



# Michigan**Science**

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ON THE COVER: According to the U.S. Department of Agriculture's Economic Research Service, farmers across the country planted 98,525 acres of organic vegetables in 2005, the most recent data available. Ninety-nine acres of organic vegetables were reported in Michigan that year.

[www.ers.usda.gov/Data/Organic/](http://www.ers.usda.gov/Data/Organic/)

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Environmental concerns may halt a mining industry resurgence in Michigan's Upper Peninsula despite more stringent regulating of acid rock drainage and other formerly potential hazards.

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### **Organic Farming a Growing Trend**

Michigan ranks 14th among the 50 states in the number of organic agricultural operations and 20th in the number of organic acres devoted to crops and pastures. The supposed benefits for consumers of organic produce and livestock, however, may be more about marketing than health considerations.



## BY THE NUMBERS

Beyond propaganda and rhetoric, numbers tell the real story

**TWO STUDIES HAVE** cast doubt on claims of a link between caffeine and breast cancer. New findings from the Women's Health Study, an ongoing assessment of 38,432 women over 10 years, indicate no significant differences in breast cancer rates between women who drink four or more cups of coffee daily and a control group that almost never drank coffee. Another study from the Harvard School of Public Health also failed to find a relationship between caffeine and breast cancer in a population of 86,000 female nurses followed over 22 years. Breast cancer is the second most common cancer in women in the United States, with 186,772 women developing breast cancer in 2004 (the last year for which data is available).

For more information, visit [www.webmd.com/breast-cancer/news/20081013/caffeine-breast-cancer-link-minimal](http://www.webmd.com/breast-cancer/news/20081013/caffeine-breast-cancer-link-minimal)

CDC on Breast Cancer: [www.cdc.gov/cancer/breast/](http://www.cdc.gov/cancer/breast/)

**A STUDENT RESEARCHER** at the University of Alberta has discovered a group of rice genes that can be modified to double the plant's yield in times of drought. While most rice grows in flooded fields, doctoral candidate Jerome Bernier studied the genome of upland rice, a variety that is grown in dry fields but is particularly sensitive to drought conditions. He began by focusing on 126 genetic markers before finding a cluster of genes producing deep-growing roots, which enable the plant to utilize deeper groundwater under drought conditions. According to the International Rice Research Institute, rice is among the leading calorie sources in the world, supplying on average 20 percent of the world's caloric intake. In

developing nations like Vietnam and Bangladesh, the proportion of calories from rice can approach or exceed 70 percent.

For more information, visit [www.sciencedaily.com/releases/2008/11/081120162847.htm](http://www.sciencedaily.com/releases/2008/11/081120162847.htm)

International Rice Research Institute: [www.iri.org](http://www.iri.org)

**A PREVIOUSLY UNKNOWN** fungus may be the cause of a disease that has decimated bat populations in New England. White nose syndrome was named for the rings of white fungus found on affected bats, but until recently the fungus was considered a secondary symptom and not a cause of the disease. Healthy bats can eat more than 3,000 mosquitoes nightly, but when the disease sets in they do not leave their roosts to seek food and eventually starve. More than 75 percent of bats in an affected colony fall victim to the mysterious illness. Michigan is home to nine species of insectivorous bat, including the federally endangered Indiana bat.

For more information, visit [www.aaas.org/news/releases/2008/1030bats.shtml](http://www.aaas.org/news/releases/2008/1030bats.shtml)

**AN ESTIMATED 6** million cases of filarial worms in sub-Saharan Africa have been prevented in the last eight years thanks to a donation of 1.3 billion doses of anti-parasitic drugs by GlaxoSmithKline and Merck. Worms like *Wuchereria bancrofti* and *Brugia malayi* can colonize the lymph system and cause lymphatic filariasis, also known as elephantiasis, a painful condition characterized by intense swelling and ulceration of the lower torso and legs. The World Health Organization estimates that 1 billion people in 80 countries are at risk for lymphatic filariasis, and 120 million are already infected. Each

dose of albendazole and ivermectin costs about 10 cents, and 500,000 people received treatment in 2008.

For more information, visit [www.dx.doi.org/10.1371/journal.pntd.0000317](http://www.dx.doi.org/10.1371/journal.pntd.0000317)

World Health Organization: [www.who.int/mediacentre/factsheets/fs102/en/](http://www.who.int/mediacentre/factsheets/fs102/en/)

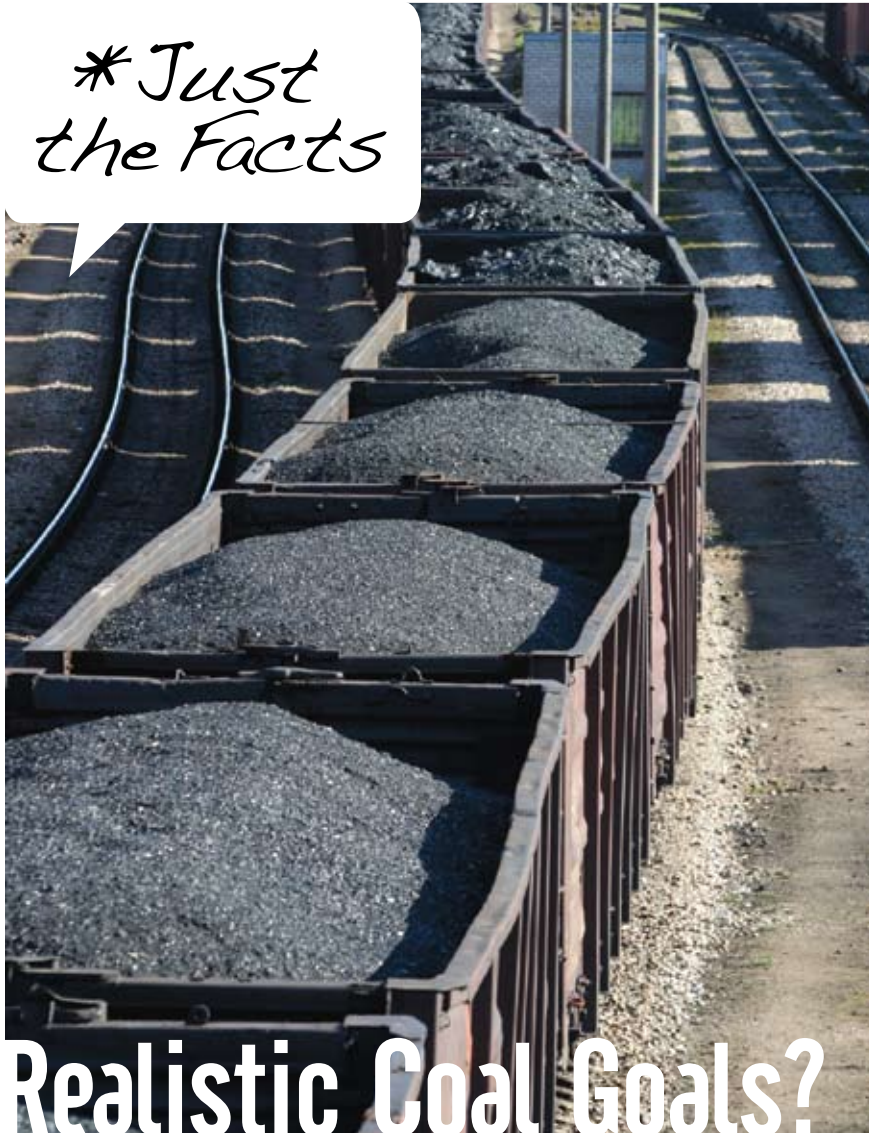


**EFFECTIVE JAN. 1, 2009**, albuterol asthma inhalers and other lung medications powered by chlorofluorocarbons were banned in favor of environmentally friendly alternatives. CFCs are used to propel drugs into the lungs, but due to their role in ozone depletion they are being abandoned for hydrofluoroalkane inhalers. Because the medication in the new inhalers is formulated differently, there are no generics available and consumers may pay \$30 to \$60 for the prescription inhalers, compared to \$5 to \$10 for CFC types. According to the Michigan Department of Community Health, asthma affects 9.3 percent of the adult population of the state.

For more information, visit [www.dailyherald.com/story/?id=256130&src=120](http://www.dailyherald.com/story/?id=256130&src=120)

[www.michigan.gov/documents/AsthmaPrev-SevMgmt\\_127071\\_7.pdf](http://www.michigan.gov/documents/AsthmaPrev-SevMgmt_127071_7.pdf)

*\* Just  
the Facts*



## Realistic Coal Goals?

**IN HER 2009** State of the State address, Gov. Jennifer Granholm announced an “aggressive goal” for Michigan’s energy policy — a 45 percent reduction in fossil fuel consumption by 2020. According to the U.S. Energy Information Administration, fossil fuels provided 70.6 percent of energy generated in Michigan in 2006 (the most recent data available), with coal providing 60.2 percent of the total. Because other fossil fuels

like petroleum and natural gas provide a much smaller amount of energy, the majority of this reduction would have to occur in Michigan’s coal-fired energy industry. Gov. Granholm addressed this by calling on the Department of Environmental Quality to assess the need for more energy and consider renewable alternatives when reviewing proposed new coal plants’ air quality permits.

Michigan leads the country in the

number of proposed coal-fired plants, with eight.

Gov. Granholm’s directive faces an uncertain future. Attorney General Mike Cox issued an opinion declaring it a violation of the separation of powers guaranteed in the state Constitution, but new coal plants still face an uphill battle.

On Jan. 6, the Detroit Free Press published an editorial by two researchers declaring that new coal plants pose a dire threat to the health and safety of Michiganders. The University of Michigan’s Howard Hu and Michigan State’s Kenneth Rosenman, both medical doctors, highlighted the effects of mercury, nitrogen and sulfur oxides, ozone and other pollutants associated with coal plants.

Though the authors correctly describe the results of extensive exposure to these compounds, they suggest that the worst possible scenarios are inevitable consequences of new coal plant construction in Michigan. Nitrogen dioxide, they point out, is a lung irritant that contributes to ozone formation. However, they fail to mention that the leading source of nitrogen dioxide in the state is not coal combustion, but vehicle emissions, and that innovations in both fields have resulted in a downward trend. In addition, the Department of Environmental Quality’s monitoring of nitrogen dioxide indicates that concentrations of the pollutant in Michigan are already well below national guidelines of 0.5 parts per million. Since 1991, the state has never recorded a concentration of nitrogen dioxide above 0.2 ppm. Sulfur dioxide is also found in concentrations less than one-third of federal air quality standards, and mercury and lead contamination is on the decline. ■



# FIELD TRIPS

Area science museums host special programs of interest for budding scientists and their families



## Lizards and Snakes: Alive!

EARLESS HEARING, THIRD “eyes” and 3-D infrared vision may sound like science fiction superpowers or characteristics of mythical beasts, but these are all real traits of various snakes and lizards from around the world. Over 60 of these reptiles, known as *squamates* because of their scaly skin, have made the Midland Center for the Arts their temporary home. The exhibit features creatures from five continents, including 20-foot pythons, color-changing chameleons and venomous gila monsters.

*Through May 3. Midland Center for the Arts, 1801 W. St. Andrews, Midland, Mich., 989-631-5930. Museum open Tuesday through Saturday, 10 a.m.-5 p.m.; Sunday, 1 p.m.-5 p.m. Exhibit free with regular admission.*

For more information, visit [www.mcfta.org](http://www.mcfta.org)



## Star Trek: The Exhibition

THE DETROIT SCIENCE Center blasts off with an exhibit based on the popular television show and movie franchise. While current technology hasn't yet created phasers or holodecks, visitors can walk on a replica of the famous *Enterprise* bridge from the original

series and experience warp speed with the help of a spaceflight simulator. The exhibit also features memorabilia from the fictional universe that has inspired generations to look to the stars and explore new technological frontiers.

*Through Sept. 7, The New Detroit Science Center, 5020 John R St., Detroit, 313-577-8400. Center is open Monday through Friday, 9 a.m.-3 p.m.; Saturday 10:30 a.m.-6 p.m.; and Sunday, 12 p.m.-6 p.m. \$18.95 for adults and \$14.95 for children and seniors, which includes museum admission. Call 313.577.8400 for discounted group rates.*

For more information, visit [www.detroitsciencecenter.org](http://www.detroitsciencecenter.org).

## Hatching the Past

IN THIS EXHIBIT at the Cranbrook Institute of Science, visitors can look at real dinosaur eggs and learn about the evolutionary history of the egg, which has undergone drastic changes and played an important role in the diversity of life on earth. The exhibit demonstrates similarities and differences with bird eggs and also features a collection of baby *Protoceratops* fossils.

*Through Sept. 7. Cranbrook Institute of Science, 39221 Woodward Ave., Bloomfield Hills, 248-645-3200. Museum is open Saturday through Thursday, 10 a.m.-5 p.m.; Friday, 10 a.m.-10 p.m. Exhibit free with regular admission.*

Test your reading of this issue of *MichiganScience*. Students in grades six through 12 can compete for a \$100 gift certificate from Edmund Science Kit. The winner will be determined by a random drawing from entries with all the correct answers. Please send entries to [walker@mackinac.org](mailto:walker@mackinac.org).

1. Which comes first in the process of constructing a new mine?
  - A. A feasibility study.
  - B. Obtaining a core sample.
  - C. A general survey of a large region.
  - D. Filing exploration plans with the Department of Natural Resources.
2. Which of the following wouldn't be found in an exhibit on squamates?
  - A. Iguana.
  - B. Gecko.
  - C. Tree frog.
  - D. Python.
3. Complete this sentence: "Organic crops are \_\_\_\_\_."
  - A. Healthier than conventionally grown crops.
  - B. Contain no chemicals of any kind.
  - C. No different than other crops.
  - D. More popular now than they were several years ago.
4. Which state has the highest certified organic acreage?
  - A. California.
  - B. Delaware.
  - C. Alaska.
  - D. Mississippi.
5. What do researchers think to be responsible for bat deaths from white nose syndrome?
  - A. The rabies virus.
  - B. A potentially new kind of fungus.
  - C. Pesticide residues.
  - D. A cold-adapted variety of bacteria.
6. Which of the following is a type of sulfide rock mined in the Upper Peninsula?
  - A. Anthracite.
  - B. Jadeitite.
  - C. Chalcopyrite.
  - D. Psammite.
7. CFCs in inhalers have been replaced with HFAs. What is the role of these chemicals in the inhaler?
  - A. Treating the inflammation that causes asthma.
  - B. Reducing ozone in the lungs.
  - C. Propelling medicine into the lungs.
  - D. Improving taste.
8. Who defines what food products are considered "organic"?
  - A. State organic programs.
  - B. The National Organic Standards Board.
  - C. The United States Department of Agriculture.
  - D. The Food and Drug Administration.
9. Which of the following is a pollutant produced by combustion in coal plants?
  - A. Nitrogen dioxide.
  - B. Seaborgium.
  - C. Elemental carbon.
  - D. Paper litter.
10. Which of the following is considered before a new mine is built?
  - A. Quality of the orebody.
  - B. Economic feasibility.
  - C. Environmental safety.
  - D. All of the above.



## SHOW US WHAT YOU KNOW! WIN CASH AND PRIZES!

Cell phones are used by more than 3 billion people worldwide.<sup>1</sup> From text-messaging teens in the United States to pre-paid phone users in developing nations, cell phones have revolutionized the way people connect with their world.

Despite their popularity, however, some argue for restrictions on cell phone use because of possible health and safety risks, especially among children and teens. Others say that the danger is minimal and that benefits provided by cell phones exceed their risks. Both sides point to scientific studies to bolster their conclusions about the safety of cell phone use.

Is it better to err on the side of safety and limit the use of cell phones, or is it more important to let users decide for themselves after weighing the risks? What kind of restrictions on mobile phone usage, if any, might be appropriate to protect human health given current scientific knowledge?

MichiganScience will award a cash prize of \$500 to the student (in grades six-12) whose 500-word essay best explores the science surrounding the health effects of cell phones and compellingly advocates for or against restrictions limiting mobile phone use.

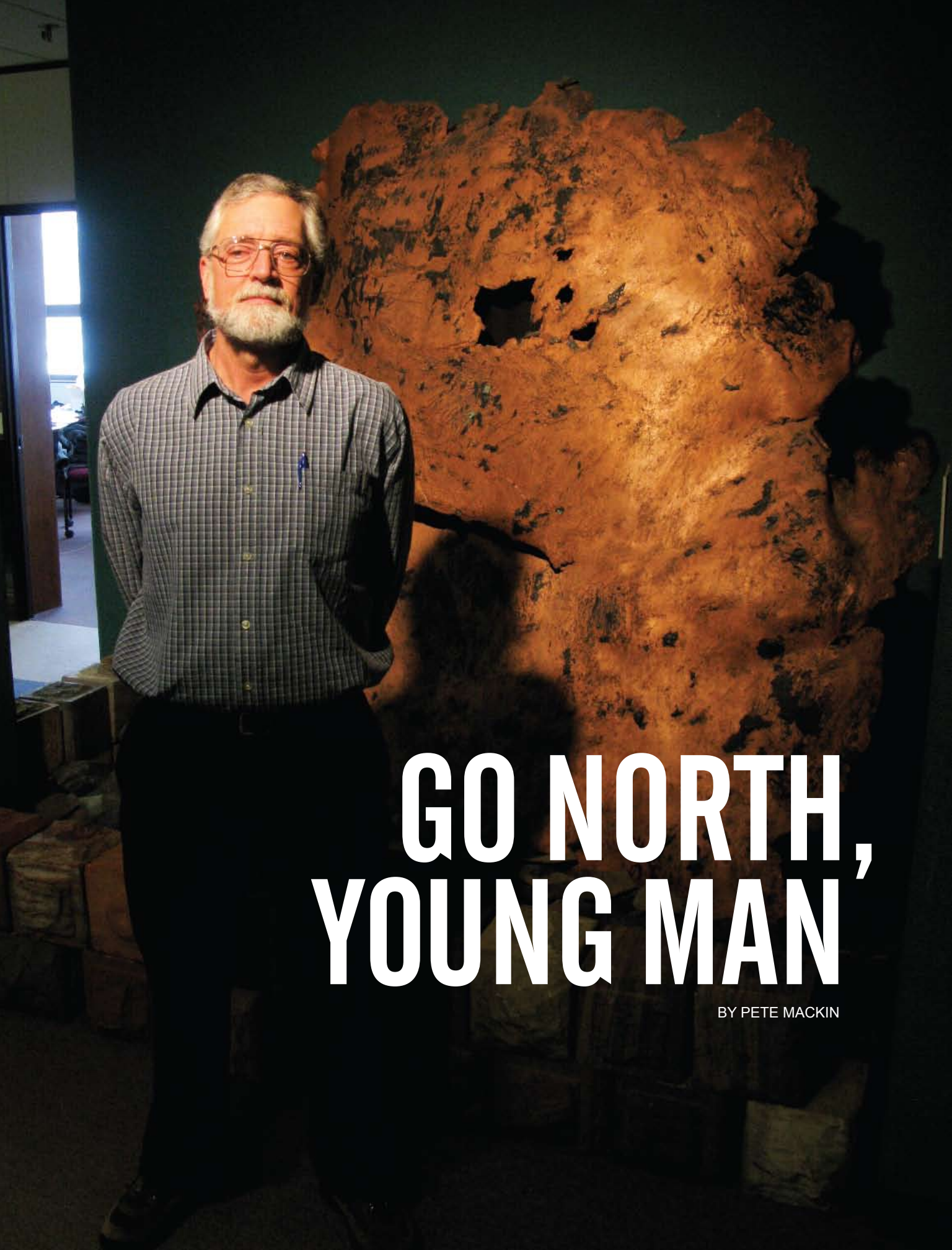
Runners-up will receive gift cards good for thousands of fun and interesting products from Edmund Scientific, a premier supplier of science kits and other educational materials.

All essays must be original, legible and no more than 500 words in length. Authors must be currently in grades six through 12. Each entry must include the entrant's name, school name and address, and a contact phone number or e-mail address. The deadline for entries is May 1, 2009. Winners will be announced in June 2009. The winning essay will be published in an upcoming issue of *MichiganScience*.

1

<http://www.smh.com.au/news/technology/mobile-phone-users-top-33-billion/2008/05/25/1211653822824.html>

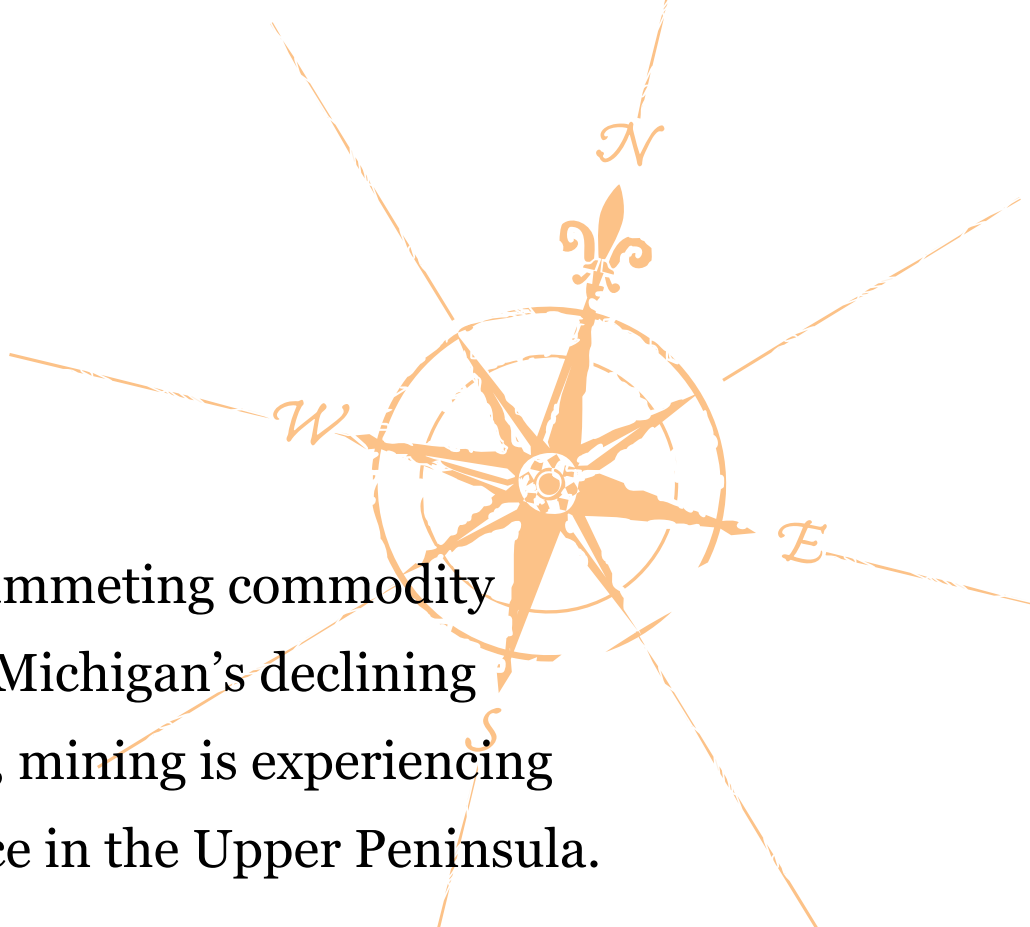




# GO NORTH, YOUNG MAN

BY PETE MACKIN





## Despite plummeting commodity prices and Michigan's declining population, mining is experiencing a resurgence in the Upper Peninsula.

Before the financial crash of 2008, the U.P. was set to explode economically with a tremendous increase in mining employment — new mining jobs at new mines — for the first time in decades. Cliffs Natural Resources announced plans to extend the life of the Empire Mine near Ishpeming six years beyond its original predicted close in 2010.

Though the company has stepped back from those plans based on a lack of global demand for steel, other natural resource firms are developing new mines. Kennecott Eagle Minerals Company, a subsidiary of Rio Tinto PLC, is set to begin mining a new mineral district in northern Marquette County rich with nickel and copper. There are also economic quantities of gold, platinum and palladium in the U.P.

Orvana Minerals Corporation is tentatively scheduled to begin construction on the Copperwood Mine in 2013. It will be the first copper mine within the Gogebic Range of Wakefield, Mich., in more than a decade. Along the Wisconsin border, Aquila Resources' Back Forty Project is on track to mine a large zinc orebody near Stephenson. Numerous other companies, large and small, are actively exploring the U.P.

According to Dr. Ted Bornhorst, director of the A.E. Seaman Mineral Museum at Michigan Technological University and an expert in the field of economic

geology, there are reasons those companies remain committed despite the news from Wall Street.

"If you go out into the market now or look on the Internet, you see that the metal prices have plummeted and yet Kennecott doesn't seem phased," Bornhorst said. "It's because the quality of that ore — the concentration of copper and nickel — is high enough where they still can make money."

Bill Williams, vice president of corporate development for Orvana Minerals Corporation, is equally optimistic about the future of mining in the U.P. Orvana is currently working on Copperwood, a large copper orebody that was originally discovered in the 1950s. Copperwood was reworked in the 1970s by Copper Range, which abandoned the orebody when it closed the White Pine mine in the 1990s.

"I've been through a couple of these (economic) cycles now," Williams said. "There is a clear timeline for making a mine. Ideally you do the planning, get the environmental work done, consider technical issues and do your engineering when the commodity price is down. We don't think (the price of copper) is going to go much lower and we believe it's eventually going to get higher."

Most of the delineation work has already been completed and the company is on a fast track. On Feb. 13, Orvana announced that historic and current core sampling efforts have shown that the stratiform copper

deposit at Copperwood is “analogous to the mineralization exploited at the inactive White Pine mine.”

This means that technological advances will be able to extract more copper from the deposit, once thought to be exhausted.

“The results from our new drilling and resampling of core from historical drilling confirm our belief that the results from the 1950s program are reliable,” Williams said in a press release announcing the results of the sampling efforts. “We are now even more confident of the thickness and grade of the mineralization defined previously by historical drilling.”

## ENVIRONMENTAL CONCERNS

Some U.P. residents fear that increased mining will recreate environmental hazards from the past — toxic stamp sands, fly ash, “yellow boy” sludge and mercury-poisoned lakes and rivers.

The primary concern voiced by opponents to mining is the potential for acid rock drainage (ARD) from sulfide deposits. The process occurs when air, water and sulfides combine under certain conditions to create sulfuric acid.

Sulfide orebodies have been mined in Michigan for more than 100 years, but past mining practices with very limited regulation and oversight led to environmental damage in the early years of the industrial age.

“I am not opposed to mining,” said Rep. Bart Stupak, D-Menominee, in response to the state Department of Environmental Quality’s approval of Kennecott’s mining permit. “However, these permits represent the first time the state is allowing sulfide mining. State officials must take their time and make sure sulfide mining is safe.”

Geologists are quick to point out that there is no such thing as “sulfide mining.” Copper, nickel or iron ore mining might occur in sulfide deposits, but nobody mines for sulfides or oxides.

The sulfide rocks which host the metals sought by miners can be different from one another. Arsenopyrite (arsenic and iron), argentite (silver), chalcopyrite (iron and copper), cinnabar (mercury), galena (lead), molybdenite (molybdenum), pentlandite (nickel), pyrite (iron), realgar (arsenic), sphalerite (zinc) and stibnite (antimony) are all present in the U.P., and the differences between types can be enormous.

“If you take a block of salt and an equal amount of loose salt and leave both outside in the elements, the salt block will slowly dissolve over time while the loose salt



Field geologists (Cody Suits, Jason Evans, Joanne Scott) examine core samples in order to determine mineral content at the Kennecott Eagle Minerals Company in Marquette.

poured out will rapidly disperse,” said Dr. Allan Johnson, professor emeritus of mining engineering at Michigan Tech. “It’s the same with certain sulfides.”

For instance, the sulfides of the Buck, Dober and Hiawatha mines of Iron River are not just polluting but dangerously reactive. The sulfides of Kennecott’s Eagle Mine are igneous pentlandite, pyrrhotite and chalcopyrite, and don’t pose the same risk.

“The iron pyrite of Iron County was the most reactive I’ve ever experienced,” said Johnson. “A mine proposed there today with modern regulations would never be constructed. However, the sulfides you find in the Yellow Dog Plains do not react in the same way at all.”

Johnson is considered by many to be a professional environmentalist. His work to remediate acid rock drainage out of the Buck, Dober and Hiawatha mines helped turn the Iron River from a habitat hazardous to biology to a DNR-designated Blue Ribbon trout stream, meeting high standards for aquatic life and water quality.

Even when ARD occurs, it isn’t always harmful. Johnson notes that there is currently ARD in western

Marquette County where the Michigan Department of Transportation recently widened a rock cut in a bluff full of sulfides.

"You'll find a similar reaction along the new rock cuts where MDOT widened U.S. 41," Johnson said. "Is MDOT polluting? No. It's a natural process and at those levels it's not likely to harm the environment."

Pictured Rocks National Lakeshore is "pictured" due to the erosion of iron, copper, manganese and limonite through the 42-mile-long sandstone cliff formations on Lake Superior. Despite thousands of years of erosion, the greatest lake remains pristine.

Rep. Stupak emphasized the importance of this debate when the first of potentially many new mining permits was approved by the state.

"It is critical that comprehensive independent studies be completed before additional permits are issued," Stupak said in a press release. "Once permitted, I am fearful as many as six additional sulfide mines will be allowed to operate on the shores of the Great Lakes, jeopardizing the world's largest body of fresh water."

## REGULATORY ENVIRONMENT

Orvana's Bill Williams says the only reason his company is in Michigan spending money is due to the nonferrous mining legislation sponsored by Rep. Tom Casperon, R-Escanaba, and signed by Gov. Jennifer Granholm.

"That's why I could take this to my board," Williams said. "That's why we came to Michigan to invest. We felt it was very transparent. We already knew the permit process is a one-year process. If things work out well, I think there is a future for our company in Michigan."

The massive zinc orebody near Stephenson known as the Back Forty Project is just a small tip of a range extending from northeastern Wisconsin to the Mississippi watershed. There are billions of dollars of metals known and mineable just south of the Brule and Menominee rivers that comprise part of Michigan's border with Wisconsin. But as it stands right now, they will never be mined.

Following several increasingly intense confrontations, a proposal to mine millions of tons of zinc near Crandon, Wis., was first undercut when the Wisconsin Legislature passed a mining moratorium in 1998. Later, the Mole Lake Ojibwe and Forest County Potawatomi spent \$16.5 million to purchase and close the operation.

"Nobody explores in Wisconsin anymore for metals



ANDREW WARE, KENNECOTT EAGLE MINERALS COMPANY EXPLORATION MANAGER

"Essentially we've just focused on the top of the earth's surface over the last 200 years. There's no reason these things don't occur say, 400 meters below the surface, it's just harder to find them."

because the regulatory environment is not welcoming," Bornhorst said. "The regulatory system in that state promotes no mining."

Kennecott successfully operated an open pit copper mine in Ladysmith, Wis., shortly prior to the mining moratorium. Though the copper was found in a sulfide orebody next to the Flambeau River, the Flambeau Mining Company was praised for its environmental stewardship. In July 2007, it received the Wisconsin Business Friend of the Environment Award and in 2003 the Flambeau received the U.S. Department of the Interior's Hardrock Mineral Community Outreach and Economic Security and Environmental Award. Community leaders in Ladysmith and geologists around the country cite it as an example of a bright future where mining and environmental protection partner together.

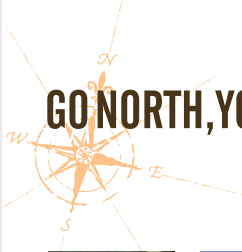
## EXPLORATION PROCESS

Likewise, Kennecott's Project Eagle nickel mine in Marquette County has blazed the path for others to follow. It was the discovery of this orebody in 2002 that inspired Michigan's nonferrous mining legislation. Most of the new mines now on track to open began as vague magnetic anomalies. Teams of geological explorers from Cameco, VMS, Quincy Energy and Bitterroot as well as the United States Geological Survey, the Michigan Department of Natural Resources and Michigan Tech have drilled hundreds of miles of core samples hoping to discover orebodies.

"Once you've defined a target and determined that it's worthwhile drilling, you need to file exploration plans with the MDNR, along with other soil erosion and applicable wetland permits, and essentially get the equipment out to the location and drill the core," Kennecott Eagle Minerals Exploration Manager Andrew Ware said. "Then you get the core out here to the core lodging facility and the team starts the process of measuring a large number of variables — density, point load testing, geotechnical logging, plus



# GO NORTH, YOUNG MAN



## COSTS TO THE ENVIRONMENT?

Though the mines were a huge source of economic growth for Michigan, their rise came at the cost of the environment. Even 19th century writers described the destructive properties of stamp sand, the coarse byproduct created when native rock is crushed by stamp mills. E.B. Hinson, a New York admirer of Michigan's copper industry, wrote in 1891 that the sheer volume of stamp sand washed into Portage Lake threatened navigation, which led to federal intervention and prompted a shift to disposing stamp sand and slag in Houghton County's Torch Lake.<sup>1</sup> In addition to problems posed by accumulation, stamp sand often contains traces of heavy metals like lead and mercury, some of which can cause environmental and health problems.

Today, Torch Lake is a Superfund Site and a Great Lakes Area of Concern. The EPA estimates that 20 percent of its original volume was displaced by copper industry waste totaling 200 million tons.<sup>2</sup> However, in 1988 the EPA began an in-depth investigation of the site in order to determine whether the barren slag surrounding the lake could be reclaimed. Following ten years of preliminary research, remediation work at the lake began with the introduction of six inches of fertile topsoil held in place by fast-growing vegetation.<sup>3</sup> After 800 acres of stamp sand and slag were remediated by autumn 2005, the construction at the site was declared complete.<sup>4</sup> Since then, the EPA has further endeavored to remove contaminated sediment and provide asbestos abatement at the site, and two areas are being developed for residential use.

1 Hinson, E. B. "Native Copper of Michigan." *Journal of the American Geographical Society of New York* 23 (1891): 324-338.

2 [www.epa.gov/glnpo/aoc/trchlike.html](http://www.epa.gov/glnpo/aoc/trchlike.html)

3 [www.epa.gov/region5superfund/npl/michigan/MID980901946.htm](http://www.epa.gov/region5superfund/npl/michigan/MID980901946.htm)

4 [cfpub.epa.gov/supercpad/cursites/csinfo.cfm?id=0503034](http://cfpub.epa.gov/supercpad/cursites/csinfo.cfm?id=0503034)



"I think everyone's proud of the coexistence we have with nature now. It's our backyard too."

PAUL WIEDMAN, KEMC MINE MANAGER

geological logging."

Mining companies and the state of Michigan keep miles of core samples in storage for the geological record. These cores are a geological roadmap to the world beneath the Upper Peninsula. To the untrained eye, the samples are just long dowels of rock, but geologists can literally find diamonds in the rough.

Once something catches the team's attention, the core takes another journey.

"If there's something of interest in terms of mineralization, we'll actually take that core and cut it in half; half of that core goes up to the prep-lab in Thunder Bay and then a split is sent off to Vancouver, where they conduct geochemical analysis to determine how much metal is actually in that piece of rock," Ware said.

The whole process starts with a general survey of a region of interest, such as the Western Upper Peninsula. A magnetic survey will identify geophysical anomalies. Gravity surveys will begin to paint a picture indicating where different types of rock can be found. What started out as a large mass of gabbro with low nickel content might end up being a smaller mass with significantly elevated amounts of nickel and copper.

This was the case for the Eagle deposit. After drilling the discovery hole in 2002, Kennecott was able to conduct an order of magnitude study by 2004, broadly analyzing the economic potential of the mine.

"Then you move forward to a pre-feasibility study, and you climb down to about 10 percent error, then to the feasibility study where you are expected to get everything at 5 percent," Ware explains. "Now we're into the mine planning phase where you really sharpen your pencil and make sure everything's right on."

Rio Tinto has taken residence in Cleveland Cliffs' old building, next door to the Cliffs Shaft Mining Museum in Ishpeming. Geologists and mining engineers can pore over a 3-D model of the Eagle orebody, while the dry room where horse teams drove supplies in for miners generations ago sits across the parking lot.

While 19th century miners had to have a good eye underground for safety's sake, technology has

made things a bit safer, for both mine workers and the environment. Computer modeling, combined with breakthroughs in research and remediation efforts, have refined the industry over the last 20 years.

"We operate in different areas of the world; some are extremely sensitive areas of the world; and actually, mining underground there's less of a footprint," KEMC Mine Manager Paul Wiedmann said. "The last mine I came from, Green's Creek, was operating out of the (Admiralty Island) National Monument (in Alaska). That was a very small footprint mine and it was a great example of environmental stewardship. I think everyone's proud of the coexistence we have with nature now. It's our backyard, too."

Despite some opposition from the Keweenaw Bay Indian Community, some residents of Powell Township and activist groups, the local governments in Marquette County have passed motions supporting the Eagle project nearly unanimously. The vast majority of anti-mining public sentiment appears to represent a very vocal minority, especially in the scientific community. Many communities are eager to see a mining resurgence, as Ovana's Bill Williams has found in his meetings with the community of Wakefield, where his company is proposing a new copper mine.

"You're always going to get opposition, so it's nice to find an orebody in a mining-friendly jurisdiction," Williams said.

Most of the easily accessed orebodies around the world have been found and mined or determined to be un-mineable. According to Kennecott's Andrew Ware, the future of mining depends on finding targets farther beneath the surface.

"With the rare exception of finds like the Back Forty orebody in Stephenson, just about gone are the days where you can go out in the field and discover something on the surface," Ware said. "Most of those have already been discovered and mined out."

"Essentially we've just focused on the top of the earth's surface over the last 200 years," Ware added. "There's no reason these things don't occur say, 400 meters below the surface, it's just harder to find them." ■



## **CONSUMER DESIRE AND ORGANIC PRODUCTS**

BY EDWARD FREUNDL

“The trend has always been growth. It’s no longer just fruits and veggies now; everything is available in organic, from clothes to bedding to highly processed foods such as cheese puffs and TV dinners.”

— TIMOTHY YOUNG, PRESIDENT, FOOD FOR THOUGHT



Before the advent of chemical pesticides and fertilizers and modern mechanized farming methods, all agricultural products could have been considered organic. But with increased concerns about environmental and health effects, organic products are

**796,436,717**

Total acreage crops and pasture nationwide

steadily gaining wider acceptance among mainstream consumers and producers.

According to the U.S. Department of Agriculture, organic farming has been one of the fastest-growing segments of agriculture for more than a decade. There were fewer than 1 million acres of certified organic farmland in the United States when Congress

**4,054,429**

Total acreage organic crops and pasture nationwide

passed the Organic Foods Production Act of 1990, but certified organic farmland had doubled by the time the USDA implemented national organic

standards in 2002 and doubled again between 2002 and 2005. Organic livestock sectors have grown even faster.

However, organics still represent a minuscule fraction — less than 1 percent — of the nearly 800 million acres of American agriculture.

In 2005, for the first time ever, all 50 states had at least some certified organic farmland. That year, U.S. producers dedicated more than 4 million acres of farmland to organic production — 1.7 million acres of cropland



Roseland Organic Farms in Cassopolis is a 1,600-acre, second-generation operation that was one of the pioneers of organic agriculture in 1985 under the ownership of Merrill Clark. The farm's organic beef, pork, hay, feed grain and vegetables were "literally unheard of in the stores until recently," said farm manager Lincoln Clark.

operations and 20th in number of organic acres devoted to crops and pastureland in 2005.

California was the leading state in certified organic cropland, with more than 220,000 acres dedicated mainly to fruit and vegetable production. Other top states for certified organic cropland were North Dakota, Montana, Minnesota, Wisconsin, Texas and Idaho.

More than 40 states also had some certified organic rangeland and pasture in 2005, although only four states — Alaska, Texas, California and Montana — had more than 100,000 acres each. The USDA lifted restrictions on organic meat labeling in the late 1990s, and the organic poultry and beef sectors have expanded rapidly.

## DEFINING "ORGANIC"

With the increase in the number of producers and the availability of "organic" foods to consumers, it's important to explain just what organic is, and what it is not.

Five years after the passage of the federal law that established standards and regulations for organic products, the following definition of "organic" was passed by the National Organic Standards Board in April 1995:

### Certified organic pasture and cropland, 2005

	Number of Operators	Crop acres	Pasture acres	Total
Michigan	164	43,105	1,414	44,519
U.S. total	8,493	1,723,271	2,331,158	4,054,429

Source: USDA Economic Research Service

and 2.3 million acres of rangeland and pasture — and anecdotal evidence suggests it has grown ever since.

According to the U.S. Department of Agriculture Economic Research Service, Michigan was 14th among the 50 states in the number of organic agricultural



“Organic agriculture is an ecological production management system that promotes and enhances biodiversity, biological cycles and soil biological activity. It is based on minimal use of off-farm inputs and on management practices that restore, maintain and enhance eco-

**0.51%**

Percentage of organic to total cropland

logical harmony. ‘Organic’ is a labeling term that denotes products produced under the authority of the Organic Foods Production Act (of 1990). The principal guidelines for organic production are to use materials and practices that enhance the ecological balance of natural systems and that integrate the parts of the farming system into an ecological whole.

“Organic agriculture practices cannot ensure that products are completely free of residues; however, methods are used to minimize pollution from air, soil and water. Organic food handlers, processors and retailers adhere to standards that maintain the integrity of organic agricultural products. The primary goal of organic agriculture is to optimize the health and productivity of interdependent communities of soil life, plants, animals and people.”

Despite the emphasis on health, the definition also notes that “the U.S. Department of Agriculture’s National Organic Program is a marketing program and makes no claims that organic farming is ‘better’ in any respect than conventional farming.”

The USDA’s national organic standards should be considered in two parts: first, the verification system that includes certification of organic agricultural products and accreditation of certifying agents; and second, the production, handling and labeling standards under which organic agricultural products are produced and sold.

The NOP is consistent with internationally accepted guidelines for certification and accreditation. However, NOP requirements for production, handling, labeling and allowed or prohibited materials differ significantly from those of other countries, such as in the European Union, particularly in livestock production standards.

For example, the U.S. has no restrictions on irradiation



Roseland Organic Farms in Cassopolis has been offering organic beef, pork, hay, feed grain and vegetables directly from the farm since 1985.

in the production and handling of organic food, there are no restrictions on the source of manure and a producer may not list more than three ingredients/food groups on product labeling.

In order to become a certified organic operation, a producer must submit an Organic System Plan to a USDA-accredited certifying agent for approval. The OSP is a detailed description of how the operation will achieve, document and maintain compliance with all applicable provisions of NOP regulations.

Specifically, the organic label designates a set of farming practices and is not an indicator of “natural” food or any specific nutritional benefits. “Organic” is not synonymous with “natural.” There is nothing in the U.S.D.A.’s National Organic Standards that defines or regulates the use of the term “natural,” and the USDA’s Food Safety and Inspection Service regulates the term “natural” on meat and poultry labels.

“A product containing no artificial ingredient or added color and is only minimally processed (use procedures that do not fundamentally alter the raw product) may be labeled natural,” according to FSIS definitions.”

**7 1**

Delaware: State with the lowest number of certified organic operations



Furthermore, “The label must explain the use of the term ‘natural’ (such as: no added colorings or artificial ingredients; minimally processed).”

The “free range” designation makes no claim that the livestock actually lived or fed outdoors, but simply indicates that they had access to the outdoors after a period of confinement.

If a poultry producer and certifier determine that poultry needs to be temporarily confined for their health, safety and welfare, a provision of the USDA National Organic Program permits such confinement without loss of organic certification.

#### **Organic Trade Association member companies in Michigan, 2008**

CADILLAC PRODUCTS PACKAGING COMPANY  
Troy (Packaging supplier)  
CHARTREUSE ORGANIC HERBAL TISANES  
Trenton (Manufacturer)  
ECO-SYSTEMS SUSTAINABLE EXHIBITS  
Grand Rapids (Manufacturer, support services)  
EVE ORGANICS Macomb (Personal care retailer)  
FOOD FOR THOUGHT Honor (Manufacturer)  
FOODWORKS Beverly Hills (Support services)  
HERITAGE MILLS Caro (Agricultural processor)  
MAGGIE’S ORGANICS/CLEAN CLOTHES, INC.,  
Ypsilanti (Organic fiber manufacturer)  
MIRAB Taylor (Manufacturer)  
NEW ORGANICS Ann Arbor (Distributor, exporter, grower, importer,  
ingredient supplier, manufacturer)  
ORGANIC POWER SOURCE LLC Grosse Ile (Publisher)  
PURITY FOODS INC. Okemos (Manufacturer)  
XELA PACK INC. Saline (Packaging supplier)

Source: Organic Trade Association

#### **A GROWING TREND?**

The organic movement has gone global, according to the Organic Trade Association, with at least 31 publicly traded national and international companies involved in manufacturing, processing or marketing organic products, including Campbell Soup Co., Chiquita, Whole Foods Market and even Nike. The Massachusetts-based trade group lists thousands of member and associate member companies involved in the organics industry, including more than a dozen members in Michigan, most of them in the southeast part of the state.



Bruce Findlay harvests organically grown spelt on his farm near Caro. Findlay had been a conventional sugar beet grower since 1978, but he decided to go organic in 1996 and now raises 750 acres of corn, soybeans, dry beans and clover seed in addition to spelt.

Many of these companies got into the organics business in the past eight to 12 years.

“Consumer awareness was a big challenge in the early years, but organic is now an established trend,” said Timothy Young, president and chef of Food For Thought in the village of Honor, about 20 miles southwest of Traverse City.

Young founded his company in 1995, which now grosses about \$1 million in annual sales and employs 10 workers.

Linda Shannon, president of Chartreuse Organic Herbal Tisanes of Trenton, which produces organic herbal teas, said the company grossed \$30,000 in 2006, its first full year of operation. Since then, it has seen annual sales increases of 20 and 25 percent by selling to small, independent stores in 15 states.

“No one is taking a salary,” Shannon noted. “Our goal is to get into larger markets like Meijer, Kroger and Whole Foods. We do sell to two Plum Markets in Ann Arbor and Bloomfield Hills, and a few IGA stores.”

But there are plenty of obstacles to be overcome when trying to make a living by selling organic products.

“Price continues to be a challenge,” said Food for Thought’s Young. “When none of your costs are hidden, our products represent true costs which consumers are used to paying at the point of sale.”

Shannon agreed. “The economy is the worst in 30-plus years, nationally and globally; small-business loans are hard to come by, and fuel costs over the past year have increased shipping costs for us and our customers,” she said.

According to Young, “Based on the latest market research, organic is leveling off. Just why is debatable, but it’s likely a combination of economic hardship and the proliferation of other social value marketing such as Fair Trade and the ‘buy local’ movement.”

 **1,460,205**  
Alaska: State with the highest amount of certified organic pasture and crop acreage

Many farmers got into the organic act within the last 15 years or so, switching from traditional agricultural practices to certified organic acreage — a three-year process under MDA rules.

Michael Findlay, whose 2,000-acre farm near Caro is one of four certified organic farms in Tuscola County, has been in organics since about 1996.

“In the last two years we added 500 (acres); we’re still transitioning that into organic,” said Findlay,

who grows spelt (a gluten-free grain that can be ground and used like flour), corn for feed, and several types of beans, including soy, black and snap.

Because organic crops represent such a small segment of the market, Findlay said he and other growers depend on each other to share information.

“My son and I have talked to growers from all over, around the state and places like Iowa,” he said. “I picked up a couple of ideas just this fall and now I’m looking forward to next year so I can try them out. If one idea works, then that’s enough.”

Findlay’s brother Bruce had been a conventional sugar beet grower since 1978 but he, too, decided to go organic in 1996. He now raises 750 acres of spelt, corn, soybeans, dry beans and clover seed.

Bruce Findlay said the lack of a marketing network for organic crops forces growers to work hard to develop partnerships with buyers.

“There’s no real infrastructure there like on the conventional side,” he said. “I have to find a buyer, and I’ve established two or three I like to work with, and we have to establish a price, and the point of delivery could be Michigan or Pennsylvania.

“It’s evolving but it will take some time,” he added. “I doubt there will ever be a Chicago Board of Trade for organics because it is such a small part of the market. With the Internet I can look at market prices

## THE PRODUCERS

On the other end of the pipeline are the certified organic farmers who supply the manufacturers with raw materials.

Certified organic farms in Michigan can be found in specific pockets of traditional agricultural regions: in the northwest, southwest and midsection of the Lower Peninsula, as well as Marquette and Houghton counties in the Upper Peninsula.

The latest Michigan Department of Agriculture figures show 52 registered organic farms in 29 counties, concentrated in the Lower Peninsula’s midsection and Thumb area, and on the Lake Michigan coastline.

 **1,916**  
California: State with the highest number of certified organic operations

### Number of certified organic operations in Michigan by county, 2008

<b>1</b>	<b>2</b>	<b>4</b>
Arenac	Allegan	Genesee
Bay	Isabella	Saginaw
Berrien	Lapeer	Tuscola
Benzie	Sanilac	
Calhoun	St. Clair	
Cass	St. Joseph	
Eaton	Shiawassee	
Emmet		
Houghton	<b>3</b>	
Ionia	Clinton	
Manistee	Gratiot	
Marquette	Ingham	
Mason	Leelanau	
Montcalm		
Washtenaw		

Source: Michigan Department of Agriculture





## THE ORGANIC CERTIFICATION PROCESS

BY EDWARD FREUNDL

Federal law allows for several options in establishing or following an organic certification program. If federal or state animal health authorities determine that stricter or more prescriptive actions are required, organic producers could be required to comply with these actions.

Option 1: A state may not establish its own State Organic Program or provide certification services under the national program. Under this option, organic growers may seek organic certification by any certifying agent accredited by the National Organic Program. The state would not be responsible for enforcement of the NOP; and enforcement would be shared jointly by the national program and the certifying agent.

Option 2: A state may choose to provide certification services under the NOP only. Under this option, the state would have to apply for accreditation. As an accredited certifying agent, the state would be responsible for conducting certifications, enforcing the production and handling standards of the NOP, and maintaining compliance with other applicable regulations of the national program. The USDA would be responsible for oversight of the state certifying agent. Organic producers and handlers within that state could choose to be certified by the state or any other accredited certifying agent.

Option 3: A state may choose to establish a state program. Under this option, all organic producers or handlers in the state would have to be certified according to the SOP, which would include the requirements of the NOP and the more restrictive provisions unique to that state and approved by the USDA. The state would assume enforcement responsibility, within its borders, for the requirements in the national standards and its SOP. However, the state may not initiate proceedings to suspend or revoke the accreditation of any USDA-accredited certifying agent; that authority is left to the USDA. Organic producers and handlers may seek and obtain organic certification from any certifying agent accredited under the NOP.

guys are getting in New York or different regions of the country.”

Fruits and vegetables are a big part of organic farming, and Almar Orchards in Flushing has been very successful in creating a high demand for its products in a short period of time.

“Since 2002 we brought small blocks in at a time and we’ve been totally organic for three years; before that we’d been in business since 1946,” said manager Dick Alday.

Almar grows 20 varieties of apples on its 125 acres, along with organic tomatoes, pumpkins, squash and corn. Almar also raises organic pork.

Environmental concerns helped drive Almar’s decision to go into organics.

“We were too small to stay with conventional (farming); we also wanted to clean up the orchard to help the environment because there’s a creek that runs through here,” Alday said.

The orchard is able to charge a little more for organics because of a crop of loyal customers, Alday said, and food co-operatives have turned out to be among the best of them.

“We established a good base of organic people, and a lot of our other people stayed with us because they liked our service,” he said. “It’s grown so much in the last five or six years.”

Organic meats are also becoming more popular because organically raised livestock are grown without hormones, crowded living conditions or irradiation, which many consumers wish to avoid.

Graham Farms in Isabella County’s Rosebush includes a meat-packing plant on its 850-acre operation for cattle, chicken and turkeys, and manufactures organic livestock feed that is delivered statewide.

“People who come here to buy our products aren’t ‘shopping’ per se. They already want organics, and

our clientele knows what we do," said owner James Graham. "There are more people looking at where their food is coming from."

Graham predicted the current economic downturn would only temporarily affect the long-term outlook for organic foods.

"I think it will slow it down or affect the growth, but I think in years to come the idea behind the organic food and the environment is going to be more prevalent," he said.

John and Suzanne Smucker, owners of Lamb Farm LLC in Manchester, went into organic meat production in 2000 with a consumer's point of view.

"We like to think beyond organics and look at the sustainability of the way it's raised on the farm," John Smucker said. "People are more concerned

44

Mississippi: State with the lowest amount of certified organic pasture and crop acreage

with the quality of the products; more big firms are entering the field and that's changing the quality."

The Smuckers raise about 200 sheep and 40 steers on 250 acres in southwest Washtenaw County. The cattle are not

certified organic, John Smucker said, "but they are pasture-raised using organic principles."

"I think one of the things you're seeing is that organics is gaining more attention," he added. "There's more of a movement to buying local and understanding who the people are who are producing the food, and that perhaps is the next phase."

Roseland Organic Farms in Cassopolis is a 1,600-acre, second-generation operation that pioneered organic agriculture back in 1985 under the ownership of Merrill Clark.

"Dad had some land and was unhappy with what he was seeing in farming, and he had an interest in trying something different," said farm manager Lincoln Clark. "We were doing it before it was called organic, but he just didn't want to see all the chemicals and things go into the land.

"Later on it became more in style, more accepted, but back then he was the oddball."

The farm's organic beef, pork, hay, feed grain and vegetables were "literally unheard of in the stores," Lincoln Clark said.

"There were a lot of people who didn't fully understand what organic means. I sometimes wonder how we made it work — it's not easy still."

Despite the economic outlook, Clark believes that the growth of the organic food industry will continue as consumers desire more choice and transparency in their food purchases.

"People are looking more at buying locally grown so they can support a family, and they don't have to wonder where the food was raised," he said.

"I think there's a great interest in knowing where your food came from." ■



Eve Organics, based in Macomb, makes a line of all-natural organic cosmetics and skin care products that do not contain synthetic fragrances, preservatives or other additives.

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