

**PROMOTING GEOSCIENCE EDUCATION THROUGH DIGITAL IMAGERY – USING GeoDIL IN THE CLASSROOM**Joseph H. Hartman<sup>1,2</sup> and Dexter Perkins<sup>1</sup><sup>1</sup>Department of Geology and Geological Engineering and <sup>2</sup>Energy & Environmental Research Center,  
University of North Dakota, Grand Forks, ND 58202**INTRODUCTION**

The geosciences provide stimulating fields of research, but somehow, few nongeologists associate mountains, earthquakes, flooding, fossils, or volcanoes with the exciting work done by geologists or geoscientists. Sure, some people know this is what geologists do, but why do so few people take Earth science classes in college and why do so many governmental agencies lack Earth scientists on their payrolls? Why did my (Hartman) parents and their brothers and sisters invest in a gas well many years back and not even think to ask their geologist son what he thought of the idea? Besides the obvious possible parent–son communication problems, we think there is some sort of misconception about what geologists do or accomplish, even with famous actors playing volcanologists or paleontologists in recent movies.

This communication is an overview of a new Web-based image database called GeoDIL, a geoscience digital image library that we think can eventually play an important role in communicating what geoscientists do and how they interpret their data. For the present, GeoDIL is a sophisticated search and browse engine tied to an image collection of around 3000 high-resolution photos, along with capabilities of virtual carousel construction and electronic classroom projection. We envisage GeoDIL to be much more as we, and other teachers, design study plans around the imagery. The result, we hope, will be that GeoDIL will be more than pretty pictures, but an integrated resource of educationally stimulating, well-documented images that bring home the message of the importance of Earth studies to all citizens and, hence, their elected public officials.

**ABOUT GeoDIL**

GeoDIL was conceived as a visual learning environment that provides an opportunity for excitement concerning the features and processes of the geosciences. With this idea in mind, we proposed a digital image library project to the National Science Foundation (NSF). We believed that the proposal was funded because we intended to document images included in the database in a way that would separate our GeoDIL Web site (1) from quality images available elsewhere on the Web. Thus images are searchable or browseable on a number of geographic and geological parameters to make finding a desired image possible.


**GeoDIL Details**

GeoDIL consists of an open database connectivity (ODBC)–compliant relational database with a custom-designed user interface. Database coding is in the industry standard structured query language (SQL). The database itself is invisible to all users, with interactions with the system taking place via a standard Web page interface ([www.GeoDIL.com](http://www.GeoDIL.com)). The administrative side of GeoDIL is password-protected and accessible only to GeoDIL administrators and designated data entry personnel (GeoDIL librarians), not to the general public. Library staff can edit the database and facilitate the uploading of images for others. Our design of GeoDIL was implemented by our lead programmer Joseph Stevens, under the direction of Henry Borysewicz in the John D. Odegard School of Aerospace Sciences. GeoDIL includes integrated search-and-browse capabilities, a general-purpose image and metadata submission form, and a means to make virtual carousels of selected images. In addition, a means to communicate with GeoDIL administrators is available with every image presented, along with a statement of use of images for educational and noneducational purposes (Figure 1). The GeoDIL computer is secure and backed up in the UND Scientific Computing Center.


**Using GeoDIL**

The public side of GeoDIL is where students, instructors, and anyone else interested in Earth sciences will go to find images. The public Web pages allow users to search the GeoDIL database for images that are of interest to them. Searches can be as simple as typing in a short text string and clicking “Search” (Figure 2). GeoDIL will search all database fields for the text string and return thumbnail images and a brief title of all images. Searches can be as complicated as entering information in any number of database fields (e.g., key words, location, photographer), which will restrict the possible selected images. All searches in any given session are saved and can be retrieved for subsequent use. A user may also browse GeoDIL (Figure 3). A number of hierarchical categories have been established (and more are created as needed) that permit the user to move through topics of interest. For example, if a person is interested in minerals, the mineral browse category includes choices for silicates, native elements, carbonates, and other mineral types. Clicking on silicates loads 10 of 132 silicate thumbnail images. Likewise, clicking on “Geologic Time” brings up all of the typical

Figure 1  
GeoDIL Homepage – www.GeoDIL.com



**A Geoscience Digital Image Library**

<p><b>GeoDIL Home</b></p> <p><b>About GeoDIL</b></p> <p><b>User Registration</b></p> <p><b>Search GeoDIL</b></p> <p><b>Browse GeoDIL</b></p> <p><b>Fair Use</b></p> <p><b>Submit GeoDIL</b></p> <p><b>Contact Library Administrators</b></p> <p><b>Log In</b></p>	<p>GeoDIL is a collection of images related to the Earth sciences. This digital image library is intended for use by K-16 educators, researchers, and the general public. The image library will grow as more images are added by people at the University of North Dakota and others who wish to see their high-quality slides and photos made available to the public. The entire library may be searched in a variety of ways, and images may be downloaded for viewing remote from the Web. Most of the images in this collection are copyrighted; please click on fair use to find out about restrictions on use.</p>	
<p>To view the GeoDIL library, either Search GeoDIL or Browse GeoDIL.</p> <p>This library was created and is maintained at the University of North Dakota. For more information, click on About GeoDIL.</p> <p>Your feedback is appreciated. If you have any comments, click on Contact Library Administrators. If you have images that we can include in GeoDIL, click on Submit Images. Note that any photograph that may be useful in any area of Earth science education is appropriate for our library.</p>		

geologic time intervals (e.g., Triassic, Cretaceous) that can be clicked on to load images of strata, fossils, or other features related to this time interval. In addition to these features, GeoDIL has an "Intimate Relationship" between images of closely related content. This feature permits GeoDIL librarians or the contributor to associate images that are intimately related. Upon retrieval of such an image, a note and direct link to other related images are provided.

Users can view images at several different resolutions. Thumbnail resolution provides a quick way of viewing a large number of images (searches can return any number of requested thumbnails). Standard view provides the first retrieved size for a single image. On most monitors this image will be about 6 x 10 cm (2.5 to 4 in.). This image can be expanded to basically four

times a standard 17-in. monitor. Thus considerable detail is available for viewing and potential study. Other projection sizes are available for classroom use.

Figure 2  
Search GeoDIL



A quality feature of GeoDIL is the high print quality of its images. Unlike many other Web sites, we wish the image selected to be used by the viewer (see Fair Use below). This subsequent study or projection use requires initial input of digital images scanned or originally photographed at resolutions creating TIFF format files between 4 to 6 Mb. Once a thumbnail is selected, the original large-format file is converted to a JPEG format for quicker uploading.

Besides these display features, users have direct access to information about the image (supporting metadata). The supporting data are the most essential and ultimately unique part of our database. The combination of digital images and associated metadata allows the database to be effectively searched beyond the initial interests of the photographer. Standard information fields displayed currently include titles, key words, image collection (e.g., Hartman photograph C4277), photographer, date of the photograph, contributor of the images, copyright information, and information about the original image format. Boxes can be clicked to note whether the image is of a vista, outcrop, hand specimen, or thin section. Detailed location information can be provided along with stratigraphic and geologic time information. With the appropriate fields entered, a contributor can click on a number of boxes that help define the information content of the image. These boxes are directly linked to the browse fields available to subsequent users (as noted above).

#### Public Submission of Images

The professional community and public are invited and, indeed, solicited to provide images to GeoDIL (Figure 4). Interested users can submit their own images for inclusion in the GeoDIL library. We are counting on submissions to help

Figure 4  
Submit Images to GeoDIL



the library grow and make its selections all the more useful to a greater audience of users. We feel that GeoDIL is a community-based library that will grow as more images are added by people at the University of North Dakota (UND) and others who wish to see their high-quality slides and prints or digital photos made available to the public. As personal examples, the authors have many thousands of slides and prints that ultimately will see limited use beyond their research interests. We think that there are many other geoscientists who have amassed similar well-documented image collections who may appreciate the ability to share their photographic data worldwide while safely archiving the originals. Conversely, conversion to electronic format can also be considered archival, as images do not deteriorate, a fact not lost on the UND faculty member who had over 6000 photographs, slides, and negatives, destroyed in the 1997 Grand Forks flood.

Figure 3  
Browse GeoDIL



Anyone can contribute to GeoDIL. After a no-cost registration (for bookkeeping purposes only), a person can upload a file from a computer, fill in the blanks and click on some boxes and upload an image to the GeoDIL computer. The user can specify the copyright holder of the image (presumed otherwise to be the photographer). The uploaded image is categorized as a "recent submission." We, as GeoDIL administrators, are notified of such submissions and can evaluate the contribution for final submission. The only requirements are that the image be of Earth science interest (in its most encompassing sense and including paleontology and modern floral or faunal analogs), be in good taste, be of sufficient resolution, and provide appropriate documentation. Note that pretty pictures without provenance or description are just that, artifacts for calendar use, a worthy use,

but will have no place in the GeoDIL collection. During the review period, contributors have the opportunity to edit their image and data, but after a contribution becomes public, only library administrators can make such changes. With the image made public, it is available to the contributor for classroom or other use or to any other user. We have a specific hope that students will find GeoDIL a resource to both submit and show off their images. Quality images uploaded at one location can easily be seen by informed associates and friends as well as by the unknown user.

#### Fair Use

The images in GeoDIL are the property of those who submitted them to the library (Figure 5). A user may copy them as much as they like for noncommercial, personal, educational, or classroom use (see further explanation below), but redistribution in any way requires the permission of the person who owns the copyright. GeoDIL administrators or staff cannot grant the right to copy or redistribute any of the images in the library, but, where possible, will facilitate communication between interested commercial users and the copyright holder.

Figure 5  
Fair Use in GeoDIL



educational exemption. "Fair use" permits the use of work for criticism, comment, news reporting, teaching, scholarship, or research. "Fair Use" means incidental use. The owner's rights and interest remain protected. "Educational exemption" provides the educational community considerable freedom in using copyrighted material. Loading images from GeoDIL into virtual carousels or other image-viewing programs falls under the educational exemption category, provided 1) the organization using the material is a nonprofit educational institution, 2) the use is part of the regular curriculum of a class, 3) the material is in a classroom, 4) the material has been legally obtained, and 5) the material will not be copied or duplicated. Submission of an image to GeoDIL means to us that the submitter has allowed the image to be used for noncommercial, specifically, educational purposes. We interpret "educational" in a broad sense, meaning both classroom and nonclassroom use. If any questions arise from this usage, we should be contacted for clarification.

## GeoDIL AND EDUCATION

### In General

GeoDIL images are intended for students of all ages and all kinds, but we specifically hope that K–20 educators and the general public will use the library to make worthy value out of the tens of -thousands of images taken by geoscientists and others. Our aim was to create a digital resource that will "... serve educators and students of all types, at all grade levels, and in all locations . . ." (2).

To be successful to any one user, our library must contain a large number of useful and exciting photos. As the collection grows, those with an Earth science interest will find satisfaction in being able to select the appropriate image from a number of choices. Educators and researchers around the globe will have the opportunity to submit images on the local geological phenomena that would make for great examples for others living in different geological terrains and climates. We anticipate having as many as 10,000 images in the library within the next few years.

With the broad number of topics available in the geosciences, categorizing images for topics of interest they may represent is an ongoing activity. Teachers and other users are invited to comment on images and the interpretations that may be possible beyond what is already reported in GeoDIL. As contributors and users ourselves, we recognize that the reason we took a picture or what value we might see in the picture may be different than someone preparing a teaching lesson, a lecture, or a book report. By e-mailing us (GeoDIL@und.nodak.edu) or clicking on the "provide comments" button next to an image, the user can inform us as

to which additional subject categories to make or text to include with a specific image. Recent category additions have concerned cultural features, such as petroglyphs (GeoDIL 312) and Earth materials in construction activities (GeoDIL 2424).

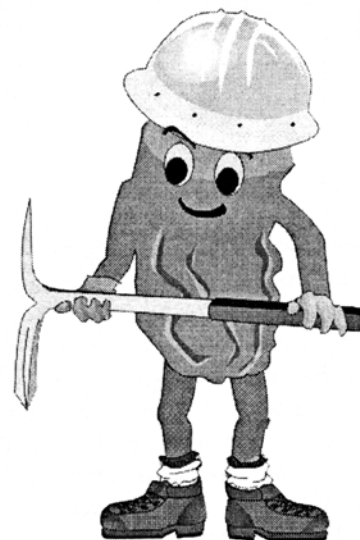
### Lesson Activities

GeoDIL can be used as a resource for imagery and information – a well-captioned photo book, as it were. By arranging selected images in virtual carousels, a lesson plan or storyboard can be constructed for classroom use. In a UND Earth Through Time class, I (Hartman) wished to show some examples of fossilization and methods of preservation. The images used were technically unrelated and used as necessary in class. The carousel consisted of images of chert nodules and chalk from the White Cliffs of Dover, England, a decomposing deer in leaf litter, shell accumulations along a North Carolina shoreline, and shells in drawers as part of a university collection. As no immediate cost (outside of having a scanner and computer and Internet link) is required to scan the image and upload it to GeoDIL, the images were uploaded before class and available for immediate use.

Carousels in GeoDIL are generally considered public. The organizing of images into a carousel and providing a carousel title means that image sets are available to any user. Although individual users are likely to have their own ideas of what they want to do, existing carousels (like one on the Grand Canyon) may help some users with new ideas or speed along the process of carousel construction.

One of early GeoDIL librarians, Tywla Baker-Demaray, has recognized the potential use of GeoDIL as a teaching resource at tribal colleges. Her presentations on GeoDIL have included lesson plans on the use of GeoDIL and the development of lesson plans. As individuals like Ms. Baker-Demaray access and implement GeoDIL for such purposes, models for the use of GeoDIL will become available to others, and educational goals of GeoDIL can be expanded to include suggestions by teachers.

Figure 6  
Mr. GeoDIL



### INSUMMARY

GeoDIL is a work in progress (Figure 6). We hope for feedback by contributors and users to make GeoDIL an obvious resource for images and geoscience information. Down the road, we wish to incorporate a geospatial component where images can be searched by map view. The addition of searchable map views, in addition to the current location searches, will make possible a wide variety of choices to the user in selecting images and constructing carousels.

### REFERENCES

1. GeoDIL, 2002, [www.GeoDIL.com](http://www.GeoDIL.com): Grand Forks, University of North Dakota, Department of Geology and Geological Engineering ([www.geology.und.edu](http://www.geology.und.edu)).
2. DLESE (Digital Library for Earth Science Education), 1999, Portals to the future – A digital library for Earth system education, preliminary and panel reports: [www.dlese.org/panelreports/reports.html](http://www.dlese.org/panelreports/reports.html).

### ACKNOWLEDGMENTS

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Figure 6  
Mr. GeoDIL

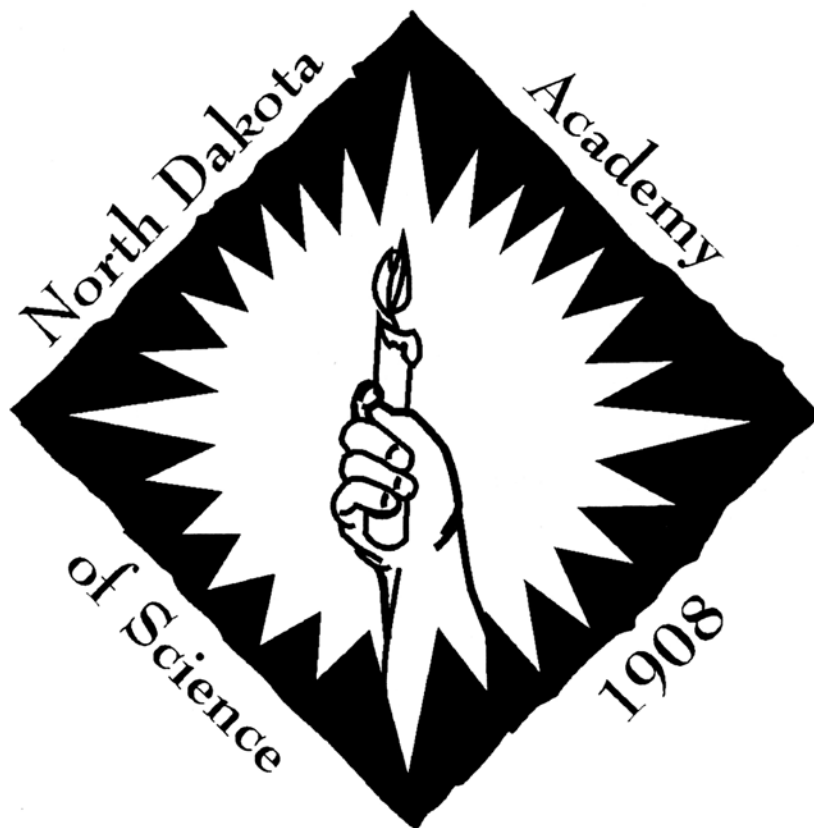


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