Core and Thin Section Photo Project

By Ed Murphy

Last fall, the Geological Survey embarked on an ambitious project to take digital photographs of all of the oil well cores and thin sections in the Wilson M. Laird Core and Sample Library in Grand Forks. The core facility contains approximately 350,000 feet of rock core and 15,000 thin sections cut from some of those cores. In February 2005, the Geological Survey and Oil and Gas Division received a $10,000 grant from the North Dakota Oil and Gas Research Council. That grant was applied towards the purchase of a camera-mounted petrographic microscope for the core and sample library in Grand Forks. The scope (Figure 1) has been used to photograph thin sections derived from oil cores. These photomicrographs, along with photographs of the cores, have been placed on the Oil and Gas Division's subscription website. For a fee of $15 per month, companies and individuals can access well files, scout tickets, electric logs, core photos, and photomicrographs on this site. An example of the core photos, photomicrographs, and well file information available for a given oil well in North Dakota can be viewed at http://www.state.nd.us/ndgs/ or http://www.oilgas.nd.gov/. The purpose of the website is to stimulate interest in the oil and gas potential of the Williston Basin by placing all pertinent information on a specific oil and gas well in one place. North Dakota is among the few oil-producing states, if not the only one, to do so.

Recently, we completed the first phase of our core photo and photomicrograph projects. All of the cores related to three major oil plays currently occurring in the Williston Basin; core from the Bakken, Mission Canyon (Ratcliffe), and Birdbear Formations, have been photographed. As of December 1, 2005, 6,800 feet of core had been photographed, generating more than 11,000 core photographs (Figure 2) for the Oil and Gas subscription website (typically eight inches of core per photograph). We are averaging approximately 1,000 feet of core per month. We entered into this project knowing it would be long-term given the large amount of core in the facility. At the present rate, it will take over 30 years to photograph the core that is currently in the core library.

All of the Bakken thin sections have been photographed. Approximately 1,100 thin sections (roughly 8,500 photomicrographs) have been posted to the Oil and Gas Division's subscription website (Figure 3). We are averaging about 200 thin sections per month. At that rate, it will take

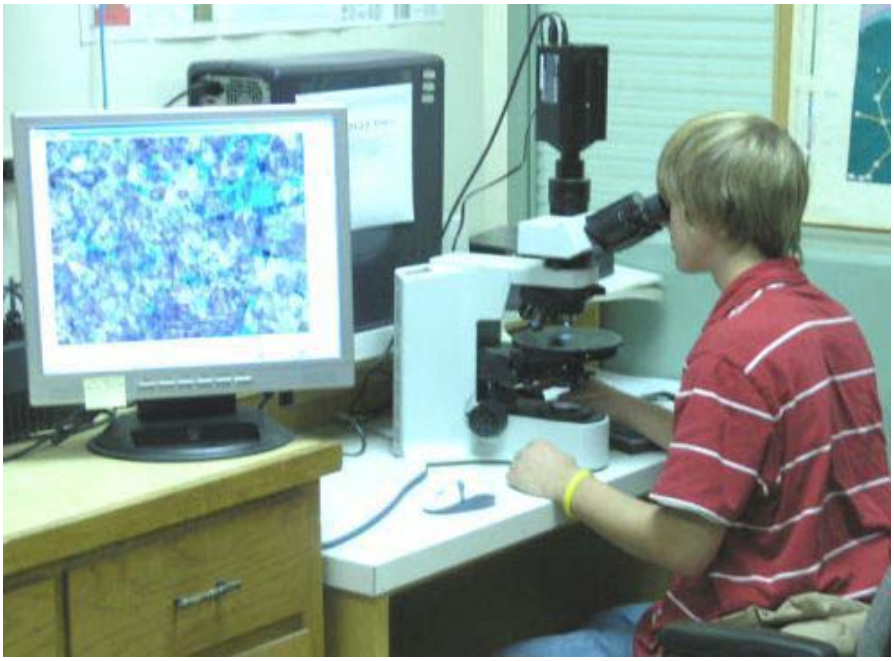

Figure 1. Geological Survey temporary employee Joshua Dub (an undergraduate student at the University of North Dakota) obtains a digital photomicrograph of a thin section using the recently acquired camera-mounted petrographic microscope. The monitor is turned ninety degrees to the left of its normal operating position.

Figure 2. An example of a window that is visible when observing core photographs on the Oil and Gas subscription website. All core photos for a given well are placed in stratigraphic order along the left column where they can be scrolled through and a section of the core highlighted to generate the close-up photo of core in the window on the right. This is a photograph of a core of (bioturbated) burrowed sandstone from the Deadwood Formation (Cambrian\Ordovician). The core is from a depth of 10,342 feet, in the William Steckler well no. 1 (NDIC permit no. 7020), Grant County, North Dakota.

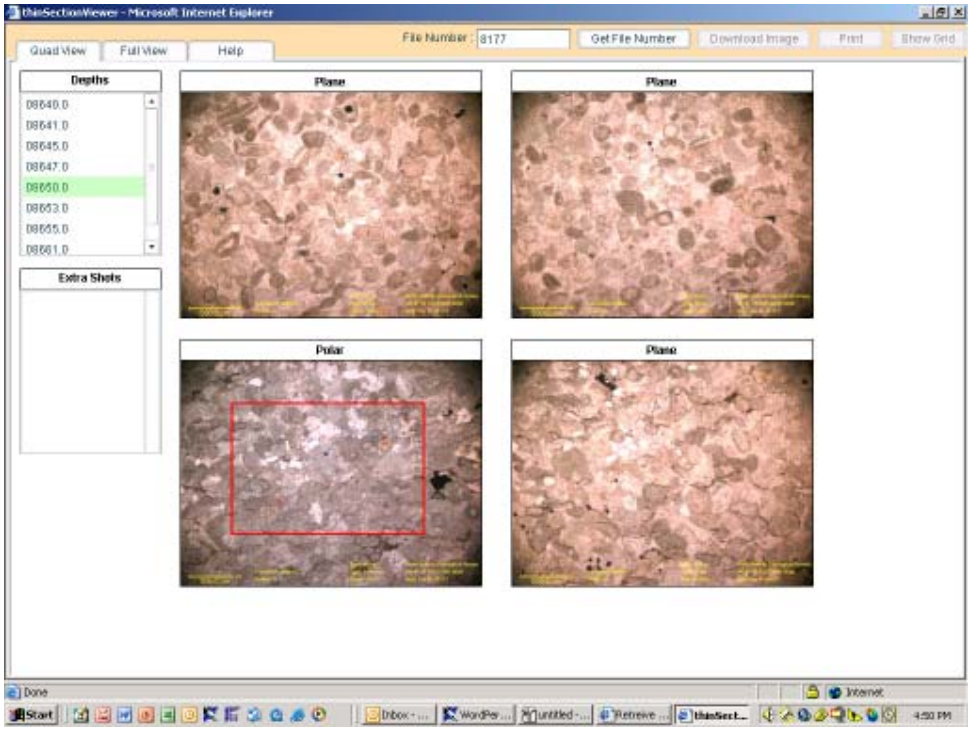

Figure 3. An example of a window that is visible when observing photomicrographs on the Oil and Gas subscription website. Approximately 80% of the thin section is displayed in the four quadrants. Each quadrant is photographed under plane and polarized light and the view can be changed by scrolling over the photographs. The area within the highlighted box will expand to fill the entire screen with the click of a mouse. These photomicrographs were taken at a power of 4x. This is a thin section of core from the Bakken Formation at a depth of 8,650 feet in the Dobrinski well no. 18-44 (NDIC permit no. 8177), Ward County, North Dakota.

about seven years to photograph all 15,000 thin sections in the core library.

The Survey has hired several geology graduate students and undergraduates majoring in geology as temporary employees to assist us with this project. Since July 1, 2005, the salaries of these students has been paid from the Oil and Gas Division's Reservoir Data Fund, funded in part by subscriptions to the website. We hope to increase student hires to accelerate the program. However, the limiting factor is that we can only photograph one core and one thin section at a time with the current equipment.

As we pull cores from the shelves to photograph, each core box is evaluated to determine whether or not it should be replaced with a new one. The core and sample library in Grand Forks contains approximately 130,000 individual core and sample boxes. We have estimated that 41,000 core boxes are damaged and need to be replaced (Figure 4). At the current rate, we will replace 6,000 boxes during the 05-07 biennium and will replace all of the damaged core boxes within the next thirteen years. The total cost to replace the damaged boxes will be about $50,000. The hand written labels on the damaged boxes (company, well name, well number, and core footage) are often difficult, and in some cases impossible, to read. As the boxes are replaced, we have been using printed labels so that the information will remain legible for years to come. An additional benefit of reboxing has been a space saving of approximately 15% (ranging from 5 to 30%) per core (Figure 5). As a result, we anticipate that once all of the boxes have been replaced, it will add an additional 25 years of life to the core facility. Although $50,000 appears to be a lot of money to spend on core boxes, it is a much better economic alternative to spending hundreds of thousands of dollars on expansion of the core facility.

We anticipate that placement of the core photographs and photomicrographs on the Oil and Gas subscription site will lead to additional studies of North Dakota cores because geologists will want to study, up close, the actual cores of interest that they will now be able to see on line.

Figure 4. A bin of damaged core boxes. Only 34 core boxes (most of which are damaged) could be stacked in this bin.

Figure 5. The core library contains 4,147 bins such as this one. Each bin will hold forty undamaged core boxes. This represents a 15% space savings when compared to the bin in the upper photograph.