Regional wood industry comes together for strength, training
Cover Story

GREAT LAKES WOOD MANUFACTURING PARTNERSHIP ORGANIZATIONS

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Michigan Technological University
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Minnesota Department of Natural Resources
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Wisconsin Department of Natural Resources
USDA Forest Products Laboratory

Community Development
Northern Economic Initiatives Corporation

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Regional wood industry comes together for strength and training

The wood products industry employs over 300,000 people in the Great Lakes region, driving an economic base of billions of dollars. NRRI is coordinating the Great Lakes Wood Manufacturing Partnership to help this important Minnesota industry maintain its competitive edge.

Fifteen wood products companies from Minnesota, Wisconsin and Michigan to share the expertise of professionals from a variety of public institutions on best practices in manufacturing efficiency and new technologies. Manufacturing improvement or product development projects specific to each company will help the regional industry maintain economic stability in today’s competitive global market.

“The wood products industry is experiencing tremendous economic pressures,” said NRRI wood products engineer Brian Brashaw, coordinator for the partnership. “At the same time, they’re slow to try more efficient manufacturing methods and new technology, they’re competing heavily with imported products and fighting restrictions in resource availability. Each of these business partners has something to gain by joining hands.”

The effort is funded by a three-year $600,000 National Science Foundation “Partnerships for Innovation” grant. Within that timeframe the group—comprised of professionals from universities, state agencies, federal laboratory and community development—will assist the private companies implement efficient manufacturing practices and product development projects. More companies are expected to join the partnership during the second year.

“Medium to large companies that are already here and strong are our focus,” said Brashaw. “We want to keep them that way. We don’t want to see them go the way of the North Carolina furniture industry, which has been really hit hard by competition overseas.”

Public partners ready to lend their expertise
The potential damage that leaf-munching gypsy moths can do to Minnesota’s forests is enough that NRRI scientists were enlisted to study their behavior before they arrive en masse. The research project, funded by the USDA Animal and Plant Health Inspection Service and the U.S. Forest Service, studies the effect of Minnesota’s cool climate on the life cycle and flight patterns of the gypsy moth (*Lymantria dispar*).

Preliminary results show that when the temperatures dropped in mid-August and again in late September of 2002, the gypsy moth emergence from cocoons also dropped. Analysis will continue on how effective the trapping system is for monitoring population levels in these cooler temperatures.

These exotic European moths have been moving west since their introduction on the East Coast 133 years ago. This year, significant gypsy moth populations have been detected along the eastern border of Wisconsin with every indication that they’ll continue moving west into the Northern Minnesota woods. Isolated populations are being controlled in the Twin Cities metro area.

“A gypsy moth invasion here would be devastating to our forests,” said NRRI scientist George Host, co-leader of the study. “They don’t just eat the leaves and go away, letting the trees rejuvenate. Overtime, they actually kill the tree.”

But studying moths that aren’t here yet required a step that might seem backward when we’re trying to keep them out of the state. Marked and sterilized male gypsy moths were shipped from Massachusetts to NRRI for release deep in county-owned woodlands near Duluth.

Researchers hung small boxes of fluorescent-dyed pupae (cocoons) on trees in three different areas. Traps baited with a synthetic female moth sex attractant were set within a square mile of each release site. Within a matter of days, the male moths left their cocoons and were drawn to the traps. Researchers recorded how many were caught compared with how many were released. Weather conditions, including temperature and humidity were also recorded off weather stations at each release site.

“Because of our cooler temperatures, our concern isn’t so much that they’ll establish themselves here and damage our forests,” said NRRI scientist and project co-leader Mark White, “but they may disperse from here to other areas where the temperature is more to their liking.”

Plans are to expand the study to areas along the North Shore of Lake Superior and in the Twin Cities area as funding becomes available. NRRI is working cooperatively with the Minnesota Department of Agriculture and the Minnesota Department of Natural Resources.
NRRI scientist coordinates nationwide study

NRRI’s Great Lakes Environmental Indicators (GLEI) project was the first of five research centers granted funds by the U.S. EPA to study critical U.S. coastal ecosystems. Like the Great Lakes study, estuaries and coastal zones of the Atlantic Coast, Pacific Coast and the Gulf Coast are being studied for environmental indicators of their health.

Estuaries are rich and unique habitats where ocean salt water meets inland fresh water. Like the Great Lakes, those areas are also under increasing pressure by growing populations of people who want to live along their shores. Environmental indicators are biological, chemical or physical attributes of the coastal ecosystems that can be measured and monitored to provide insight on the study area’s condition.

Also, like the GLEI project, each research center covers vast areas and requires the collaboration of multiple research institutions. The centers are charged with developing indicators of condition for their coast. The challenge for the entire program is to identify indicators that are useful on multiple coasts.

“The species will be different from coast to coast, and fresh water to salt water, but we’re looking for indicators that work across the map,” Brady explained. “For example, we might examine how much diversity of fish there is in each area, even though the kinds of fish are different.”

All five research centers will identify indicators that state agencies can use in ongoing aquatic monitoring programs. The data will also provide an important base for future research.

NRRI scientist Joe Mayasich received $40,000 from the U.S. Fish and Wildlife Service to conduct status assessments on one amphibian and three small perch species.

The eastern hellbender, a large salamander primarily found in southeastern states, is one of many amphibian species that are declining worldwide. They are found mainly in the southern and eastern Great Lakes states. Eastern hellbenders grow to be almost two feet long and prefer clear water lakes and streams. Their populations are declining with low reproductive rates and inhibited maturation.

The eastern sand darter, spotted darter and crystal darter are three species of small perch that have declined throughout their range in fresh water streams. They can be found in all the Great Lakes states. The darters’ habitats of clean sand and gravel bottom streams are becoming less available as heavy silt loads and pollutants move into the waterways.

NRRI’s research of literature and data on these species will be used by the U.S. Fish and Wildlife Service to make decisions on listing priorities for threatened or endangered status consideration.

Conducting a research study on the entire U.S. Great Lakes basin—about 5,000 linear miles of coastline—is an ambitious undertaking currently underway by NRRI.

Now multiply that project by five and you have the Estuarine and Great Lakes Ecological (EAGLE) Indicators research initiative that spans the U.S. from sea to shining sea. The task of coordinating all five research centers has been given to NRRI Research Associate Valerie Brady. Brady holds a doctorate degree in Zoology/Aquatic Ecology from Michigan State University. Her expertise is in the community ecology of stream and wetland invertebrates.

Valerie Brady coordinates the nationwide EAGLE project. For more information visit es.epa.gov/ncer/centers/eagles

NRRI researches status of freshwater creatures

Crystal Darter

Sand Darter

Spotted Darter
Sing out and be counted

NRRI bird census is state’s most complete

NRRI has been monitoring bird populations in Northern Minnesota forests for the past 12 years, making it the largest database of its kind in the state. The study is funded primarily by the U.S. Forest Service, which is required by law to monitor indicators of their forests’ health. The project also receives funding from the Legislative Commission for Minnesota Resources.

To the untrained ear, it’s a cacophony of twitters, chirps and whistles. To Jim Lind, it’s a conversation between friends on an overloaded party line.

Lind is one of 12 NRRI bird researchers this year who can listen to around 35 bird species chirping at once, and tell you which song belongs to which bird. The researchers need to recognize the calls of 120 birds, including two or three different calls for each species. Lind knows the sound of the Nashville Warbler—which is different than the Canada Warbler, or the Black-throated Green Warbler, or the American Redstart Warbler—all of whom were making their presence known in Jay Cooke State Park in early July as the bird monitoring field season was ending.

“I’ve always been interested in birding,” said Lind. “This job takes us into areas of the forest that many people don’t go, and I get to see birds many people don’t get to see.”

Bird census data is often requested by other universities for research projects or by individuals interested in birding.

Birds are valuable in their own right, but they also tell us how well we’re maintaining the forest ecosystem. By listening carefully, we can learn about their habitat quality and quantity. And because they’re vocal, it’s easy to survey them.

The monitoring is a straightforward process: the researchers go to points established more than a decade ago when the study began, listen for exactly 10 minutes, and note the species they hear inside and outside an approximate 100 meter circle. The researchers are in the woods when the birds begin their morning calls as the sun rises, sometimes as early as 4:30 a.m.

And there’s a lot of ground to cover. They listen at 400 points in Wisconsin forests, 550 points in the Superior National Forest, 400 points in the Chippewa National Forest and 200 points in Carlton, Pine and Mille Lacs counties.
They say that mineral prospecting is like looking for a needle in a haystack—and your haystack has been buried for billions of years. When Minnesota geologists search for economically viable minerals they use a mixture of cutting-edge science, creativity, hard work and a good dose of luck.

That’s why NRRI geologists, working with George Hudak from University of Wisconsin Oshkosh, were thrilled this summer when they uncovered textbook perfect clues that point to a potential occurrence of an ancient copper deposit.

Billion year-old clues lead to new mining possibilities

NRRI geologists see potential in multi-metallic rock

Geologist George Hudak and NRRI geology team members Steve Hanck, Dean Peterson and Richard Patelke, lead a tour of a volcanic-hosted massive sulfide occurrence near Tower, Minn.
massive sulfides formed in underwater volcanic lava that flowed in prehistoric northern Minnesota.

Volcanic-hosted massive sulfide ( VHMS) deposits are often targeted for exploration and development because they are generally multi-metallic with copper and zinc with by-products of lead, gold and silver. Individually, the economic value of these minerals rises and falls. Mining them together is a much more stable economic prospect.

The NRRI geologists started this particular study three years ago, using models based on new mineral deposit processes. Following the clues, the geologists started at Five Mile Lake, east of the Tower-Soudan area and mapped their way to Six Mile Lake.

“We’ve found something that hasn’t been recognized in over 100 years of geological mapping in the Lower Ely Formation,” explained Hudak. “This could only be done now because of our increased understanding of mineral deposit processes associated with seafloor settings.”

When the earth was young, some 2.7 billion years ago, the area was underwater and bubbling with volcanic activity. Volcanic fault zones provided channels through which hot, metal-rich fluids made their way up toward the seafloor, mixed with cool seawater, and deposited dissolved metals as sulfide minerals.

As the earth continued to change over the next millennia, regional forces in the earth folded the layers of rock until they were lying vertically instead of horizontally. The area’s whole geological history is essentially laid out from beginning to end that one can follow walking south to north—“like walking through time and seeing the whole volcanic complex evolve,” said Hudak.

These Minnesota rocks cross the border from Canada as the southern extension of the geological Canadian Shield. Canada is a world leader in mining VHMS. Continued investigations of the occurrence in Minnesota could lead to the development of the first massive sulfide deposit here. NRRI’s goal is to provide information that will encourage exploration companies to come to Minnesota and further evaluate potential mineral targets.

“The whole Lower Ely rock formation has the potential to have multiple deposits,” said Project Leader John Heine, “but we’re just looking at one little sliver, a section that’s a mile wide or so. It’s hard to say what else lies nearby or below this area until an exploration company goes in and does more work to see if it’s economically viable to pursue further.”

Based on detailed field mapping, the team put together a geologic model of the area that points to the possible sulfide occurrence. The next step would be for a mineral exploration company to come in with the resources to do geophysical surveys and core sample drilling to verify the dimensions of the occurrence and evaluate the economic potential that team thinks is there.

The geologic investigation of the Five Mile Lake area was completed this summer and a summary report can be accessed via the Internet at www.nrri.umn.edu/egg/. More detailed reports will be available on the website after the first of the year.

NRRI geologists have been deciphering deposits for years with an eye to reaping some rewards from rich deposits by starting with detailed analysis and mapping. NRRI’s Economic Geology Group has provided extensive research and insights on the Duluth Complex, a geologic area 140 miles long and 28 miles wide that starts in Duluth, arching up the north shore of Lake Superior. The Complex is 1.1 billion years old, and may prove to be the world’s third largest copper-nickel sulfide resource.

For the past 17 years, NRRI geologists have described the geology of almost one million feet (almost 190 miles) of drill core samples and contributed to detailed geologic mapping of the Complex. This base of knowledge has been invaluable to exploration companies trying to determine where further mineral exploration is potentially viable, both economically and environmentally. Four companies are now actively exploring this area further for nickel and copper sulfides and platinum-group elements, such as platinum and palladium. Several other exploration companies have acquired state and federal mineral rights so they can also begin mineral exploration.

The market for the metals found in the Complex goes up and down, so timing is important. Nickel, one of the most useful non-ferrous metals, is used in stainless steel. Palladium, one of the rare platinum group elements, is used in catalytic converters for automobiles. Copper is used for many electronic and construction applications.
Great Lakes Environmental Indicators
Research for $6 million GLEI project starts in the field . . .

The Geographic Information Systems (GIS) and analysis team pointed the way to 673 sampling sites.

Tom Hollenhorst
Nick Danz
Val Brady
Terry Brown

Fish/Macro-Invertebrates

The feeding habits of fresh water fish and benthic invertebrates (spineless aquatic insects that live near the lake bottom) bring them in close contact with sediments, where chemicals accumulate. Sampling at 120 sites around the Great Lakes under the direction of Lucinda Johnson (NRRI), Carl Richards (Minnesota Sea Grant) and Tom Hrabik (UMD Biology), NRRI researchers netted fish and collected insect samples as indicators of the ecosystem condition. They also noted the area’s vegetation type, water depth, temperature and pH levels.

(Pictured: Dan Breneman and Matt Kocian, NRRI)

Chemical Contaminants

Field researchers working under the direction of Deborah Swackhamer (U of M) traveled around the lakes last summer lowering nets of minnows into the waters at 16 targeted sites. Eight days later, they collected the nets to see if the minnows survived.

Setting up a mini lab on shore, the technicians dissect the minnows and tested them for xenoestrogens (which mimic the female estrogen hormone) and highly carcinogenic polycyclic aromatic hydrocarbons (PAH).

(Pictured: Randy Lehr and Andy Adams, University of Minnesota)
Diatoms and Water Quality

Algae and microscopic diatoms are a very diverse group in all aquatic systems—with estimates counting some 100,000 species worldwide. Algae and diatoms respond rapidly to changes in water quality, especially chemical and physical disturbances from concentrations of nutrients, salts, clay and acidity.

NRRI researchers, working under the direction of John Kingston and Rich Axler, collected diatom samples from lake sediments or natural underwater surfaces, like rocks and plants, for lab study. They also collected water samples and checked water clarity, temperature and phosphorous concentration levels at 145 sites around the lakes. NRRI is collaborating in this research with the U.S. EPA Office of Research and Development, the University of Michigan and John Carroll University.

Wetland Birds

NRRI’s JoAnn Hanowski and her research team monitored breeding birds and amphibians at wetland sites around the Great Lakes basin. Graduate student David Grandmaison and his colleagues kept careful watch over more than 300 red-winged black bird nests at 11 sites. The Great Lakes basin supports one of North America’s richest concentrations of breeding birds. Monitoring their breeding success is an important indicator of large-scale ecological stressors, such as landscape degradation and change. The researchers noted how many eggs were laid, how many hatched and how many chicks survived.

Amphibians were also studied at wetland sites around the basin because of their sensitivity to environmental change. NRRI is collaborating on this research with the University of Wisconsin and Cornell University.

Vegetation

Wetland vegetation is often severely impacted by environmental changes around the Great Lakes basin making them an excellent indicator of physical and chemical conditions. Vegetation also provides habitat for a wide variety of fauna, supports plant communities and buffers land-to-lake exchanges of nutrients.

NRRI’s Carol Johnston directed the GLEI Vegetation team, with research partners at the University of Wisconsin-Madison and Cornell University. The field researchers visited 45 sites in all five Great Lakes last summer. They are studying coastal wetland plants that can be used to evaluate both current conditions and future environmental changes.
Environmental Outreach

Hope for polluted urban harbors being tested in Duluth

New electrically charged technology could clean up contaminate

A promising new technology to quickly and efficiently rid city-side harbors of contamination is being tested by NRRI in Duluth.

The technology uses electrical charges applied in steady doses through probes pushed into sediments on the harbor floor. The ElectroChemical-GeoOxidation (ECGO) charges break down organic contaminants—primarily polycyclic aromatic hydrocarbons (PAHs)—to reduce them to levels deemed safe by the Minnesota Pollution Control Agency. PAHs are highly carcinogenic pollutants and a common by-product of urban life.

NRRI, the U.S. Army Corps of Engineers and the EPA’s Great Lakes National Program Office are teaming up to study this promising technology.

“Their efforts to clean up our nation’s air and water, and during the past two decades, we have seen wide-ranging successes related to protecting our environment,” Congressman James Oberstar said. “However, our job is not finished. We must make it a national priority to study and develop new technologies to make our environment cleaner and healthier for future generations. This project is an excellent example of that.”

Many urban harbors across the U.S. are likely to have unsafe levels of PAHs. Studies by various federal, state, and local agencies have identified millions of cubic yards of PAH contaminated sediments in the Great Lakes alone. The Minnesota Slip in the Duluth Harbor, in particular, was identified by the Minnesota Pollution Control Agency as an area of elevated contamination. Sediments from the slip, where the S.S. William A. Irvin steamship is docked, were dredged and moved to the Erie Pier confined disposal facility for this study.

“The Minnesota Slip is the fourth most contaminated site in the Lake Superior Harbor,” said Judy Crane, Minnesota Pollution Control Agency water standards researcher. “There are five storm water outfalls that drain into it, some from the central hillside and I-35, carrying run-off from the roads.”

Crane explained that PAHs are found in tires that abrade on the roads and wash into the storm drains. Some of the slip’s contaminants may also be historical, from industrial plants near the water long ago.

Untreated control pond at the Erie Pier site
The current method of dealing with contaminated sediments is expensive and inefficient. Remedies typically involve dredging the sediments from the harbor bottom, treating it, and burying it in a landfill. Dredging is always a controversial alternative because of the potential for contaminants to be released back into the water. This new technology is exciting because it’s non-invasive, doesn’t require chemical additives and can be done on-site with no disposal issues and minimal sediment disturbance.

The ECGO process has been used to treat millions of tons of soil in Europe but the treatment of Great Lakes sediments is a new application. The inventor of the technology, Falk Doering, president of Electrochemical Processes, LLC in Stuttgart, Germany, toured the Duluth test site. Electro Petroleum, Inc. in Wayne, Penn., a subsidiary of the German corporation, and licenses the ECGO patent in the U.S. for this application.

Two ponds were dug at the Erie Pier facility for the study—a control pond with no treatment and a pond for the test equipment. Samples were taken over four months from each pond and tested for sediment chemistry, physical properties and toxicity. Previous data from tests done in Europe are encouraging, but the independent testing at the Duluth harbor is an important step before the technology is used in the U.S.

**While the electrical charges go to work on the PAHs, what effect does the treatment have on the plant and animal life in the pond?**

Research at Erie Pier by NRRI biologists showed interesting differences in the sediments. Preliminary results found that in the untreated pond there were about twice as many organisms—mostly midge larvae (*Chironomidae Diptera*) and Oligochaeta worms which tolerate degraded conditions—but fewer species. Sediments in the ECGO technology treated pond had less animal life but more diversity of species. Examination of sediments, plants and open water combined showed a few more species in the untreated pond over the treated pond.

NRRI scientists will continue to monitor the differences in each pond’s ecology.

“Being able to tap into the skills of the various disciplines here at NRRI really adds to our ability to better understand and interpret how new technologies like ECGO work and potentially impact their surroundings,” said research coordinator Larry Zanko. “It’s always nice to have a variety of tools to choose from when doing research.”
Chemical soup
NRRI scientist predicts toxicity of chemical mixtures

Day in and day out, we come into contact with over 80,000 commercial chemicals. They are part and parcel of life in our industrialized world, but we actually know very little about them. The chemicals also come into contact with each other, mixing and reacting with repercussions we don’t always fully understand. Most importantly, how do these chemical mixtures affect people and the environment?

“The problem is, once we make chemicals, we think we can keep them under control; but we cannot. Chemicals are released every day. I think I’m using this soap only to wash my hands, but it is also going into the ground through our water systems,” said Dr. Subhash Basak, an internationally renowned expert in predictive toxicology at NRRI.

Understanding how chemicals behave when they’re mixed together, and then predicting how those mixtures affect ecology and human health, is Basak’s area of expertise. But instead of testing his hypotheses on lab animals (in vivo), or in a test tube (in vitro), he designed a software program that does complex mathematical computations to develop computer models of the individual chemicals, allowing scientists to predict their toxicity in silico (in the computer). This saves an incredible amount of time and money. (See sidebar)

The explosive amount of data coming forward in the post-genomic era is moving this research along in exciting ways. Basak and other scientists can now use the chemical structure and recently released genomics (mapping and sequencing of genes chromosomes) and proteomics (collection of all the proteins in a cell or tissue) data to model the biological effect of the chemicals with more precision.

“Basically, we look at the properties of each chemical in the mixture to predict how they act together,” Basak explained. “Like with chicken noodle soup. If we
know what chicken tastes like and we know what noodles taste like, we can predict what the soup tastes like.”

NRRI recently received two grants totaling $1.6 million to use Basak’s skills and computer modeling program in real world applications.

The Center for Disease Control awarded NRRI $700,000 to help them understand the toxicity of what Basak calls the “chemical soup” found in polluted Superfund sites across the country.

There are over a thousand Superfund sites designated by the U.S. Environmental Protection Agency for clean up of hazardous chemical wastes. The Center for Disease Control is specifically looking at the chemical mixtures at the sites that are potentially dangerous to people or the environment or both.

The second grant of $900,000 from the U.S. Air Force is to develop models using mathematical chemistry, genomics and proteomics to predict toxic effects of pollutants including the jet fuel called JP-8 used by the U.S. Armed Forces. This will be an especially challenging task because JP-8 is an unknown mixture of as many as 2,000 chemicals. That’s too many to test individually, so Basak will cluster chemicals in related groupings to predict their toxicity. After developing a model, Basak will be able to make sense of the chemical structure alone, minimizing expensive lab work.

Computer modeling of this magnitude requires the best minds from around the world and Basak knows them all. He has compiled a “virtual team” of experts in predictive toxicology, making NRRI a center of excellence in this emerging field. (See list)

“This is something I’ve been working on for the past 25 years,” said Basak. “But I don’t want to sit in a lab doing endless basic research. I want to see it applied. These are real world problems being solved with theoretical ideas in a cost effective way.”

Saving research money

Basak’s software program is an excellent example of using new technology to save millions in research dollars. For example, the cost of testing one chemical for cancer:

- $5 million using lab animals (in vivo).
- $20,000 to $100,000 using petri dishes and test tubes (in vitro).
- One cent using the computer (In silico, literally “in silicon”).

Predictive toxicology “Virtual Team”

Basak’s international reach includes 53 scientists at the top of their field from:
- United States
- India
- United Kingdom
- Canada
- Japan
- Russian Federation
- Italy
- Germany
- Croatia
- Slovenia
- Estonia
- China
**In Business**

NRRI’s Coleraine Minerals Research Laboratory

**Part One: Brainpower driving Minnesota mining**

*Part Two in the upcoming Spring 2003 NRRI Now will cover the mining, minerals and research expertise of engineers Tom Larson, Jeremy Pletka, Richard Kiesel and Harlan (Pete) Niles.*

Taconite ore is one of the toughest rocks in the world. It takes three tons of the low-grade ore to make one ton of taconite pellets in a long process of mining, crushing, separating, concentrating, mixing and pelletizing. From beginning to end, the operation requires massive machinery and considerable energy, as well as ingenuity to keep the industry innovative. NRRI’s Coleraine Minerals Research Laboratory has the best minds in the business to focus on one goal: strengthening Minnesota mining.

This is Part One of a two-part series on the expertise and research skills made available to the mining industry at the Coleraine Lab. Each person lends to the lab’s overall synergy—working together they have a greater effect than what could be accomplished with the sum of their individual skills.

**Dave Hendrickson**

“My goal is to grow our research and development capabilities. Collectively, we have the talent to do unique and novel things to reduce costs for the taconite industry and bring new employment opportunities to this region,” says lab director Dave Hendrickson. “In the tough economic times we are pushing R & D harder to come up with new ideas, reduce costs and advance technology transfer.”

Hendrickson pulls from a broad minerals background to guide and focus the talents at the Coleraine lab. He spent 23 years in the taconite industry working in advanced process control, large power energy management and quality improvement, plus, three years of experience managing a taconite research facility and doctoral work in environmental engineering. He sees great potential in the ideas being generated and is excited about applying them to advancing and diversifying the taconite industry, cleaning up polluted sediments in the Great Lakes, and developing Minnesota’s non-ferrous mining opportunities.

**Iwao Iwasaki**

The prestigious Endowed Taconite Chair position at the Coleraine Lab belongs to Iwao Iwasaki for his dedicated efforts in moving the Minnesota mining industry forward over the past 50 years. Iwasaki holds a Doctor of Science degree in metallurgy from MIT, a Doctor of Engineering degree from Tohoku University, Sendai, Japan, and an Honorary Doctor of Engineering degree from the Colorado School of Mines. He is also a foreign associate of the National Academy of Engineering for his decades of work researching the iron ore industry.

Thirty of those years were spent on the U of M campus in the Twin Cities as a researcher and professor of metallurgical engineering. Iwasaki also brings with him experiences gained working in the copper industry, and international expertise from time spent working in the Japanese steel industry. His latest project pulls from that experience to develop direct reduced iron/metallic nuggets, a potentially new product for the Iron Range. His background in surface chemistry and electrochemistry is also valuable as the laboratory addresses environmental clean-up issues.

“I firmly believe that coming up with a value-added project from taconite is very important for the Iron Range right now,” says Iwasaki. “The current trend in the steel industry is increasing electric furnace steel production in mini-mills and a gradual decrease in conventional steel making using taconite pellets. A product mix of nuggets and pellets would enable us to continue and prosper well into the 21st century.”
**Blair Benner**

“I’ve always been a problem-solver,” says minerals process engineer Blair Benner. “I’ve been working in mineral processing for 30-plus years and you can pick up a lot of useful information in that time.”

Benner started his career in the copper industry in New Mexico in the areas of leaching, solvent extractions and pyro-metallurgy. He spent over 20 years working on grinding, magnetic separation and flotation processes for the Iron Range taconite plants. Benner is particularly skilled at looking for incremental process changes that can save a penny per ton throughout the system for long-term productivity gains. He’s also excited about using his past work experience for new ventures in copper-nickel mining on the Range.

“When I worked for U.S. Steel, we looked at almost every piece of mineral processing equipment there was on the market, and I essentially worked on all of them,” says Benner. “I draw on all of that experience and more for problem-solving in many areas of this industry.”

**Dave Englund**

A hands-on education in pelletizing and agglomeration, grew into work in pellet quality evaluation and mineral development for Dave Englund. Research in computational fluid dynamics with the Minnesota DNR Minerals Division under the Minnesota Iron Ore Cooperative Research Program landed Dave Englund at the Coleraine lab in another specialty area: computer modeling of induration machines. The induration process is the cooking process—heating up the pellets to 2,250 to 2,400 degrees to give them the strength they need for transportation to steel plants.

Finding ways to improve this process is critical, but expensive and time-consuming if it’s done in the plant. Englund can make computer models of the proposed changes and look at how the changes will affect fuel use and productivity, air flow or heat transfer. It’s a skill taconite plants need, but it’s often too expensive to hire out.

“When I started doing this in 1990, I was the only one doing it,” says Englund. “Now I’m one of just a few people who do this for the taconite industry.”

**Salih Ersayin**

The concentration process, making the taconite powder that is balled into pellets, is Salih Ersayin’s area of expertise. He makes computer models of the concentration process to help engineers look for ways to increase efficiency. His skills were honed over 13 years in a university research capacity and through earning his PhD in computer modeling and simulation. He came to the Coleraine lab in 1999 to do taconite plant simulation models.

Because the software needed for this task is so specific, Ersayin built onto a basic program, making it fit the unique needs of Minnesota taconite plants.

“There’s no way we can do to help the taconite industry,” says Ersayin. “One year ago, I might not have been able to do something for them that I can do today. Eventually, we will be able to simulate the entire pelletizing process.”
Abstracts are now being accepted for the 17th Annual Meeting of the Society for Conservation Biology, to be held on June 28 - July 2, 2003, in Duluth, MN. The local organizing committee is accepting abstracts until January 10, 2003, for invited symposia, oral and poster presentations. The theme of the meeting, “Conservation of Land and Water Interactions,” will focus attention on water, forests, wetlands, the Great Lakes, other large lakes and rivers of the world, marine and coastal systems, and associated biodiversity issues.

For more information, see the meeting’s web site at www.conservationbiology.org/2003 or contact Kris Lund at (218) 726-7810.