JOURNAL FOR EXCELLENCE IN TEACHING AND LEARNING

A VISUAL LIBRARY FOR THE GEOSCIENCES

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KEYWORDS:

Geology, Visualisation, online resources
Funding allocated: £2860

This project developed a digital library of annotated photographs of geological specimens which has been integrated with the Department of Geology's existing Blackboard resources. The library is available 24/7 enabling students to use it for enhanced learning, reference and revision. Images are downloadable to mobile devices (e.g. phones and mp3 players) and can be used for reference by students in the field. Difficulties were experienced with colour balancing in the photographs (which in some cases made the material difficult to recognize) and representing 3D patterns on 2D images. However, the students found the material a useful addition to the online materials and the library could be packaged for distribution outside Blackboard. This will require further, ongoing work.

1. BACKGROUND

The skills of describing and identifying rock, mineral and fossil specimens lie at the heart of the teaching of Geoscience degrees. These skills are typically taught in the laboratory where specimens are examined alongside textbooks showing idealized reference diagrams (e.g. Fig. 1). However, students often experience difficulty in comparing an idealized diagram or picture with a real specimen and this acts as a brake on the rate at which they learn. In the late 1980's photographic atlases of minerals and rocks in thin section were published, and while expensive these were popular, but most are now long out of print [1],[2]. There are a number of websites with illustrations of material but these often concentrate on museum quality specimens [3] or arlimited in scope [4]. The Department of Geology at the University of Leicester holds one of the finest collections of undergraduate teaching specimens in the country, enabling students to gain access to an unprecedented range of material in the laboratory – but, until now - not outside it when they might need to make reference to key practicals or materials.

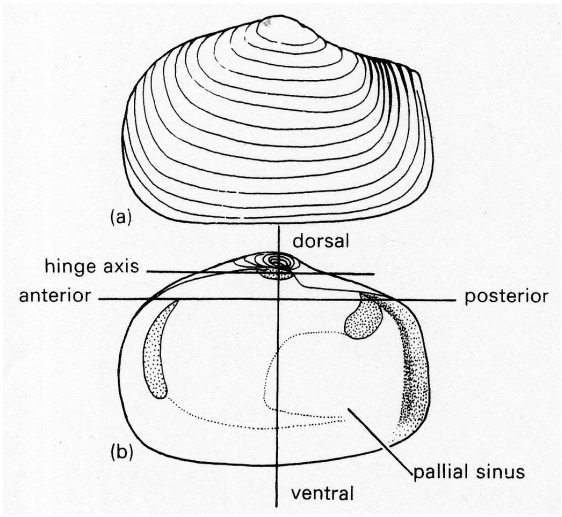


Fig. 1. Example of a textbook diagram used by students as an aid to describing a bivalve fossil (from: Clarkson, E. N. K. Invertebrate Palaeontology and Evolution. 1st Edition. Allen & Unwin)

2. PROJECT AIMS AND OBJECTIVES

This project aimed to address both the issues of provision of visual material and remote access to that material by building a library of annotated photographs of key examples of rocks, minerals, fossils and thin sections from the department's teaching collections. It was intended that the image library would link to the module resources already created on Blackboard. We envisaged that students working in our wireless-enabled laboratories would access the library direct from their benches via their laptops. The images would be stored in a form that will allow them to download them onto mobile devices so that they should be able to make reference to laboratory material even when undertaking fieldwork.

This approach was designed to enhance learning in a number of ways:

Students will be able to refer to diagrams of actual material when making their own observations (as opposed to the use of idealized textbook images). This will lead to a better recognition and understanding of the key characteristics of a wide range of geological materials.

They will access images of a wider range of materials than is available in even the best and most expensive textbooks.

They will have a portable reference library for use outside the laboratory, both online and for reference in the field.

From a departmental point of view it was envisaged that the library would contribute significantly to the department's online 24/7 learning and teaching resources and would make wider use of our teaching collections. Second, this library would support our development of distance learning resources and could potentially be marketable to other HEI's and students. The methodologies we develop will have applications in other disciplines with a strong descriptive base, e.g. Archaeology, Biological Sciences and Medicine. We envisaged that the library could be created as a Wiki to which the students themselves could add new materials, and learning exercises could be built around this.

3. PROJECT OUTCOMES AND ACHIEVEMENTS

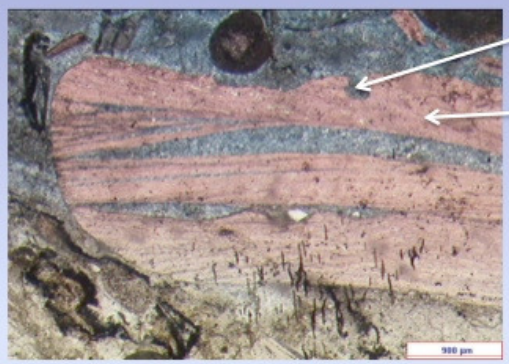
An online digital library annotated images of representative geological specimens (minerals, rocks and fossils) and thin sections has been produced by staff and students. Once the materials had been identified by staff and then photographed they were distributed to students for them to produce the descriptions as MS Powerpoint files. These were then checked (for accuracy and format) by staff. The students involved in this phase of the project gained enhanced skills in systematic description of minerals, rocks and fossils and in IT. Once the materials had been checked for accuracy they were uploaded to Blackboard. Staff also have access to all the images via departmental computer storage for creating other teaching and outreach materials.

This material is available 24/7 as powerpoint and .jpeg files. These can be viewed and /or downloaded to students laptops in the wireless enabled teaching areas for reference during practicals or in the student's own time. In addition the .jpeg files (which are considerably smaller (c. 100 kb) are available for download to mobile devices (MP3 players or mobile phones) for use outside the laboratory e.g. while doing fieldwork.

The materials are beginning to be used extensively, particularly by all students in years 1 and 2 where the fundamental skills of mineral, rock and fossil identification, description and analysis are taught and practiced. Some examples are given below. Here, the complex textures of carbonate rocks, viewed in thin section, have always been challenging to teach in the setting of a large practical class. The new material though, available for powerpoint projection and discussion for the whole class while in the practical class, and then available for private study, has significantly helped both teaching (for the lecturer and demonstrators) and study (for the students).

Biosparite

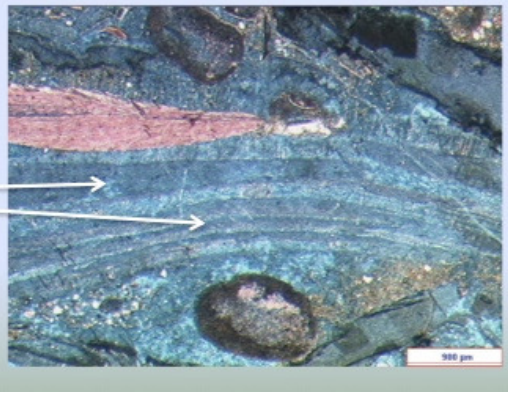
PPL



Boring in shell filled with ferroan calcite cement

Oyster shell (red staining indicates non-ferroan calcite); note fracturing (splitting) of shell by compaction before cementation.

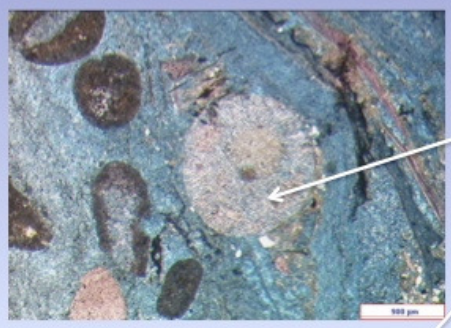
PPL



Shell outlines in blue stained calcite indicates original aragonite shell, dissolved and then infilled with diagenetic cement

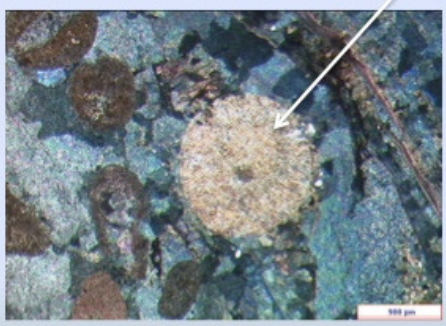
Biosparite

PPL

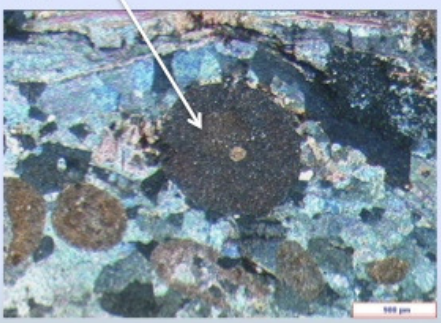


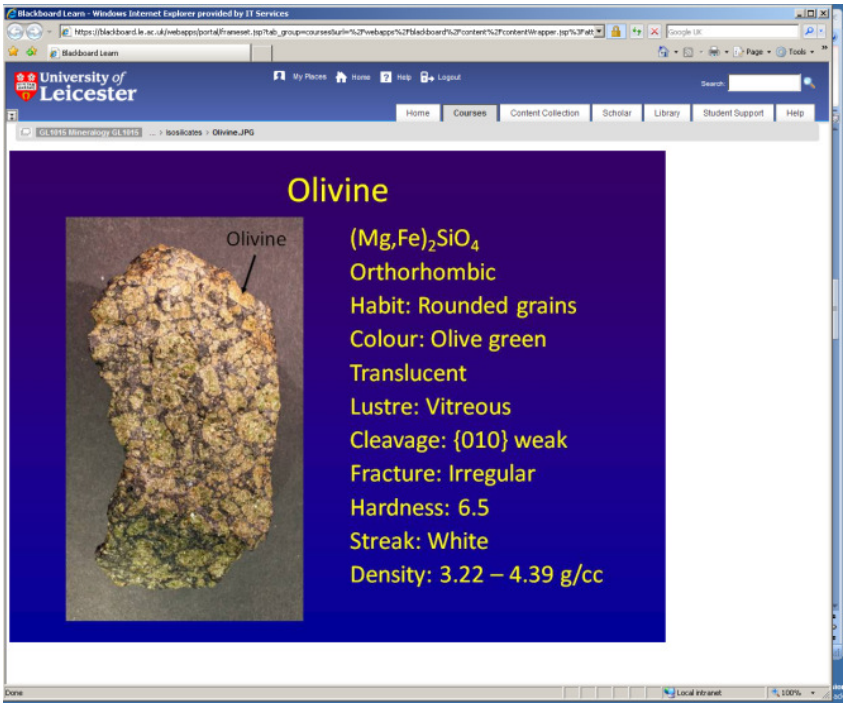
Cross-section through echinoid spine; extinction as single crystal is characteristic of echinoderm fossils.

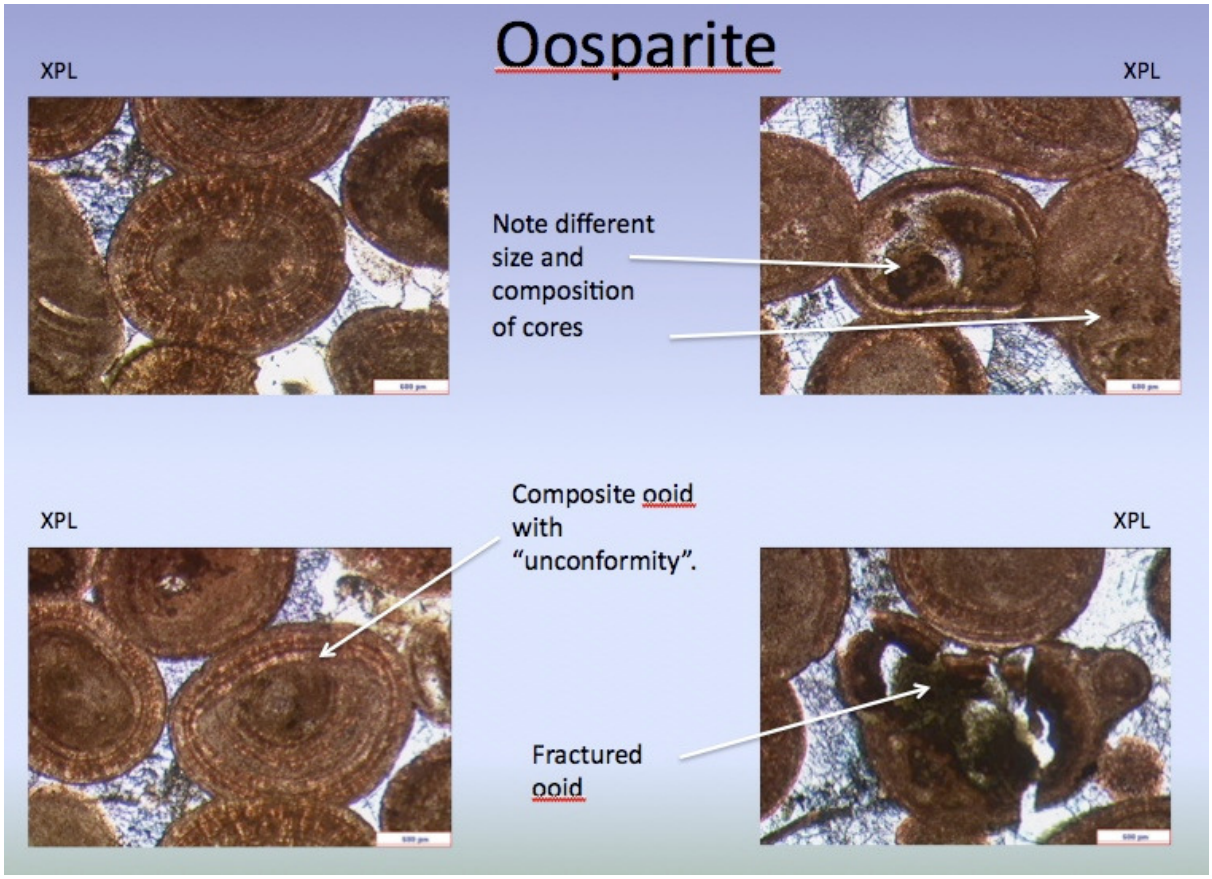
XPL



XPL




Blackboard Learn - Windows Internet Explorer provided by IT Services
University of Leicester
Home
Courses
Content Collection
Scholar
Library
Student Support
Help
Olivine
Olivine
(Mg,Fe)2SiO4
Orthorhombic
Habit: Rounded grains
Colour: Olive green
Translucent
Lustre: Vitreous
Cleavage: {010} weak
Fracture: Irregular
Hardness: 6.5
Streak: White
Density: 3.22 – 4.39 g/cc


Oosparite
XPL
XPL
Note different size and composition of cores
XPL
XPL
Composite ooid with "unconformity".
Fractured ooid

In mineralogy, the students have access to images of hand specimens of common minerals from the teaching collection. These images, an example of which is given below, include standard descriptions and they have been stored as a mineral reference library. The images can readily be downloaded by the students for use in or outside the laboratory.

Saudi-Aramco have expressed an interest in purchasing the image library for their own in-house training program and once all the descriptions are complete the library will be made available on CD or over the web for distribution to secondary schools and sixth-form colleges with which the department has good contacts as an outreach exercise.

4. EVALUATION

We have not undertaken any formal evaluation of the effect of introducing the material, but instead have discussed with the students and staff the impact on the availability of the material on their work and how the material might be improved.

The material has led to an improvement in the systematic description skills of the students e.g. there has been an increase in the average mark gained by mineralogy students from 68% to 74% for this aspect of their work. The images and accompanying descriptions provide examples of best practice, raising awareness of what students are expected to do.

The availability of the material has meant that students have images of rocks, minerals and fossils from the department's own collections rather than the idealized images or photographs of pristine 'museum' specimens available on the w.w.w. or in text books. The department teaching collections are representative of the types of material that students would normally find themselves (for instance, in their independent fieldwork projects) and, critical features and textures can be highlighted and described, which may not be included in museum specimens. The material is free to the students; they don't have to purchase a book of images. What they have access to is also presented in the educational context that we as staff wish to present it.

However, the project also has raised some issues which we will need to address before taking the project to its next stage. The main issue is that it proved much more difficult than expected to take detailed photographs of the material that accurately reproduce the colour of the specimen and had sufficient depth of focus to convey its full 3-D form. At an early stage of the project video was explored as a means of overcoming the latter issue, but this would have made the resulting files too large to be easily transportable; this route was not pursued but could be investigated further at a later date. Some specimens could not be accurately described by students from the photographs because of the imaging constraints and these have not been included in the final collection.

Another problem was that while the students obviously benefitted from being able to access systematic descriptions of minerals, rocks and fossils, a few used the information in the images as a substitute for undertaking their own descriptions. This may be mitigated to some extent by developing the image library into a full Wiki (See below) that the students interactively compile. The great majority of students did, though, use the images to enhance their knowledge.

5. CONTINUATION OF THE PROJECT

The results of the project have been integrated with the Department of Geology's existing electronic Blackboard teaching materials which are under constant development by staff as part of their normal annual review and update of modules. Now that there is a critical mass of material available there is an incentive to create additional material for the library and staff have expressed an interest in providing images of other material (e.g. more examples of thin sections of rocks). There remains a wealth of material in the departmental collections that could – that *should* – be made more easily available to the students (and the high-quality images, too, will, encourage the students to seek out and examine the specimens themselves). One original idea for the project which has not been realized, largely due to time constraints, was to make the library interactive in the form of a wiki. This would provide an environment in which students will be able to add material as part of a learning exercise which will lead to sustainable development of the library. An implementation trial which involves the students building a mineral reference library/Wiki will be undertaken in the mineralogy module in the 2010/11 session.

Longer term it is anticipated that the results of this project will form part of a larger searchable library based around course notes and other online learning and teaching resources including material from and relating to field courses already being produced by the Department of Geology. The Department is committed to integrating new technologies into its teaching programme and greater active learning through use of these technologies as one of its strategies in maintaining its leading position in the National Student Survey.

ACKNOWLEDGEMENTS

The project leaders would like to acknowledge the contribution of Gemma Tongue who took most of the photographs of the material and all those students that participated by contributing descriptions and comments on the project.

REFERENCES

[1] MacKenzie, W. S. & Guilford, C. 1980. Atlas of rock forming minerals in thin section. Longman.
[2] Murray, J. W. 1985. Atlas of invertebrate macrofossils. Longman.
[3] Natural History Museum Earth Lab datasite http://internt.nhm.ac.uk/jdsml/nature-online/earthlab/
[4] Minerals.net http://www.minerals.net/