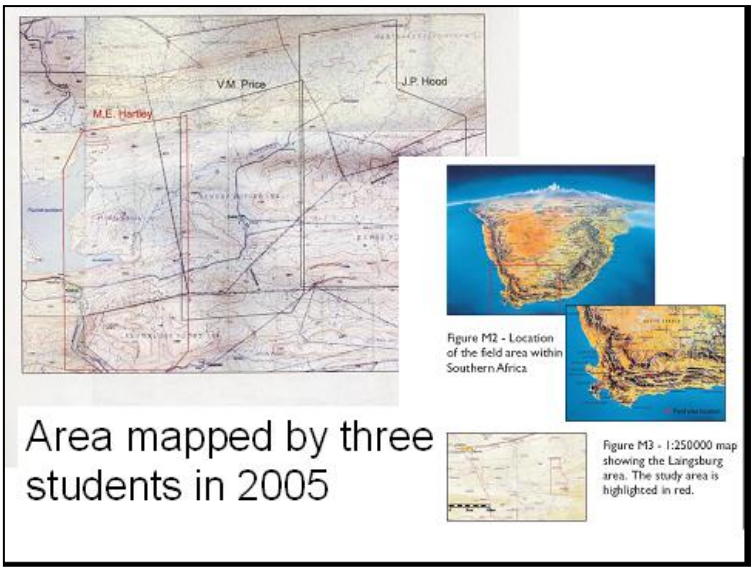
To be more specific however, I will unpack the contents of the report a little more and then illustrate this by showing examples of work produced by students over the last 3 years. Firstly, from the fieldwork itself, they will have field slips that will include their actual logging of geological information whilst in the field. They are expected to have taken rough sketches and notes in the field, as well as lithological logs. Examples of rocks are often collected under controlled circumstances in order to allow thin section analyses back in Cambridge. Recognizing that they are part of a wider area mapped by other students is important especially as this may have entailed discussions during their fieldwork over different interpretations of the geology and structure of the areas that might overlap. An acknowledgment of this mutual support is usual.

Secondly, as required by the Department for the completion of the project, the students will have produced a report of 5000 words, a geological map at approximately1:12,500 and at least one cross-section. The map must be printed in A1 or A0 format as well as re-produced in A4 format in the report. Examples that I will show include maps from South Africa and Namibia produced by students still currently in the Department. Photographs and often overlays, clearly indicative of the ability to recognize geological features such as dips and strikes, are useful means of demonstrating knowledge. Stereoplots can be included illustrating the folding of rocks in the area. The students must display geological field data on appropriate graphs, charts and stereoplots, using simple statistical methods for data analysis. Finally, they are expected to include a short bibliography. The students are not required to use a preferred citation style but must select an appropriate style and be consistent.

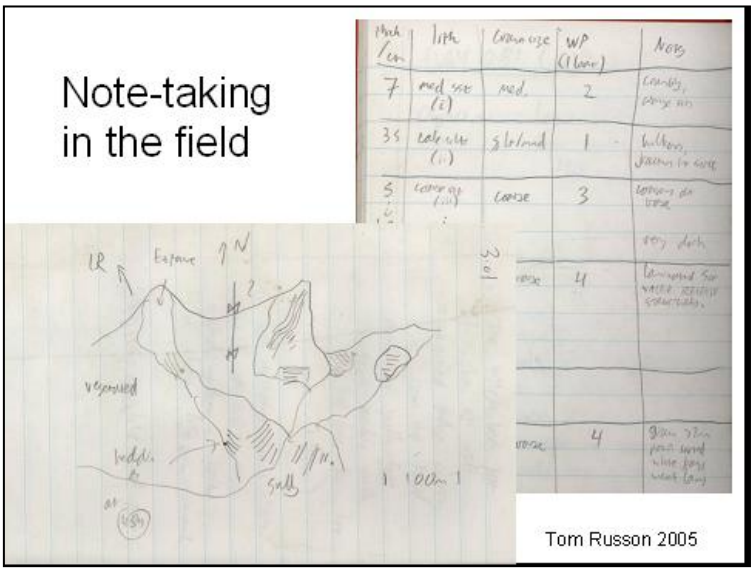
Examples of work in progress and the finished maps and reports



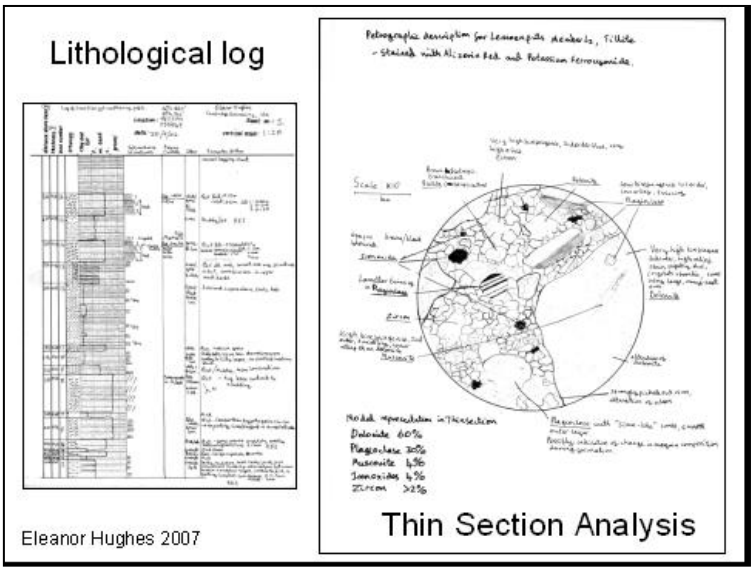
This is an example of a field slip for an area mapped in South Africa. Essentially the student uses a topographic map, ideally at 1:10,000, from which sections have been photocopied to create field slips that the students mark up in the field. They regularly use a GPS system to ensure accuracy in location.



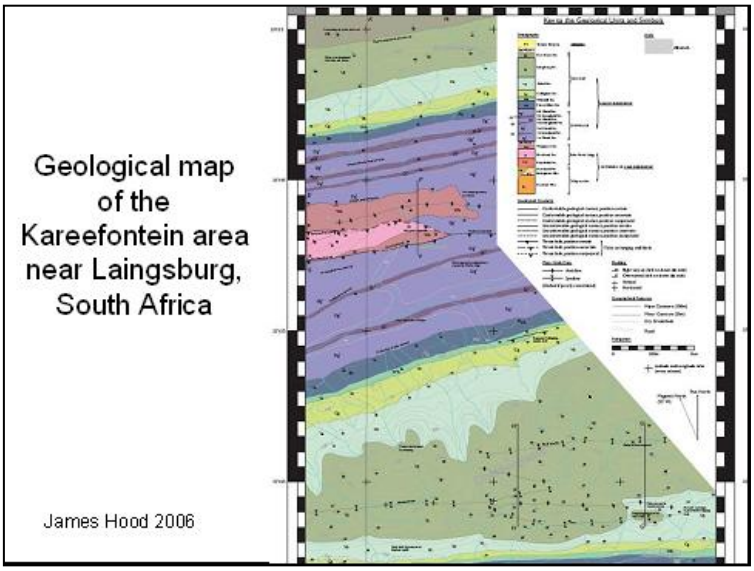
Three students who mapped together acknowledge the relation each had to the others' areas but including a map of the whole area showing their specific mapping areas.



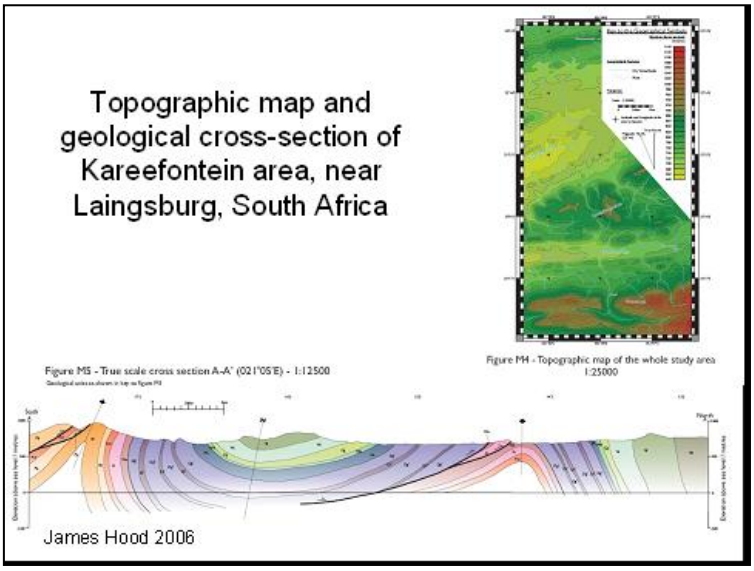
Note taking and rough sketches in the field provide important clues for the student when back in Cambridge.



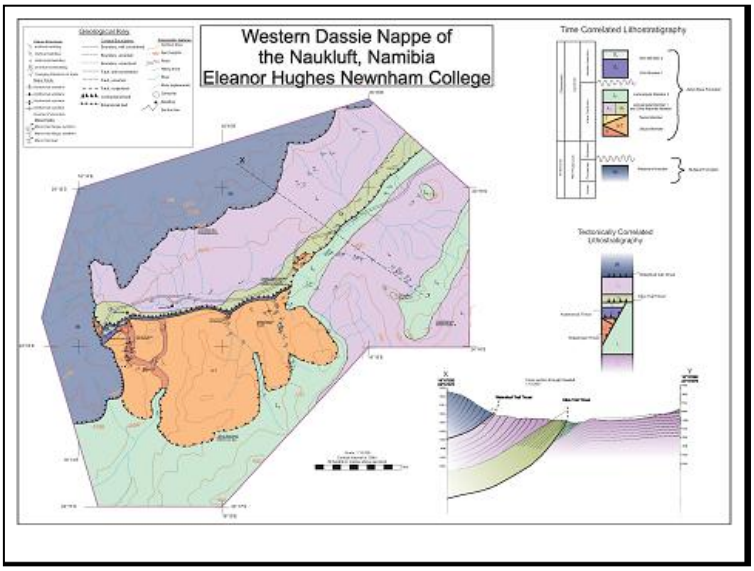
A lithological log is usually expected and the information created in the field is accepted in the final report. Examples of rocks collected in the field are made into thin sections when back in Cambridge which the students are expected to analyse.



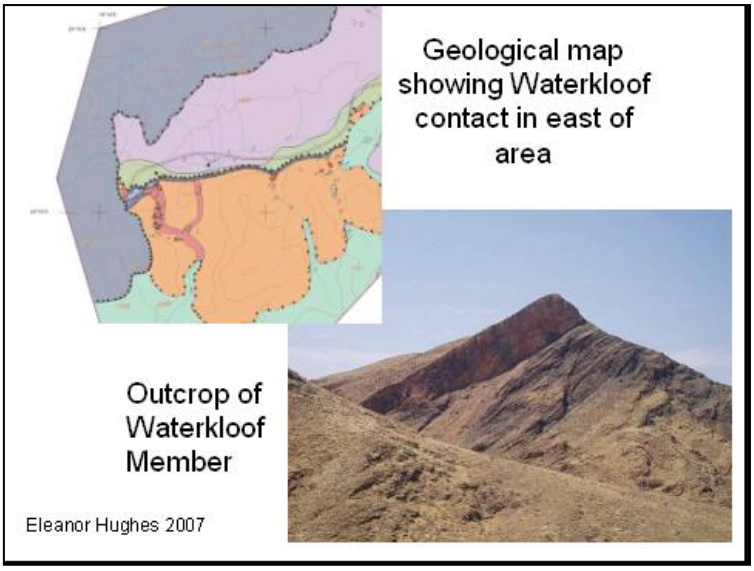
This is part of a final map produced by one of the students in South Africa.



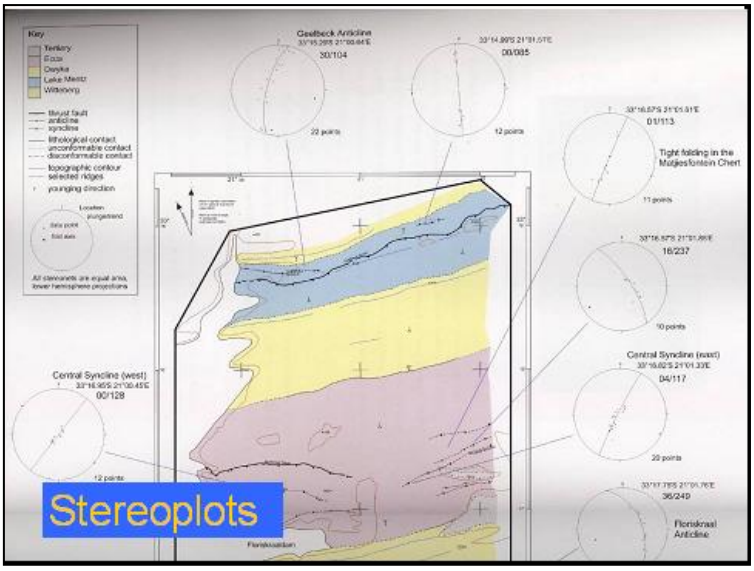
The cross-section is a required element of the report and is usually located with the geological map and occasionally a topographic map is also included.



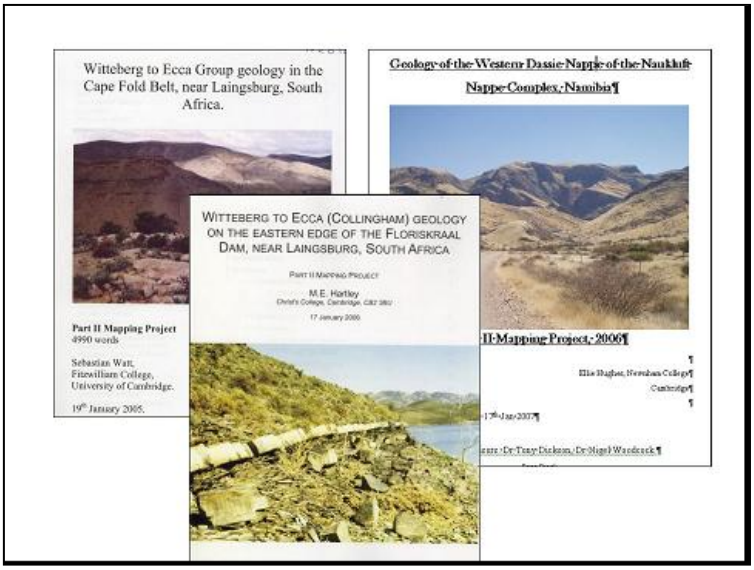
This is another final map by a student who mapped an area in Namibia in August 2006.



This same student is using photographs with a section of the final map to illustrate a key point in the report.



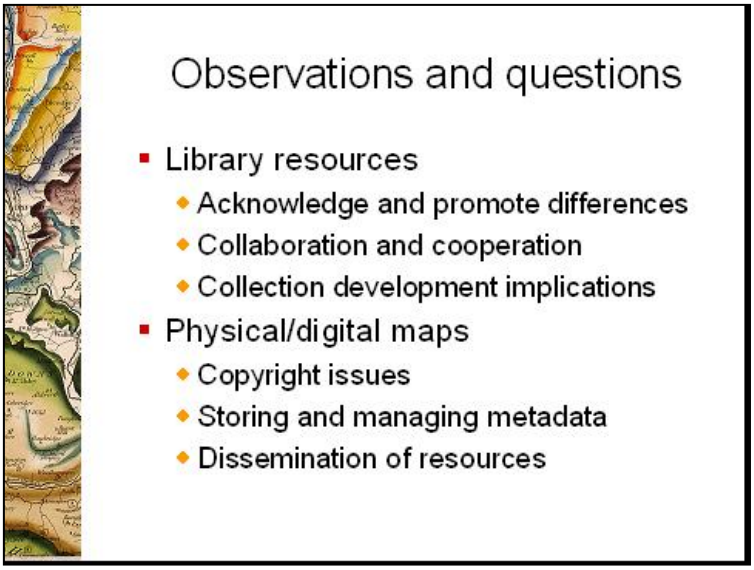
Stereoplots may be utilised in conjunction with the map to demonstrate recognition of rock folding. Because the map is drawn at the scale that it is, it becomes possible to include this level of detail, which on a more normal 1:50,000 or smaller scale map could not be included.



The final reports of three students visiting South Africa and Namibia over the last three years are shown here.

Observations and Questions

I have already made the point that each of these maps produced is unique and includes data that would not be available at a different scale. Also, no geological maps at a similar scale have been published before. I have some observations to make about this and the implications this may have for our own library service and for appropriate services in Africa. I have also some questions about, or suggestions of, what could happen with such a resource.



There are two issues; one to do with the profile of library resources and services, and the other related to the physical result of the project.

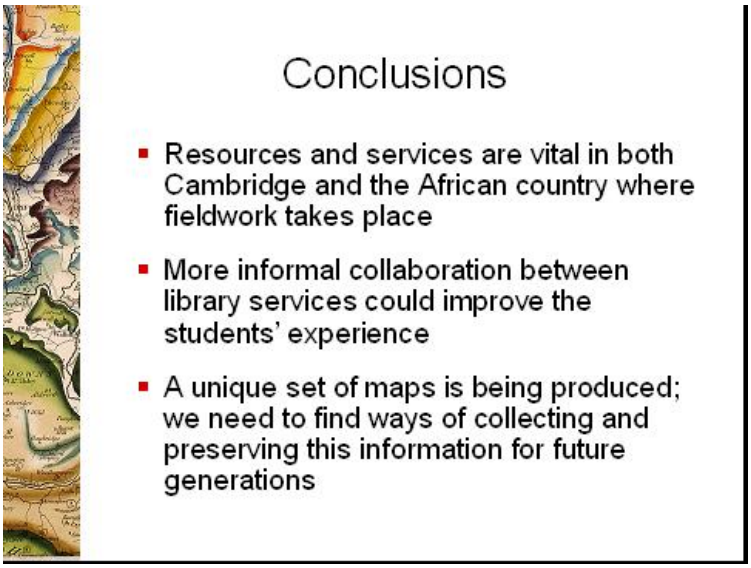
With respect to the profile of libraries, it goes almost without saying that no one Library service can possibly claim that they have all the information that is available on a specific area. However, it is true to say that African library resources in particular are not acknowledged and promoted sufficiently in Cambridge, and yet they contain a wealth of local, specific resources, along with helpful staff. Personal expertise providing information, reassurance and practical help on location is invaluable to the students.

If the above is true for the projects that have taken place recently, then I would suggest that there is an implication for libraries in both countries. Firstly, collaboration at this level does not take place at the moment but there is clearly a place for this. The Cambridge Earth Sciences Library knows where students are considering going for their projects and could initiate more formal collaboration especially in the area of resource provision. For example, if 1:10,000 scale topographic maps are available in South Africa then the student does not need to obtain them in the UK. The onus for collaboration and cooperation is on us – i.e. the staff at the Library in Cambridge. A further implication is related to collection management, and in particular to collection development and stock

selection for both Libraries. Some element of resource sharing might be possible for those areas that see students regularly.

With respect to the physical map, resulting from the project it is clear that unique maps are being created and the related question must be, “What is happening to them?” They are to all intents and purposes the property of the students themselves and hard copies can only be collected in a very ad hoc manner by the Earth Sciences Library and with the permission of the student i.e. it cannot be a standard element of the library’s collection development policy. One of the main reasons for collecting any at all is for subsequent mapping project students to have an opportunity to see what previous students have achieved. If there were to be any possibility of collecting all the projects as a matter of course, then an initial decision would need to be taken at Faculty level. The students would have to give their permission for our Library to retain a copy. Decisions such as methods of storing and managing the cataloguing or metadata associated with the work, followed by decisions over access and dissemination of information about maps as a ‘resource’ would also need to be taken. However, if decisions were taken such that collection could take place, then at least the Library would be guaranteed to have copies of all the projects and these unique maps.

Conclusions



Unique information is being created through a process of resource and service use of libraries in Cambridge and South Africa and Namibia. What we do with that unique information is I think important so that is it not lost – using this type of project we can also begin the process of collaboration between libraries and institutions. The onus is, I believe, on us in the UK – we hope to move forward with this.

Thank you

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