Field Notes

Under Cover

By Lorraine A. Manz

Mapping the surface geology of eastern and central North Dakota is a bit like trying to identify the contents of a Christmas present, or any gift for that matter, just by looking at the wrapping. In my current field area near Devils Lake the metaphorical gift is a maddeningly complex assemblage of glacial sediment that was deposited during the latter part of the Late Wisconsinan glaciation, about 12,000 years ago. The wrapping, if you will, is a covering of soil, which may be up to several feet thick, and which is invariably populated by a variety of grasses, trees, assorted crops, and other vegetation. The shape and overall appearance of the package is subtle: a gently undulating landscape dotted with lakes and sloughs, loose rocks and the occasional very large boulder.

A surprising amount of geologic information can be gathered simply by looking at such a seemingly unremarkable prospect. Black and white, color, and infra-red aerial photographs reveal landforms and features that are essentially invisible at ground level. Together with the contours on topographic maps they show the shape of the land and consequently provide clues about the conditions under which it was formed. Strings of small lakes and depressions, for example, suggest the presence of an abandoned or partly buried glacial meltwater channel. Sinuous chains of elongated hills and ridges are indicative of eskers - accumulations of sand and gravel deposited by streams flowing within and beneath a melting glacier. And so on. But no matter how skilled the interpreter may be, at the end of the day he or she still needs to get under the wrapping and find out if the terrain on the aerial photos and topographic maps has been described correctly.

In eastern and central North Dakota this is no easy task. There are few, if any, natural outcrops, and around Devils Lake especially, many of those described in earlier studies are now under water. My colleagues and I must therefore rely upon the hand of man to open the wrapping for us. We eagerly seek out gravel pits, construction sites, roadcuts, and any other kind of activity that makes holes in the ground. If there are none, we dig our own. The set of hand augers I carry with me in the field will, under the right conditions, extend to a depth of about thirty feet, although I confess that I have never gone down quite that far. The thought of single-handedly wrestling with a thirty-foot chrome-molybdenum pole that weighs almost thirty pounds is worrying, to say the least. Five or six feet is my limit. (NDGS field geologists have access to motorized equipment for slightly deeper work, thank goodness.)

At this time, my mapping area has a plethora of gravel pits, due largely to construction projects associated with raising the elevation of the levee around the town of Devils Lake. Opportunities to see what lies hidden under the wrapping therefore abound, and I had the good fortune last summer to be able to study some very interesting geology. I like gravel pits for two reasons: firstly they are usually large and deep enough to reveal a considerable amount of geologic information, and secondly the types of materials found in them (silt, sand and gravel for the most part) are easy to work with. They can be scraped, dug, and handled with the minimum amount of fuss, unlike lake sediments.

I don't like lake sediments at all. I especially don't like them after it has rained. Lake sediments consist primarily of clay and they are never found in gravel pits, which means that we usually have to dig for them ourselves. Identifying likely locations is not a problem. Dry lake beds are smooth and flat, the topsoil is usually black or very dark brown in color, and there is often a conspicuous absence of anything larger than a sand grain. Augering this material, particularly when it is wet, is like trying to auger Play-Doh®. It sticks to everything and stubbornly refuses to allow itself to be removed from any surface. Boots quickly begin to assume the weight of lead, the auger bucket is frustratingly difficult to empty and keep clean, hands, hair and clothing somehow manage to get plastered in the stuff and, I am sorry to admit, tempers start to fray. Working with lake clay is undoubtedly one of the low points of field work as far as I am concerned.

Till can also be a problem. Till is an unsorted mélange of rock debris ranging in particle size from clay to boulders larger than a car that was deposited directly by, and beneath a glacier. Most of eastern and central North Dakota is covered by a blanket of till, and it is by far the most common type of glacial sediment to be found in this part of the state. Because it is such a chaotic assortment of rock debris, augering or coring through till can be quite an adventure. Even the most sophisticated and expensive drilling equipment on the market may pause when it hits a piece of Precambrian granite. It will usually get through it eventually, so what chance do we mere mortals have? I have lost count of the number of occasions when, having augered a foot or so into till without

difficulty, I have been greeted by the sound of metal grinding on an immovable fragment of rock. It doesn't have to be very large, either. A well-positioned pebble will effortlessly stymie any attempt to dislodge it. The only thing to do under these circumstances is fill in the hole and start another one a few feet away. In all probability, the process will repeat itself. A foot or two down the grinding will be heard and felt again, and again in the third hole and in the fourth. By this time patience is wearing a bit thin and it is best to simply accept defeat. What you are working in is clearly what you thought it was - till, and unless something shows up on the aerial photograph or well logs in neighboring areas suggest otherwise, it is prudent and conducive to one's sanity to simply move on to the next site.

So what is the point of it all? Why do field geologists scrabble around in gravel pits and muddy trenches, dig holes, get dirty, cold, wet, and bad tempered? We do it for the simple reason that we love our work. As scientists we are curious about the world around us and have an insatiable need to understand it. The outdoors is our laboratory. It is where we do most of our learning and where we can experience the excitement of discovery to the fullest. Each time I drive the auger into the ground I am filled with anticipation: what will I find today?

Of course there is another, more important reason why many geologists spend so much of their time in the field: it is part of their job. One of my major duties as a geologist for the North Dakota Geological Survey is to make maps of the surface geology of areas of socioeconomic importance around the state. These maps are a compilation of data and observations collected by many individuals - geologists, soil scientists, engineers, and others - and it is my job, and that of my colleagues, to collate and interpret this information and, with the help of mapping and GIS technicians, present it in a form that makes it easily accessible and legible to the citizens of North Dakota and others.

Why bother? There are many reasons to bother. At its most fundamental level a geologic map is an educational tool. It is the basic database for almost all earth science-related investigations. What lies in the earth beneath our feet has a profound effect on the world around us. The geology of an area governs its susceptibility to natural hazards such as flooding or landslides, and dictates the location of natural resources like coal and oil. It affects the availability of groundwater, the location of aquifers, shapes the landscape and even controls natural habitat by influencing what kind of vegetation grows best where. Thus, in order to develop a thorough understanding of any and all these things in North Dakota we need to understand its geology as well. And while a geologic map cannot answer all our questions, it is an integral part of the story. A reflection from just one facet of the gem that is North Dakota.

We are not content to receive gifts and leave them unopened, no matter how attractively wrapped they may be. It is wasteful and, let's be honest, our curiosity simply would not allow it. By the same token, geologic maps cannot be compiled from inference alone. We need to peel away the wrapping of plants and soil and see for ourselves what lies beneath - seize every opportunity to catch as many tantalizing glimpses of the gift as we can, for this one we will never be able to open completely.