THE MANITOBA MUSEUM

Features
MAGAZINE
Winter 2002 Volume 1/Issue 3

Northern Exposure

Uncovering Churchill's Unique Nature

"This is the only place where I have ever seen the past so clearly in three dimensions; it is the closest one can get to time-travel..."

View along the rocky shore site.

Dolostone fills a crevice in a cliff of Churchill Quartzite.

Northern Exposure

Uncovering Churchill's Unique Nature

– Dr. Graham Young,
Curator of Geology and Paleontology

Today will be a good tide day. It is July, and I am a member of a paleontological research team in the Churchill area of northern Manitoba. Most of the fossil-rich rocks in this area are on the shore of Hudson Bay, where they are covered by the tide for more than half of each day. If the low tides are at morning and evening, then we go to work very early in the morning, and have a second shift after dinner, staying until the sun is too low to give good light. But today the low tide will be in the early afternoon; today we get to sleep in and have a hot breakfast.

I awaken at 6:30 AM. Most of the others have already dressed and left the room. In the Churchill summer, it is only dark for a short time in the middle of the night, and the early risers can find few excuses to stay in bed. Ed Dobrzanski, Museum Associate, comes into the room; he has been outside to have a look at the day and has phoned Environment Canada for a forecast.

"Get up, you slackers! It's a fine morning, clear sky, a bit of light cumulus to the southwest, wind from the west at 15, plus eight out there now and going up to 17." A former meteorologist, Ed demonstrates that a weatherman never really retires.

Dressed and showered, we are all at breakfast before it officially starts at 7 AM. A few of the other scientists and students based at the Churchill Northern Studies Centre are sipping their first coffees of the day, discussing test plots, helicopters and bears while Mike the cook takes orders.

Our group has grown over the past few days and we now total seven – a record for our Churchill field team, now in the middle of the sixth field season in this region. Ed and I, along with Dr. Bob Elias of the University of Manitoba, first visited this region to do reconnaissance on the rocks and fossils in 1996. We came to study the fossil corals which other scientists, working here in the 1980s, had noted encrusting ancient boulders along a superbly-preserved 445 million year old shoreline.

In 1998 we were joined by Dave Rudkin of the Royal Ontario Museum (ROM), who came along to look for the crustacean-like trilobites at that same site. That field season confirmed that the Churchill area is a treasure-trove of past environments. We located two new sites that gave a window into a part of geologic time which spans one of history's great extinctions of life. We also discovered the world's largest trilobite, now on exhibit at our Museum.

Ed Dobrzanski in a shoreline fog. [Photo: David Rudkin]

"We located two new sites that gave a window into a part of geologic time which spans one of the great extinctions in the history of life."

This morning in the Studies Centre's cafeteria, Ed, Bob, Dave, and I are joined by Dr. Godfrey Nowlan, a scientist with the Geological Survey of Canada in Calgary; Brian Iwama, a technician from the Royal Ontario Museum; and Norman Aime, a University of Manitoba student who was also our field assistant last year. We discuss plans for the day; by 8 AM the trucks are loaded with packs, field gear, and guns, and we are ready to go.

The Centre and its surrounding buildings make up

[Photo: Godfrey Nowlan]

Dave Rudkin helps Brian Iwama to put on the propane heater.

the old Churchill rocket range, a strange cluster that sits like the set of a science fiction movie between the coastal tundra and inland boreal forest. The buildings recede in the rear-view mirror as we set off down the highway which links the Centre to the town, about 25 km away. This road was once paved, but now I must drive a meandering route between the potholes and gravel-covered sections.

This morning, the third of our 2002 season, we will visit the main rocky shoreline site. Parking by the roadside, we apply bug dope, put on packs and load shotguns. Away from the vehicles we always carry guns and cracker pistols (which can fire a variety of 'bangers' to scare polar bears away). As it turns out we will not encounter any bears today, but we will see several this year, fortunately always at sufficient distance that they can be avoided.

Heading across the tundra and rock, Dave and Brian carry an extra load today – a propane cylinder and large burner (which looks like a flamethrower). They plan to experiment with this heating system as they attempt to make molds from trackways of the giant trilobites, which are preserved in rock low on the modern shoreline. These tracks, exposed for only a couple of hours each side of the extreme low tide, are perpetually damp and cold. In previous years the cold defeated Dave's attempts to make the replicas which are essential for the scientific study of these trace fossils. This year, we hope that Brian's expertise in field moldmaking, combined with the 'heavy artillery' and substantial preseason planning, will defeat the shoreline.

Up the hummocks of Churchill Quartzite and down through squishy sphagnum, we follow a complicated route refined over several summers, to the bluff overlooking a calm, blue Hudson Bay. It is always a breathtaking sight, and today we can see a pod of beluga whales cruising along close to shore. We traipse down the scarp in single file, stopping at a lookout spot to scan the boulder-strewn shore for bears (which can look remarkably like boulders from no great distance away!).

Finally in the boulder field, we tread carefully on the wet surfaces. The boulders and

[Photo: David Rudkin]

Example of one of the large trilobite trackways (hammer for scale).

scarp are both made of Churchill Quartzite, a hard grey rock that was already a billion years old when the trilobites lived here. As we walk, we are at first on modern gravel and cobbles that fill spaces between the boulders. Then, tongues of buff-brown dolostone rock begin to appear below this modern overburden. Farther on, this dolostone completely surrounds the rounded boulders, and extends in front of them in sloping planes. Between the boulders, there are patches where the dolostone is absolutely packed with fossil corals. In previous years, we spent many days crawling over these rocks, identifying and measuring every fossil coral in a large sample area; I probably know this piece of ground better than I know my own backyard. Nevertheless, it does not lose its ability to amaze, and today in the brilliant sunlight it is doing a very good job of this.

The modern subarctic shoreline sits on a much older shore, formed at a time when this area was on the equator. This is the only place where I have ever seen the past so clearly in three dimensions; it is the closest one can get to time-travel, and I am pleased to see that Godfrey and Brian, the 'new boys,' are suitably impressed.

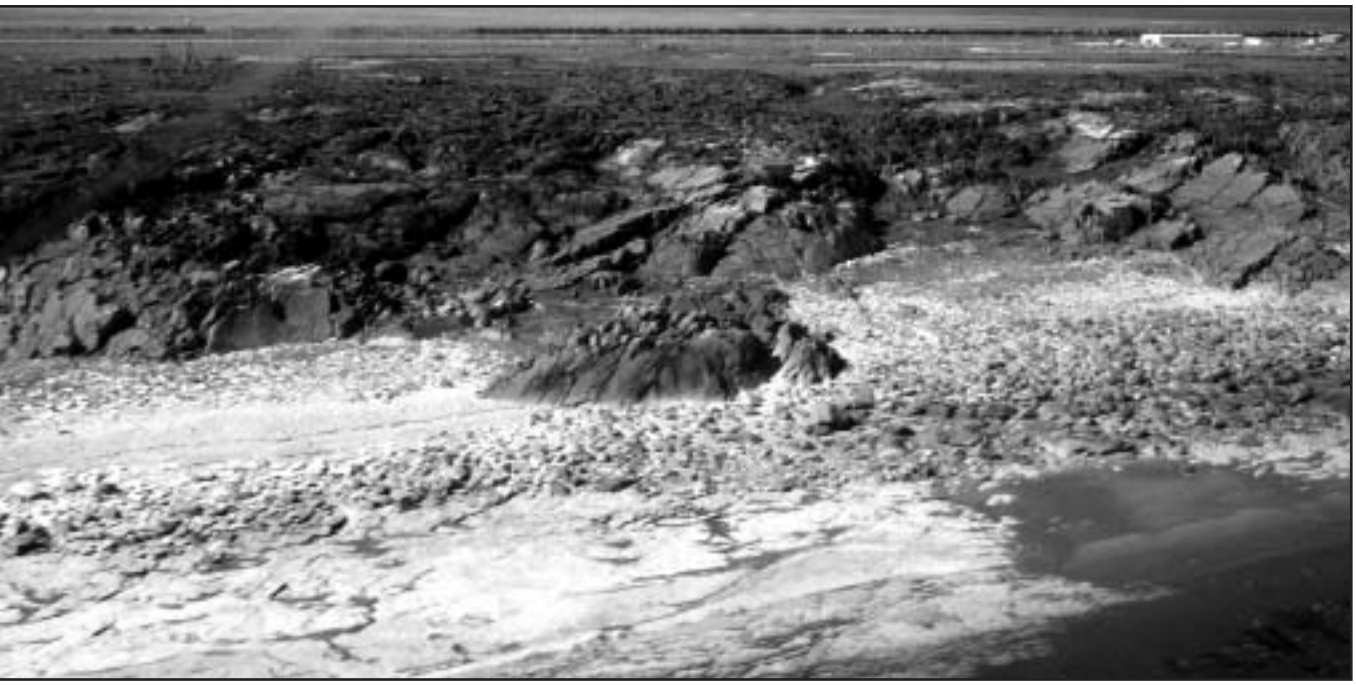
Bob and I finished gathering coral data at this site last summer, so today we can focus on other activities. I select a place on top of a large flat boulder about the size of a pickup truck. Here, I set up a tripod and cameras, and start to produce a photographic composite of this unusual site. I rotate the camera on its tripod through 360 degrees, clicking away to produce a set of overlapping photographs that show the scarp, boulders, dolostone, and sea. Back at the Museum, these could be 'stitched' together on a computer to produce a virtual reality image for a gallery computer or for the Web site.

Norman Aime and Brian Iwama prepare a latex mold of a trilobite trackway. [Photo: David Rudkin]

Farther down the shore, Dave assesses the locations of trilobite trackways and tries to determine what damage has been done by storms and ice since our last visit. Norman assists Brian as he unpacks moldmaking equipment and starts to plan how to replicate the trackways in this difficult location. Behind them in the boulder field, Ed scans the scarp to ensure that there are no bears in the area.

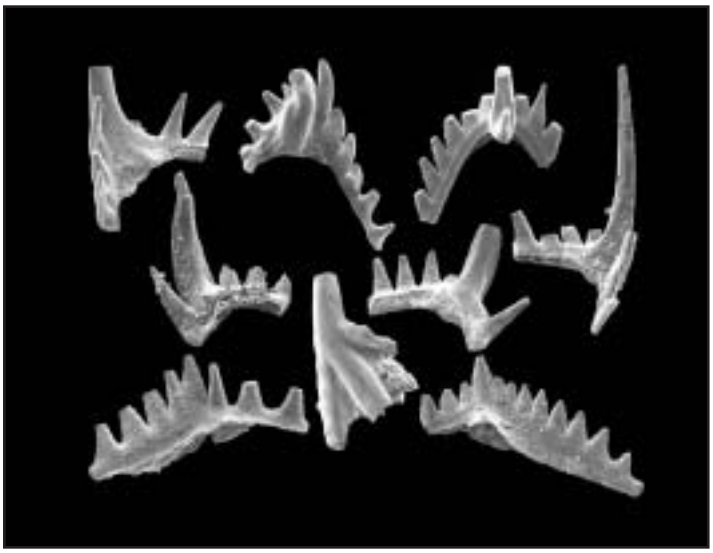
"I probably know this piece of ground better than I know my own backyard."

Bob takes on the role of tour guide, showing Godfrey the varied features of this locality. Although this is Godfrey's first visit to the area, he has actually been involved in the Churchill project for several years, examining material that we sent to him. He is a noted expert on *conodonts* – microscopic tooth-like structures which formed the jaws of an extinct group of small marine animals possibly related to the



[Photo: Graham Young]

"[Godfrey Nowlan] is a noted expert on conodonts – microscopic tooth-like structures which formed the jaws of an extinct group of small marine animals ..."



[Photo: Godfrey Nowlan]

View, from a helicopter, of the main rocky shore site. [Top left] **A quartzite scarp forms the background, the boulder field is in front of the scarp, and sloping dolostone beds are in foreground.**

Scanning electron micrograph of conodonts similar to those found at Churchill.

modern hagfish. Although this may seem like an esoteric area of science, conodonts are among the best tools for the dating of rocks from the Paleozoic Era (about 540 to 250 million years ago). These tiny fossils are useful because they occur in many of the rocks formed in ancient seas, and because they can be super-abundant (Godfrey has separated as many as 1,317 fossils from a four-kilogram sample of Churchill-area rock). Because the conodont animals evolved very quickly, the kinds of conodonts in a particular rock layer can tell us where we are in the geologic time scale. In past years, we shipped many bags of limestone and dolostone to Godfrey's lab, where the rocks were slowly dissolved in vats of acid to yield resistant conodont fossils. Now, he is able to see the area from which those fossils were collected.

By the time we have finished these tasks and collected a few new fossil samples, the tide has turned and is starting to cover the sloping beds of dolostone. The late morning sun brings out swarms of horseflies, called 'bulldogs' here in reference to their size and persistence, but fortunately there is enough breeze today to keep them from becoming a menace. Gathering our gear, we walk one-half kilometre to the west, to a site where different features of the ancient rocky shore can be seen. Here, behind a smaller exposure of the boulder field, is a place where the Ordovician dolostone comes into direct contact with the much older quartzite. In crevices in the quartzite's face, we see tantalizingly small dolostone fillings, remainders of the time when the deepening tropical sea began to rise up the side of what would have been steep cliffs. Occasionally, the chambered shells of squid-like nautiloids are visible within the fossilized hash of the crevice fills.

Back at the base of our scarp path, we pause for a late lunch. At a spot such as this, even the most prosaic ham and cheese sandwich tastes wonderful. Lunch is finished with the usual discussion of

bears and jokes about not eating sardines in the field (these are said to be among the most effective polar bear attractants – I've never wanted to test whether this is true).

The day is still far from done. Returning to the trucks we split into two groups; a few of us will cross the Churchill River by helicopter, while the rest return to the Centre to prepare for tomorrow's work. Above the quartzite and bog across the river, Jody the helicopter pilot asks us where we would like to set down. Bob, in the front seat, indicates that the top of the ridge above the site would be fine, but Jody tells us that it will be no problem to land right in the middle of the site. Here, large shelves of sandstone slope away from a steep ridge of Churchill Quartzite. The sandstone, which appears to represent an ancient beach, contains abundant molds of nautiloid shells and sponges. We spent much of the first day of the field season measuring the compass orientations of these to determine if they can tell us about the flow directions of ancient waves and currents. The environment in which this sandstone formed was very different from that at the main rocky shoreline. This is one of the most intriguing aspects of the Churchill study – the fossil-rich rocks were apparently deposited in a great variety of environments surrounding small islands made up of the ridges of Churchill Quartzite. The variety of paleoenvironments can make it a bit difficult to date some sites; the fossils of this sandstone appear to be the same age as those at the rocky shore site, but conodont data would be useful to confirm this. Pure sandstones tend to yield very few conodonts, and Godfrey searches for places where the rock looks like it might produce results. The helicopter is coming back by the time we have found the likeliest places, collected conodont samples, and levered out some exhibit-grade nautiloid slabs. Since the slabs are very large and heavy, we are now quite grateful that the helicopter can land on the site. We are also grateful for the downdraft from the rotors, which drives away the clouds of blackflies and mosquitoes that have plagued us this afternoon. Then it's back

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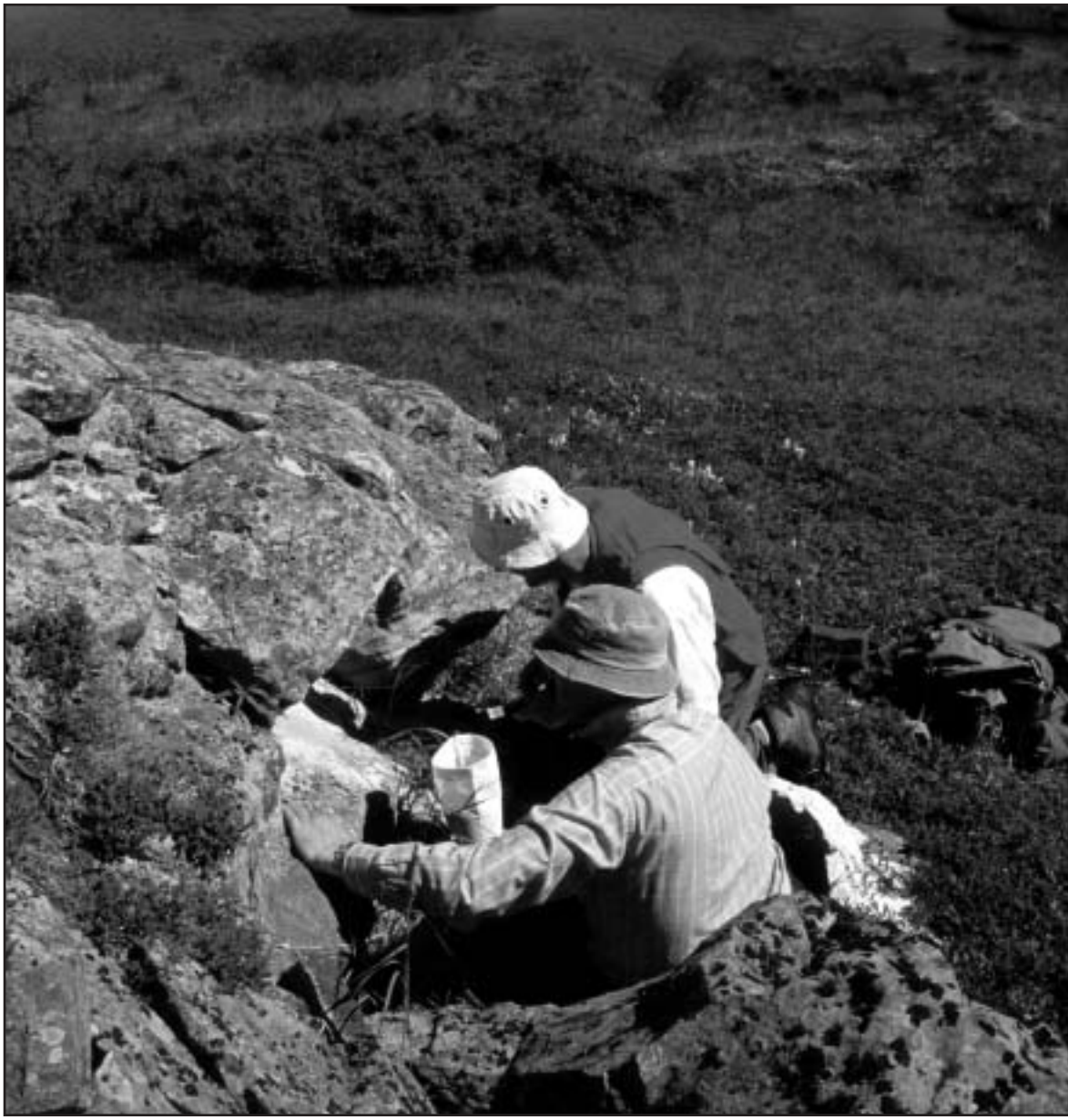

Godfrey Nowlan and Bob Elias collect conodont samples from the sandstone site. [Photo: David Rudkin]

An excellent slab of snail and clam fossils collected in 2002 from the Churchill area.

Starfish are very rare in the fossil record because their skeletons are fragile. In 2002, we collected more than a dozen of these beautiful fossils from the Churchill area. [Below left]

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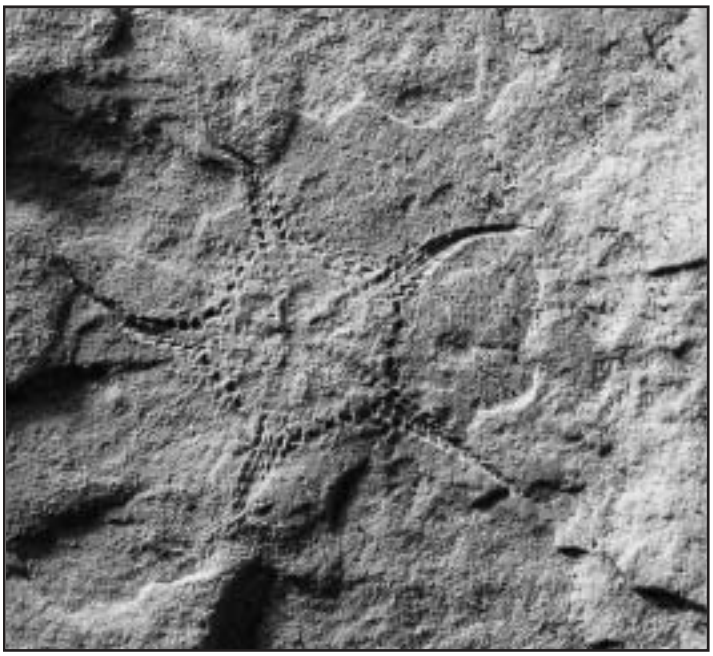

[Photos: Graham Young]

across the river by helicopter, as the late afternoon sun glints off the water beside the grain terminal.

At dinner time we gather at the Studies Centre. In the evening we lay out fossils and field gear to dry, plan for tomorrow, and play a bit of pool on the table in the back of the research labs. Later in the week the field party will grow to a total of eight people as we are joined by Dr. Jisuo Jin of the University of Western Ontario, who brings expertise on brachiopods, the 'lamp shells' that were abundant in Paleozoic seas. Also, later in the week, Brian Iwama will prevail, and large latex replicas of the trilobite trackways will be curing in the lab.

By the end of July we will ship back to Winnipeg nearly a tonne of samples, which will be the subject of intensive study at our various institutions before they are placed in the Museum's permanent collection. We anticipate that several scientific publications will result from this work, along with popular articles, exhibits and Web-based publications. We look forward to having opportunities to share this knowledge with the Museum's public.

We have now nearly completed all of the field research for the Churchill project, but it is likely that a few of us will have to return there next year for the final pieces of work. In each day of our Churchill field studies, we have recognized that we are working in a unique place, on a unique part of the geological record.

This research project has been made possible by support from the Manitoba Museum Foundation Inc., the Natural Sciences and Engineering Research Council of Canada (NSERC), the National Geographic Committee for Research and Exploration, the Royal Ontario Museum Foundation, the University of Manitoba, the Churchill Northern Studies Centre and The Geological Survey of Canada.