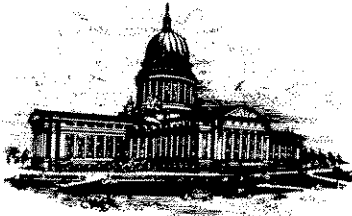


AB 236 42



Wisconsin Legislature  
Assembly Chamber

April 9, 1997

Chairman Marc Duff  
Assembly Environment Committee  
306 North State Capitol  
hand deliver

P.O. Box 8952  
Madison, Wisconsin 53708

Dear Chairman Duff:

We are writing in regard to the agenda for next Tuesday's public hearing of the Assembly Environment Committee. We are pleased that you have joined with the growing public and legislative consensus that Wisconsin's mining laws are too weak and need to be strengthened. The legislation that you have scheduled for committee action, however, will do nothing to improve Wisconsin's mining laws.

We are disappointed that it appears that you are using the committee hearing on AB 236 to divert attention away from the Mining Moratorium Bill, Assembly Bill 70/Senate Bill 3, both of which are waiting for action in your committee.

AB 236 is simply the language included in the budget bill. Like the moratorium bill, it adds an additional condition for granting of a mining permit. However, unlike the specific and scientifically based requirement contained in the mining moratorium bill, the budget bill language is vague and does not, in any meaningful way, provide a standard by which to better evaluate a proposed mine. AB 236 would not require any proof that the technology in question has actually worked successfully in a mine of any sort, much less a sulfide metallic mine such as Exxon's proposed Wolf River mine. It also has no requirement that a mining operator prove by example that the technology has worked over a period of time.

AB 236 was introduced only 6 days ago and was not even circulated for cosponsorship until the evening after the state Senate overwhelmingly passed the Mining Moratorium Bill 29 - 3. Despite the many shortcomings of AB 236, it appears to be on the fast track for Assembly review.

Assembly Bill 70, on the other hand, was introduced almost 2 months before your legislation and was referred to your committee on February 10, 1997. Senate Bill 3 was referred to your committee on March 13, 1997, after it passed the state Senate Agriculture and Environment Committee and the full Senate. Unlike AB 236, the Mining Moratorium bill has strong public backing and bi-partisan legislative support. Although Rep. Black has sent you two letters requesting you to schedule a committee hearing, you are continuing to block committee action on the mining moratorium bill.

In view of the broad public support for the mining moratorium bill, we encourage you to schedule prompt public hearings and executive action in the Assembly Environment Committee on Senate Bill 3.

Sincerely,

*Peter Bock*  
Peter Bock  
State Representative

*Judy Robson*  
Judy Robson  
State Representative

*John La Fave*  
John La Fave  
State Representative

*Spencer Black*  
Spencer Black  
State Representative



Memo

**TO:** Members of the Assembly Committee on Environment  
**FROM:** Joan Hansen, Director, Tax & Corporate Policy  
**DATE:** April 15, 1997  
**RE:** 1997 Assembly Bill 236 - Mining Permits

Wisconsin Manufacturers & Commerce (WMC) is appearing for information on Assembly Bill 236, which requires additional steps to be taken in the metallic mining permitting process. More specifically, it requires the Department of Natural Resources (DNR) to make a finding that proven technology exists to ensure that a mining project will not pollute groundwater or surface water from acid drainage or the release of heavy metals. It further requires the proposed mining operation to utilize this proven technology.

WMC is appearing for information on AB 236 for several reasons:

Although the language contained in AB 236 in theory is reasonable and arguably must be met anyway, it adds yet another unnecessary regulatory step in the metallic mining permitting process. Wisconsin laws and regulations surrounding the permitting process mandate environmental protection. They are thorough and already completely cover the areas addressed by this bill.

Current law allows the Department of Natural Resources to grant a mining permit only if compliance with all state and federal environmental laws are met; conformance with local zoning ordinances are met; unique land with critical ecological or historical importance is safeguarded; a suitable plan for reclamation is included; the local economy is benefited; and finally that public health, safety and welfare is protected.

In very simple terms, this means groundwater, surface water, wetlands, air, unique land and endangered species must be protected. It also requires a tailings management plan, a feasibility report, a plan of operation and several other reports and studies. Financial and perpetual responsibility is also required under law.

[All of these requirements come under DNR's permitting process and requires several rigorous steps beginning with the notice of intent, the environmental impact report, environmental impact analysis, permit/plan approval and master hearing (see handout). ]

To give you an idea of what this means for Crandon Mining Company, for example, in terms of completing various scientific, environmental studies such as those related to water, land, atmosphere, wildlife, and socio-economics - - in 'man' or 'woman' hours, it has required an effort of over 165,000 hours in 18 major areas of study which translates into about 15 years of field data collection. To date, this has taken the Crandon Mining Company almost four years (not

counting the work done by its predecessors) and, of course, the review process continues. This certainly is a process which requires intense scrutiny at every level.

The Legislature has specifically allowed for mining in the state as long as it is accomplished in an environmentally sound manner. And that is precisely what our current mining laws and the rigorous permitting process already demand.

WMC urges the Legislature to tour the site of the Flambeau Mine which, like the proposed Crandon Mine site, is also a sulfide metallic mine and see for yourselves that Wisconsin's existing laws are working, and working well.

Metallic mining is arguably the most regulated industry in the State of Wisconsin. We understand that. Protecting Wisconsin's pristine environment is and should continue to be a top priority for every Wisconsin citizen. Wisconsin's laws demand environmental protection, and they are delivering.

## MINE PERMITTING PROCESS

### Notice of Intent

**The Submission of a *Notice of Intent* to collect data to support a prospecting or mining permit application formally begins the permitting process.**

*Once it has been determined that metallic minerals are present in an apparently minable location and at an acceptable cost, an applicant files a Notice of Intent to collect data to support a mining or prospecting permit application. This document provides a preliminary description of the proposed project, gives formal public notice of the project to the DNR and to Wisconsin's citizens, and requires full public review at an informational hearing in the area of proposed activity.*

### Environmental Impact Report

**The *Environmental Impact Report* is a detailed document that provides information about the condition of the existing physical, biological, and socioeconomic environment.**

*The Environmental Impact Report is typically a multivolume compilation of technical data pertaining to the regional and local setting of a proposed prospecting or mining site; it includes a description of the project, alternatives to the project as proposed, and analyses of potential environmental impacts. It contains technical data about the physical, biological, and socioeconomic environment; the proposed prospecting or mining project, as described by the applicant and reviewed and verified by the DNR, is evaluated within this context.*

### Environmental Impact Analysis

**The *Environmental Impact Analysis* and review process is a major area of public involvement in decision making.**

*Wisconsin law (s. 1.11, Wis. Stats.) and DNR's ch. NR 150, Wis. Admin. Code, mandate full public disclosure of potential environmental impact related to proposed metallic mineral prospecting or mining operations. Public information includes 1) a Draft Environmental Impact Statement; 2) a mandatory public hearing; and 3) a Final Environmental Impact Statement, in which the DNR responds to all oral and written comments. The Environmental Impact Statement identifies and evaluates the project's potential effects upon the environment, means of mitigating adverse impacts, alternatives to the proposed action, and any loss of environmental resources that would occur.*

## Permits, Plans, and Approvals

**Permits, Plans, and Approvals** form the basis for decisions about prospecting or mining proposals and describe how the projects are to be operated.

*Several types of Permits, Plans, and Approvals form the basis for the decision about whether or not to allow metallic mineral operations to proceed. Typically, several state and federal permits must be obtained before mining can begin. In addition, to making decisions about permits, the DNR must approve a number of plans and reports, such as the Feasibility Report and the Plan of Operation for a mine-waste disposal facility. Decisions about all permits are based on legislatively mandated standards or criteria or on the DNR's discretionary authority to approve required plans. All such decisions are subject to a formal hearing.*

## Master Hearing

**The Master Hearing** is the legal forum for the formal evaluation of the proposed metallic mineral operation.

*The Master Hearing is a formal legal proceeding at which the evidence and testimony about the environmental assessment process and all permits, plans, and approvals are entered into the formal record. It is a formal hearing, in effect, a trial with rules of evidence, sworn testimony, and provisions for legal due process. The Master Hearing is also an opportunity for further public comment about the proposed metallic mineral prospecting or mining operation. On the basis of the record of the hearing, decisions are made regarding the appropriateness of the proposed operation within the context of the state's laws and rules.*

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### Source:

*An Overview of Metallic Mineral Regulation in Wisconsin*, Revised Edition, by Thomas J. Evans, Wisconsin Geological and Natural History Survey, Special Report 13, 1996: pages 16-24.



**THE LEAGUE  
OF WOMEN VOTERS OF WISCONSIN, INC.**

122 State Street, Madison, Wisconsin 53703-2500 608-256-0827 FAX 608-256-2853

**STATEMENT TO THE ASSEMBLY COMMITTEE ON ENVIRONMENT REGARDING  
AB 236 RELATING TO METALLIC MINING  
April 1997**

The League of Women Voters believes in high standards for water and air quality and adequate waste disposal. The League supports government regulations and enforcement of the standards. We also encourage legislation that clearly states public policy.

AB 236 appears to restate existing state law and to admonish state regulators to carry out state law regarding ground and surface water protection. The League questions how adopting such language adds to policies and direction in the existing state statutes.

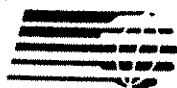
New mining legislation should not simply restate existing law, it should substantively and scientifically improve Wisconsin's environmental protections. AB 236 does not appear to do this.

AB 236 requires that the DNR issue two additional findings before issuing a permit for metallic mining. First, the DNR must find that proven technology exists to ensure that the proposed mine will not violate state ground or surface water statutes from acid drainage at the tailing site or at the mining site or from the release of heavy metals. Secondly, the DNR must find that the proposed mine will use that technology to comply with these state laws and rules.

AB 236 would not require any proof that the technology in question has actually worked successfully in a mine of any sort, much less a sulfide metallic mine such as the proposed Crandon Mine. Nor does it require that a mining operator prove by example that the technology has worked over a period of time. Waste in tailings piles can remain toxic for centuries, and any leakage from the tailings could contaminate ground and/or surface water.

Unfortunately, AB 236 is vague and does not define "proven technology." Will this new standard be used to approve the use of plastic liners (with a useful life 20-25 years at a solid or hazardous waste landfill) as "proven" for use at a metallic mine site? Will this language pave the way for engineering solutions used in factories and non-mining situations to be approved for metallic mining sites without actual proof that they can handle the specific, long-term needs of a site estimated to produce 88 billion pounds of acidic waste? The DNR must evaluate waste chemical neutralization, groundwater seepage barriers and waste system encapsulation. How does this legislation assist them in meeting these challenges?

The League questions the value of adopting AB 236 and does not recommend its adoption.



## LUTHERAN OFFICE FOR PUBLIC POLICY IN WISCONSIN

Testimony before the Assembly Environment Committee  
Representative Marc Duff, Chair  
Tuesday, April 15, 1997  
Re: Assembly Bill 236, Issuance of Metallic Mining Permits

Good afternoon Representative Duff and members of the Environment Committee: Thank you being allowed to speak concerning A.B. 236. I am Rev. Sue Moline Larson, director of the Lutheran Office for Public Policy in Wisconsin, the legislative advocacy voice of the six Evangelical Lutheran Church in America synods with congregations in Wisconsin. The mission of the office is to advocate justice for disempowered people and for the responsible care of creation.

On August 28, 1993, the ELCA voted in its churchwide assembly to adopt the social statement on care for the earth titled, "Caring for Creation: Vision, Hope, and Justice." It expresses a deep concern for the environment, and a faithful return to the biblical vision to love the earth as God does. The vision of this statement explains that God's gift of responsibility for the earth dignifies humanity without debasing the rest of creation.

However, as fallen members of humanity, we have treated the earth as a boundless warehouse and have allowed powerful interests to exploit its richness and to jeopardize efforts to achieve a sustainable future. The resulting damages are frightening, and include depletion of resources, destruction of habitats, erosion and pollution of soil, air and water, increasing volumes of non-biodegradable wastes, and increased conflict over a decline in economic security and greater vulnerability of community health and well-being.

Despite a philosophy of 'time cures all ills', the time is indeed very short for taking action to counter the complexity of environmental degradation, and to protect the forests, water, and air for our children and their children to come. This will only occur when all people are given a voice and invited to participate in decision making. For that reason, I thank you for the time to speak today, and to voice the concern of ELCA congregations throughout the state which endorse legislation based on the principle of sufficiency, which affirms environmental stewardship, and the principle of sustainability, which provides an acceptable quality of life for future generations, evidenced by limited consumption and a reduction of waste.

Any legislation addressing mining practices in Wisconsin must move towards consensus on how technology is evaluated in addressing its feasibility to measure and address the future

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322 East Washington Avenue Madison, Wisconsin 53703-2834 608/255/7399

*Advocating justice for disempowered people and responsible stewardship of creation  
A ministry of the Evangelical Lutheran Church in America  
Division for Church in Society, in partnership with  
Northern Great Lakes Synod Northwest Synod of Wisconsin  
East-Central Synod of Wisconsin Greater Milwaukee Synod  
South-Central Synod of Wisconsin La Crosse Area Synod*

impact. Scientific requirements must be proven over the span of many years. As a middle school student, I spent a summer visiting family members in Butte, Montana, at that time the site of one of the continent's largest operating open-pit copper mines, owned by the Anaconda Copper Company. Today, ore is no longer being extracted, and the pit is a vast poisonous lake of polluted sulfuric water, too dangerous to be released into the ground, and too potent to be neutralized in any way for any other use. It is an enormous reminder in that community, which sits in the beautiful Rocky Mountains, right on the continental divide, of the seemingly unsolvable riddle of responsibly disposing of the by-products of copper mining waste and the continued blight it has created for the residents of that place. It is a strange tourist attraction, indeed!

Please continue to include the voices of those most concerned about the future of mining sites in the state in your efforts to achieve inclusivity and consensus on this powerful issue. Worthy legislation defining mining permits will assure that long-term environmental protections are not in doubt. No suppositions or estimates of future impacts can responsibly substitute for proven evidence. The faith community joins with the people of the state in our commitment to safeguard the health of God's creation for future generations. Thank you.





**MARC  
DUFF**

STATE REPRESENTATIVE

Chair: Environment & Utilities

Vice Chair: Urban Education

Co-Chair: Joint Legislative Council

TO: MEMBERS, COMMITTEE ON ENVIRONMENT

FROM: REP. MARC DUFF, CHAIRMAN *MD*

DATE: APRIL 16, 1997

RE: TESTIMONY OF CLAIRE VANDERSLICE

Attached is a copy of Ms. Vanderslice's testimony from yesterday's hearing. She has requested that it be distributed to all committee members.

OFFICE: State Capitol  
P.O. Box 8952  
Madison, WI 53708-8952  
608-266-1190  
HOME: 1811 South Elm Grove Road  
New Berlin, WI 53151  
414-782-0763  
TOLL-FREE HOTLINE: 1-800-362-9472  
E-MAIL: USWLSA98@IBMMAIL.COM



ENCLOSED MATERIALS RELATE TO SULFIDE DEPOSITS, CHEMICALS, AND TECHNOLOGIES.  
YOU MAY COPY AND SHARE THEM AMONG YOURSELVES. THEY ARE 35 PAGES.

TO: CHAIRMEN REP. DUFF AND HOVEN APRIL 15, 1997

TO: LEGISLATIVE COUNCIL: REPRESENTATIVES LA FAVE,  
ROBSON, BLACK, BOCK, DUFF, HOVEN, JOHNSRUD, HAHN,  
SERATTI, KEDZIE

PLEASE CONSIDER MY PROTEST AGAINST  
THE ASSEMBLY BILL <sup>236?</sup> CONTAINING THE "GOVERNOR'S  
LANGUAGE"

AND

INSTEAD I URGE YOU TO SUPPORT THE  
MINING MORATORIUM BILL SPONSORED BY SPENCER BLACK  
AS IT WAS WRITTEN IN SENATE BILL 3 AND  
PASSED OVERWHELMINGLY BY THE WISCONSIN  
SENATE.

SULFIDE MINERALS ARE THE FOCUS OF NEW  
DISCOVERIES IN EARTH SCIENCE

SULFIDE MINING IS NOT NEW BUT HAS HISTORICALLY  
ALWAYS RESULTED IN BAD DAMAGE TO RIVERS AND  
GROUNDWATER AND PLANTS, ANIMALS AND PEOPLE  
IN ITS WAKE.

THE GOVERNOR'S "LANGUAGE" IN THIS IMPOSTER  
MINING BILL 236(?) PURPORTS THAT A PROVEN  
TECHNOLOGY CAN BE FOUND AND DECIDED UPON BY  
POLITICAL APPOINTEES - SCIENTIFIC OR OTHERWISE.

THIS IS FOLLY! THERE EXISTS NO  
PROVEN TECHNOLOGY AGAINST ACID MINE DRAINAGE  
ESPECIALLY IN A WASTE DUMP THE SIZE AND SCALE  
OF THAT PROPOSED FOR THE EXXONERIO-ALGOM OWNED  
PROPOSED CRANDON MINE.

THE METALLIC SULFIDE MINING MORATORIUM BILL  
THAT WAS PASSED IN THE SENATE IS A WORTHY AND  
EXTREMELY VALUABLE TOOL TO PREVENT USING OUR  
BEST AND CLEANEST WATERS AS GUINNEA PIGS  
FOR UNPROVEN TECHNOLOGIES SO THAT ENGLISH AND  
CANADIAN AND AUSTRALIAN AND MULTINATIONAL MINING  
CORPORATIONS CAN WALK AWAY WITH BILLIONS OF  
DOLLARS.

SINCERELY, CLAIRE VANDERSLICE  
2276 HWY I (GRAETAN 1-21)  
MINING IMPACT COMMISSION OF WISCONSIN

worldwide. If you have opinions and want to participate in the development of resolutions and strategies which will have international impact, then you should be at this congress. Costs are £150 by 30 May 1996, and £175 thereafter, for full participants. For complete information, please contact the Administrator, Second World Congress, Department of Earth Sciences, University of Cambridge, Madingley Road, Cambridge CB3 0EZ, United Kingdom; phone UK (01223) 62522; fax UK (01223) 60779.

#### *SVP '95—Pittsburgh, Pennsylvania*

The second circulars which contain the registration and auction forms as well as other pertinent information about the upcoming 1995 Annual Meeting will be mailed in mid-May. Please note that you will receive a \$40 discount for registrations postmarked before October 1st. Checks, money orders, and MasterCard/Visa will be accepted. We look forward to seeing you in November.

### — PREPARATORS CORNER —

#### *Reduction of Bentonitic Claystones*

Bentonitic claystones, which occur with some frequency in terrigenous rock units of the Western Interior, often contain significant microvertebrate assemblages, yet they can be exceedingly difficult to process using underwater screenwashing methods. The included clay mineral, montmorillonite (smectite), is characterized by extreme colloidal behavior, impermeability, and hydrophily; if present in sufficient quantities, rock matrix often turns to an unwashable, doughy mass or, worse, external clast layers swell with water, forming an impenetrable barrier and preventing disaggregation of individual clasts. The problem in exacerbated in field situations, where water sources are often saline, because the most prevalent salts tend to cause flocculation of individual clay flakes. Given prolonged (several days) soaking in warm, fresh water, bentonitic clasts will generally disaggregate through clay deflocculation, so that box agitation (and attendant specimen damage) is unnecessary; however, this is often impractical for large samples. We have found that many agents (detergents, wetting solutions, etc.) commonly used to disaggregate rock are ineffective on bentonitic claystones. Because charge deficiencies occur in the center of montmorillonite flakes, deflocculation can be effected by a basic solution, which provides free electrons to  
 \* bond with the cations of the clay mineral. We have had some success with solutions including OH (e.g., "lime," calcium hydroxide), although some salt precipitation frequently occurs. An extremely effective agent is, ironically, a salt itself: soda ash (Na<sub>2</sub>CO<sub>3</sub>). A working solution of soda ash has a pH of about 11; preliminary experiments show that it causes rapid deflocculation of bentonitic claystone. Soda ash is used to control pH in swimming pools, and is widely available, at moderate cost, at pool supply stores. We have not yet experimented with its effects on screenbox materials or on skin, but it is reasonable to advise use of rubber gloves and other protective clothing when working with it. (Richard L. Cifelli)

### — PUBLICATIONS —

#### *Bibliography of Tertiary Rodents*

Professor R. Lavocat (France) has prepared a bibliography of Tertiary rodents containing 3,600 titles, plus 750 key words. These are available on two 3½" disks and are for use with Macintosh System 7. Microsoft Word 5 is needed for the key words and End Note Plus 2 for

## GOLD RUSH IS ON IN WISCONSIN!

(and zinc, copper, silver, lead, uranium, and other metals that are chemically combined in the rocks as sulfides. These are not the relatively harmless iron ores once mined in Wisconsin! Metal-sulfides and metal-oxides are two different types of ore. Metal sulfides were formed without the presence of oxygen. When exposed to air or water however, they become oxidized.

FEDERALLY-FUNDED SCIENTIFIC RESEARCH AND EXPLORATION in the mid 1970's in the Pacific Ocean off the coast of North America on deep ocean ridges, led to an understanding of how and where sulfide deposits form and especially of how gold deposits occur—**THIS WAS NEVER KNOWN BEFORE!** These discoveries plus United States Geological Survey maps tipped off multinational mining companies to where the treasure might be buried. In the mid 1970's exploration in Wisconsin began in earnest.

In the ancient bedrock under the glacial deposits, minerals were intruded up through cracks in the earth's crust. Many of the mineral deposits contain metals bonded with sulfur. Wisconsin's sulfide-metal ores are "fossil" ocean floors - places where in ages past, the continental plates were rifting and spreading due to "hot spots" under the earth's crust. These hot spots also tend to lift portions of the crust higher.

Northern Wisconsin has higher elevations than the rest of the state. This map shows the major river systems that flow out from the water-rich glacial deposits which overlay the crustal rocks. Wisconsin is a water state. It has more lakes and rivers than any state other than Alaska! It is defined on its borders by rivers and 2 of the 5 Great Lakes. Its glacial soils and wetlands are a source of groundwater for rural wells.

**CLEAN WATER IS WISCONSIN'S GOLD!** Fresh water is our most valuable mineral. We shouldn't put it at risk and sell it cheap! It will be no good for drinking or fishing if it becomes acidified and poisoned. The results of sulfide mining are well known. When the sulfides are crushed and exposed to oxygen in air and water, sulfuric acid is the result. Acid leaches out toxic heavy metals contained in the ore.

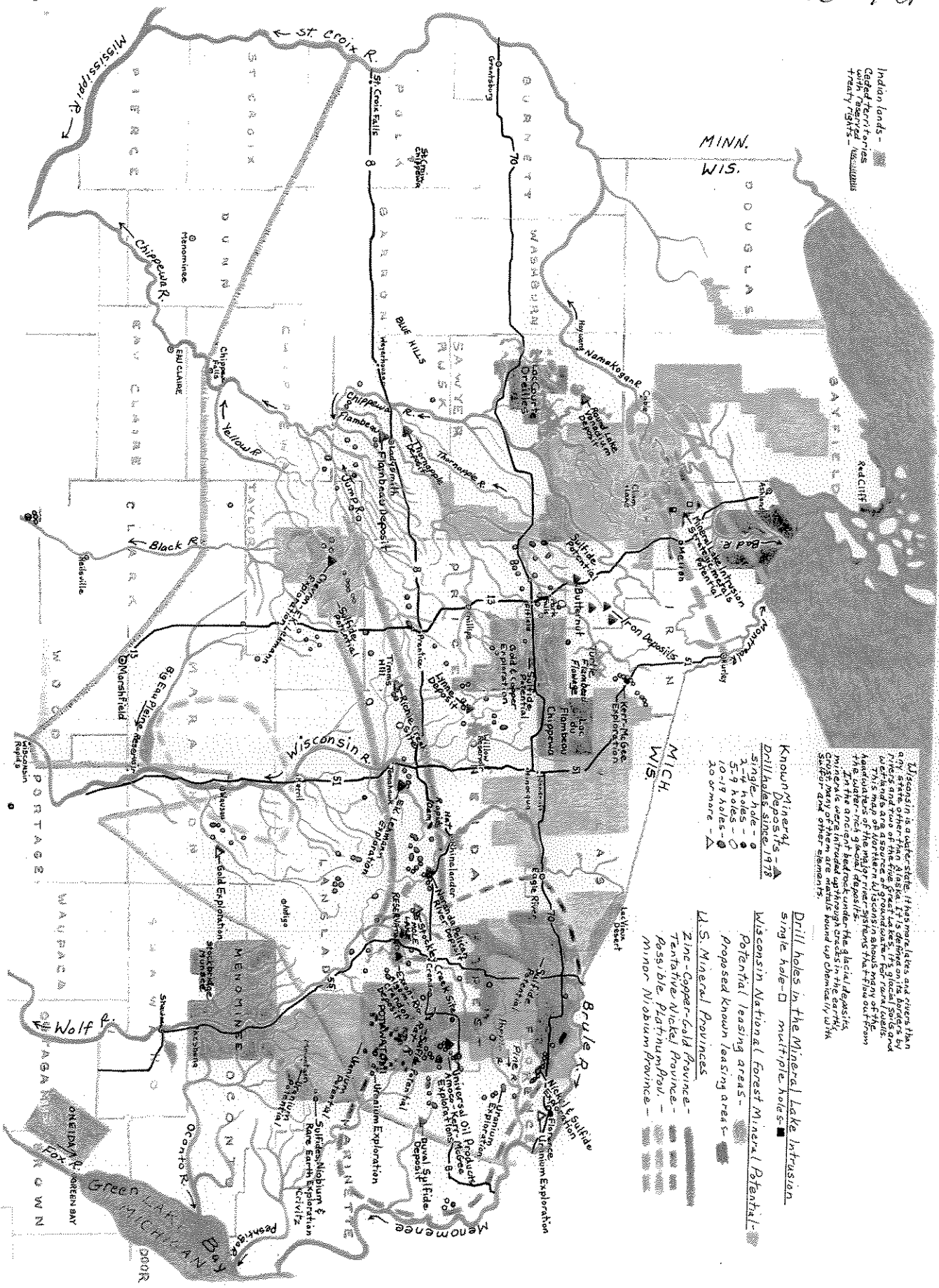
**THERE HAS NEVER BEEN A METALLIC SULFIDE MINE ANYWHERE IN THE WORLD THAT HAS NOT POLLUTED DURING ITS OPERATION AND/OR AFTER ITS CLOSURE!** Over 10,000 miles of rivers in the U.S. alone have been poisoned by acid mine drainage.

SULFIDES + AIR & WATER = ACID & HEAVY METALS

Huge multinationals such as EXXON, KERR-McGEE, AMOCO, WESTERN NUCLEAR, and KENNECOTT (RIO TINTO ZINC) have quietly leased more than half a million acres for mineral exploration and development.

Mineral exploration permits have been taken out on both public and private tracts of land in Wisconsin and many more are being sought on state and county lands. Typically, these permits involve a 50 year lease with the option to mine during that time. On federally owned lands, the 1872 Mining Act gives these leases for as little as \$5 an acre!.....\$5 FOR A 50 YEAR LEASE!

Indian lands -  
 Ceded Territories  
 with Reserved  
 Treaty Rights - *Neumann*



Wisconsin is a water-rich state. It has more lakes and rivers than any state other than Alaska. It's the home on its borders by rivers and two of the five Great Lakes, 1% glacial sands and loess, and a large amount of ground water. For rural lands, hydrocarbons are a major resource. The topography is mostly flat with the water-rich glacial deposits. In the ancient bedrock under the glacial deposits, minerals were intruded up through cracks in the earth's surface. Other minerals found are metals found up directly with Serford and other elements.

**Known Mineral Deposits - 1978**

- Drill holes since 1978
- single hole - ●
- 3-4 holes - ○
- 5-9 holes - ◉
- 10-19 holes - ⊙
- 20 or more - ⊕

- Drill holes in the Mineral Lake Intrusion**
- single hole - □
- multiple holes - ■
- Wisconsin National Forest Mineral Potential**
- Potential leasing areas - ▨
- Proposed known leasing areas - ▩
- U.S. Mineral Provinces**
- Zinc-Copper-Gold Province - ▨
- Tantalum-Nickel Province - ▩
- Possible Platinum Prov. - ▨
- Minor Niobium Province - ▩

# ELEMENTS ARE STUFF

There are 88 naturally occurring elements. The Elements of Life are the lighter elements. They are also the most abundant and available. People have found practical uses for all the elements - many of them very recently.

1 HYDROGEN	2 HELIUM																										
3 LITHIUM	4 BERYLLIUM	5 BORON	6 CARBON	7 NITROGEN	8 OXYGEN	9 FLUORINE	10 NEON																				
11 SODIUM	12 MAGNESIUM	13 ALUMINUM	14 SILICON	15 PHOSPHORUS	16 SULFUR	17 CHLORINE	18 ARGON																				
19 POTASSIUM	20 CALCIUM	21 SCANDIUM	22 TITANIUM	23 VANADIUM	24 CHROMIUM	25 MANGANESE	26 IRON	27 COBALT	28 NICKEL	29 COPPER	30 ZINC	31 GALLIUM	32 GERMANIUM	33 ARSENIC	34 SELENIUM	35 BROMINE	36 KRYPTON										
37 RUBIDIUM	38 STRONTIUM	39 YTTRIUM	40 ZIRCONIUM	41 NIOBIUM	42 MOLYBDENUM	43 TECHNETIUM	44 RUTHENIUM	45 RHODIUM	46 PALLADIUM	47 SILVER	48 CADMIUM	49 INDIUM	50 TIN	51 ANTIMONY	52 TELLURIUM	53 IODINE	54 XENON										
55 CESIUM	56 BARIUM	57 LANTHANUM	58 CERIUM	59 PRASEODYMIUM	60 NEODYMIUM	61 PROMETHIUM	62 SAMARIUM	63 EUROPIUM	64 GADOLINIUM	65 TERBIUM	66 DYSPROSIUM	67 HOLMIUM	68 ERBIUM	69 THULIUM	70 YTERBIUM	71 LUTETIUM											
87 FRANCIUM	88 RADIUM	89 ACTINIUM	90 THORIUM	91 PROTACTINIUM	92 URANIUM																						

The bigger the number, the heavier the element.

← Metals

Non Metals →

→ All elements after Uranium are man-made. They are radioactive and short-lived.

- The most abundant elements in the earth's crust.
- The main elements that make up all living things - The elements of Life. These make up 99.97% of all the atoms in our bodies.
- Essential trace elements for life - these are required by most plants and animals.
- Strategic metals - alloys, aerospace, industrial. These are stockpiled to protect.
- Platinum group - alloys. These are found together.
- Used in electronics and semi-conductors.
- Gases found in air - used in luminescent tubes and lasers.
- Rare Earth metals - high-tech uses; fluorescent light tubes, color TV, radar, lasers, nuclear technology, magnetic resonance imaging (MRI), ceramic/metal alloys, neutron absorbers.
- Used in photocells.
- Not found occurring naturally on earth - radioactive and short-lived.

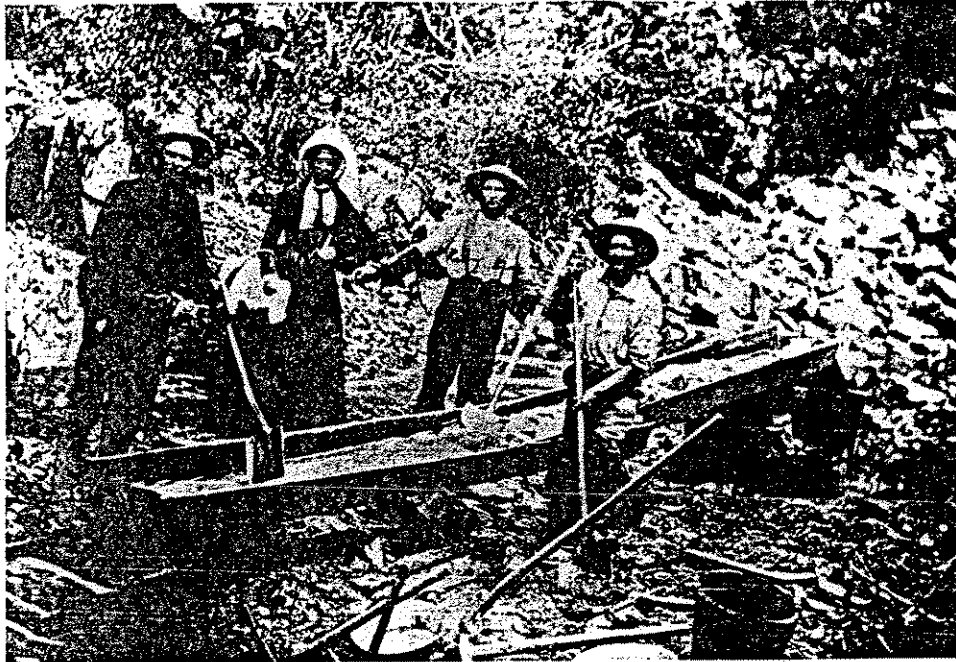


FIGURE 23.12 Gold mining in the Sierra Nevada, California, 1852. *California State Archives.*

filled pan allows the lighter minerals to be washed away, leaving the heavier gold in the bottom of the pan. Because of the recent high prices of gold, old-fashioned gold panning is undergoing a revival.

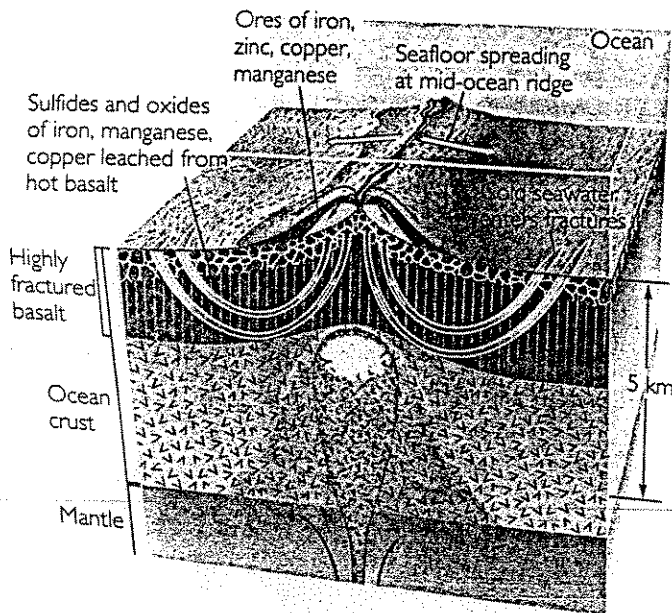
Some placers can be traced upstream to the location of the original mineral deposit, usually of igneous origin, from which the minerals were eroded. Erosion of the Mother Lode, an extensive gold-bearing vein system lying along the western flanks of the Sierra Nevada batholith, produced the placers that were discovered in 1848 and led to the California gold rush. The placers were discovered first, then their source. This was also the sequence of events that led to the discovery of the Kimberley diamond mines of South Africa two decades later.

Although there is probably an abundance of ore bodies on the deep seafloor, most known ore bodies are found on the continental crust. They either originated on the continent or occur as remnants of mineralized pieces of ocean crust thrust onto the continent in plate collisions. Figure 23.13 shows the locations of some of the major metallic ore deposits on the same map of continental deformation over geologic time that appears in Figure 21.1. Note that iron ores tend to be found in older parts of the crust and that ore deposits tend to be associated with orogenic belts.

## ORE DEPOSITS AND PLATE TECTONICS

With the advent of plate-tectonics theory, the various types of igneous activity could be explained in terms of the interactions of plates at boundaries where they separate or collide. Since igneous processes bring chemical elements and their mineral compounds from the interior to the surface, the theory of plate tectonics provides a foundation for understanding the origin of ore deposits. Such an understanding not only helps to explain existing ore deposits but also can lead to the discovery of new ones.

In 1979 geologists exploring the seafloor at a plate-separation center (the East Pacific Rise) made one of the most important geological discoveries in many decades. They found hot springs, laden with dissolved minerals, venting on the seafloor (see Box 17.2). These hot springs have their origin in seawater that circulates through fractures near the rift where the plates separate. The seawater is heated to temperatures of several hundred degrees Celsius when it comes in contact with magma or hot rocks deep in the crust. The heated seawater leaches minerals from the hot rocks and rises to the seafloor. When the hot waters, now loaded with dissolved minerals, reach



**FIGURE 23.14** Cold seawater percolates through fractured volcanic rocks at mid-ocean ridges and is heated when it approaches the magma chamber below. The hot fluid leaches metals from the basaltic rock and rises to the seafloor. When the hot fluid with its dissolved metals vents into the cold ocean-bottom waters, the metals it is carrying in solution precipitate as rich sulfides of iron, zinc, copper, and other ores.

the cooler upper crust and near-freezing ocean-bottom waters, the minerals precipitate (Figure 23.14). This is the origin of the “black smokers” shown in the photo in Box 17.2. In this manner enormous quantities of sulfide ores rich in zinc, copper, iron, and other metals are being deposited along mid-ocean spreading centers. High-grade deposits of native gold have been found in one submarine deposit on the Mid-Atlantic Ridge.

Once it was understood that current spreading centers are rich sources of mineral deposits, geologists began to look on land for the geological remains of ancient seafloor, which might also hold valuable resources. They found some of them in plate-collision zones where fragments of ancient oceanic lithosphere are occasionally emplaced on land. These deposits, known as ophiolites, are discussed in Chapter 20. The rich copper, lead, and zinc sulfide deposits in the ophiolites of Cyprus, the Philippines, the Apennines in Italy, and elsewhere probably owe their origin to the process of hydrothermal circulation along

ancient mid-ocean rifts. The copper deposits of Cyprus were as important to the economy of ancient Greece as Middle East oil deposits are to the modern economy. Economically important deposits of chromite ores are occasionally found in deeper portions of ophiolites. They may have originated by fractional crystallization within magma chambers that underlie mid-ocean ridges.

Many other types of deposits of sulfide ores, of hydrothermal or igneous origin, are found at modern and ancient plate-collision boundaries, including those of the cordillera of North and South America, the eastern Mediterranean to Pakistan, the Philippine Islands, and Japan (see Figure 23.13). Figure 23.15 summarizes some of the associations between plate tectonics and mineral deposits. Deposits found in magmatic arcs are thought to result from the igneous activity that typically occurs in collision zones. One hypothesis proposes that some of these collision-boundary deposits represent the second stage in a two-stage ore-forming process. The first stage is the creation of mineral ores by hydrothermal activity at a mid-ocean spreading center. The second stage, separated in time and space from the first, is the subduction and partial melting at a collision zone of oceanic sediments and crust containing these previously concentrated minerals. As the plate descends into increasingly hot regions of the mantle, the metals “boil off”—that is, they melt and rise into the overriding plate along with magma. The iron, copper, molybdenum, lead, zinc, tin, and gold found along convergent plate boundaries could have been created by hydrothermal activity and reborn by igneous processes, all driven by plate-tectonic movements.

The seafloor away from plate boundaries, however, may be the first candidate for deep-sea mining because of the widespread occurrence of **manganese nodules**, spherical aggregates of manganese, iron, copper, nickel, cobalt, and other metal oxides (Figure 23.16). The nodules vary in size, but most of them are a few centimeters in diameter. They are potentially valuable not only because of the gradual depletion of high-grade deposits of manganese on land but also because they are rich in other metals. Deposits are estimated to be in the trillions of tons.

This brief summary of the geology of mineral deposits barely touches on the great diversity of geological settings in which various minerals of value are found. Some minerals or ores are found mainly or only in one kind of deposit; others are found in a variety of settings. Table 23.2 shows the geologic occurrence and uses of some of the principal kinds of mineral deposits.



## Acid Rocks - Heavy Metals

The metallic sulfide ore found in the Wolf River headwaters and across north central Wisconsin is approximately 1/2 sulfur. Sulfur in the pulverized ore combines with the oxygen in the air and with water to make sulfuric (battery) acid. The 60 million ton Crandon orebody contains a lot of sulfur for making sulfuric acid.

The metals in the ore share chemical bonds with sulfur. When sulfur breaks up with its heavy metal companions to go with oxygen & WATER and become acid ( $H_2SO_4$ ), the heavy metals are liberated. The number of heavy metals concentrated principally in sulfide deposits is large; copper, lead, zinc, nickel, molybdenum, silver, arsenic, selenium, antimony, bismuth, cadmium, cobalt and mercury together with numerous rarer ones that occur mostly or only as atomic substitutes like gallium or indium. Gold is also found and uranium.

The Crandon deposit had its origins in metal rich brines; chemical interaction of volcanic liquids and gases with seawater.

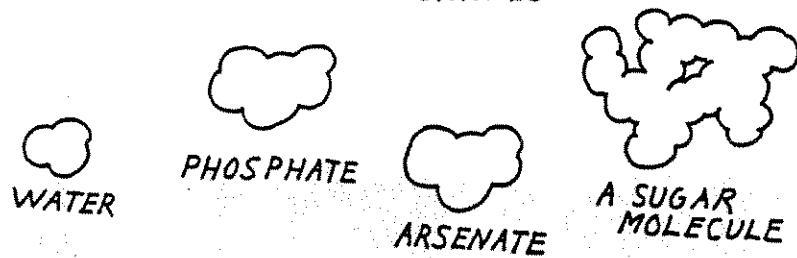
These ores have been locked up in solid rock and have never before been exposed to our oxygen-rich atmosphere except around their edges where they have been "weathered" underground by percolating groundwater.

What's wrong with mining anyway? What can be harmful in taking stuff out of the ground - the natural environment - removing valuable things from this stuff and leaving what's not wanted behind?

The waste products from the mine would contain many elements that our bodies are not familiar with or are not used to in large amounts. Our bodies have not evolved to use elements like mercury, lead, arsenic, cadmium and others. They were not usually available to us in our food and water and were relatively rare in our environment. Therefore we cannot defend against their interference in our body's chemistry when they are taken in and displace other familiar elements in our metabolism.

The huge scale of the proposed mine and its gigantic amount of waste would make the Crandon mine the largest hazardous waste containment experiment ever in Wisconsin.

SOME MOLECULAR SHAPES



**Arsenate and Phosphate — Chemical Look-Alikes.**

An arsenic atom will readily combine with four oxygen atoms to form the arsenate molecule. The arsenate molecule is a chemical look-alike to the phosphate molecule, similarly formed from phosphorous and oxygen. Phosphorous is an important element for living organisms. It forms nerve tissue, bones and teeth. Also, it makes up a part of the membrane tissue that surrounds living cells and transports the energy that fuels muscle contraction.

The cells recognize the shape of the phosphate molecule and readily absorb it. Unfortunately, as the diagram shows, the shape of arsenate is so nearly identical that cells do not distinguish between arsenate and phosphate. Thus, if substantial concentrations of arsenate are provided to the body, the damaging arsenate is taken into cells instead of the phosphate which the cells need.

METALLIC SULFIDE MINING IN WISCONSIN - A BAD IDEA

The only elements that would leave the Crandon mine site on train cars would be the saleable ones like gold, silver, lead, copper, and zinc. Unrecovered quantities of those, plus <sup>all waste</sup> ~~everything else~~, would remain permanently in the Wolf River watershed or be piped to the Wisconsin River. Mining the 60 million ton orebody would result in 55 million tons of pulverized waste rock, plus sludges, reagent chemicals, explosives residues, and contaminated acidic water. Everything that's junk to the <sup>multinational</sup> ~~mining~~ company would stay behind in Wisconsin's northwoods and wetlands.

There will be no traincars leaving the area loaded with arsenic, mercury, cadmium, or pyrite. Those will stay behind in the mine shafts and tailings heaps and pipes and streams and rivers - underground, out of sight, in solution, here, there, who knows where? - forever, or until water, which is always going somewhere, takes them along - usually to the nearest waterway by seepage or trickle or flood.

The trick to the mining company's getting a permit to mine the sulfide deposit in Forest County is in explaining away 55 million tons of acidic, toxic heavy element-leaching, goopy rock dust. Can they assure people that a 55 million ton toxic time bomb will be kept from the waters forever?

Probably not.

But, can they lobby the legislature to weaken water protection laws?

Can they pass minimum water standards that degrade water quality but allow them to pass the tests?

Can they proceed - unregulated - regarding wetlands, groundwater, construction, and waste dumping on their facilities?

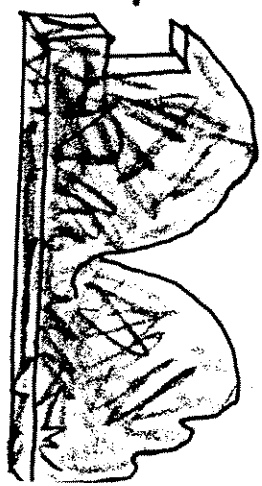
Can they do all this and pay no severance tax on the valuable ore?

NO! NOT IF THE PEOPLE SAY "NO SULFIDE MINES IN WISCONSIN!"

WATER IS OUR MOST VALUABLE MINERAL RESOURCE! METALLIC SULFIDE MINING PUTS OUR <sup>FRESH</sup> WATER AT TOO GREAT A RISK! IT'S A BAD IDEA!  
<sup>SUPPLY</sup>

# THE IMPORTANCE OF PARTICLE SIZE

CRANDON OREBODY



BLASTED OUT "STOPE"



CRUSHED ORE ROCK

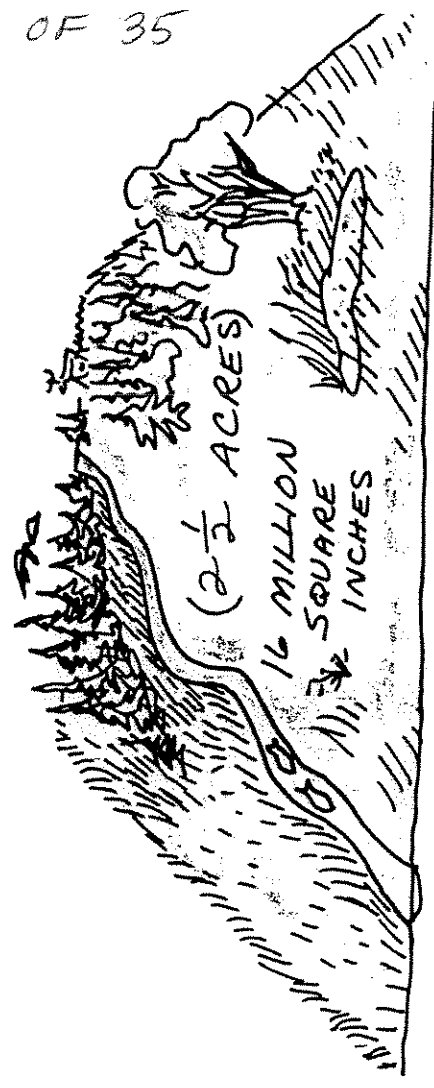
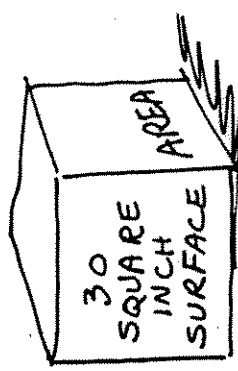


POWDERED ORE



THE "WASTE" SULFIDES RELEASED DURING THE MINING PROCESS COMBINE WITH WATER AND AIR TO MAKE ACID. THE SMALLER THE PARTICLES THE GREATER THE AMOUNT OF STUFF THAT CAN BE DISSOLVED

YOU CAN GET AN IDEA OF THE IMPORTANCE OF PARTICLE SIZE FROM THE FOLLOWING STATISTIC: A POUND OF AVERAGE ROCK IN A SOLID CUBE WOULD HAVE A SURFACE AREA OF ABOUT 30 SQUARE INCHES. BUT WHEN GROUND TO A 300-MESH POWDER (VERY FINE), THE SURFACE AREA IS INCREASED TO SOME 16 MILLION SQUARE INCHES.



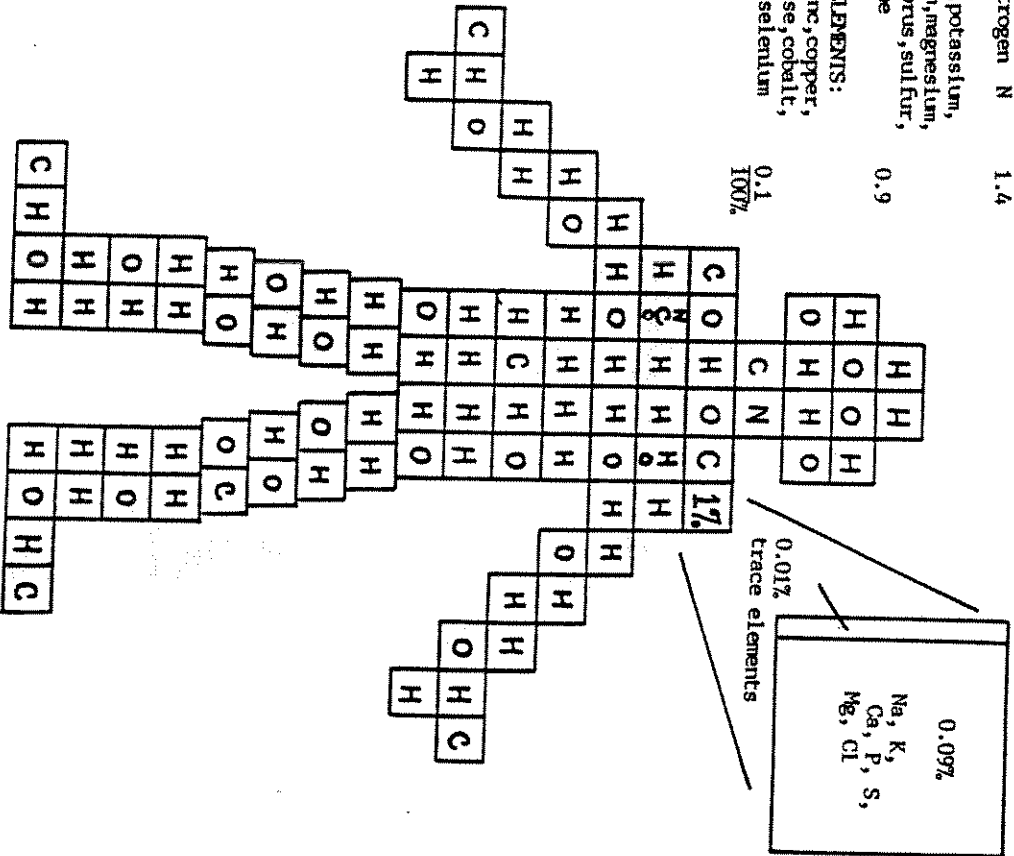
hydrogen	H	62.8
oxygen	O	25.4
carbon	C	9.4
nitrogen	N	1.4

sodium, potassium,  
 calcium, magnesium,  
 phosphorus, sulfur,  
 chlorine

0.9

TRACE ELEMENTS:  
 Iron, zinc, copper,  
 manganese, cobalt,  
 Iodine, selenium

0.1  
 100%



0.097%  
 Na, K,  
 Ca, P, S,  
 Mg, Cl

0.01%  
 trace elements

The health of your body depends on the right types and amounts of elements in your drinking water and in the soil where the fruits and vegetables grow. Plants take elements from the soil, air and water and knit them together into molecules your body needs, like vitamins and amino acids and plant sugars.

NOT TOO MUCH OF AN ELEMENT, NOT TOO LITTLE, BUT JUST RIGHT!

The atoms in your body are in relationships with each other using their energy and attractions to knit together molecules to build structures (cells, flesh, bones), to transfer electrons for energy capture (lungs, blood), to transmit information (nerves, brain, DNA), and to keep your whole body growing and rebuilding in a sophisticated "homeostasis".

YOU CHANGE AND GROW BUT YOU REMAIN YOU!

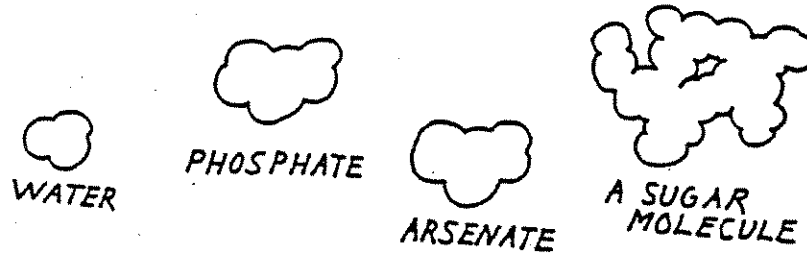
LARGE SCALE METALLIC SULFIDE MINING changes the abundance and availability of heavy elements in the soil and water. Pollution from METALLIC SULFIDE MINING has resulted in vast areas around the world where plants can't live and the animals and fish sicken and die. Too many sulfur atoms and metal atoms and unfamiliar chemical molecules are the cause. WATER, which is always going somewhere, takes them along - usually to the nearest waterway by seepage, trickle, or flood.

POLLUTION CAN BE INVISIBLE

Even dissolved and invisible in water, excess or unfamiliar elements and chemicals are a threat because, taken into your body they can mimic or displace needed elements and cause disease.

There are 100 squares in this figure. Each one represents 1% of the total number of atoms in the body. Just 4 elements - hydrogen, oxygen, carbon, and nitrogen - make up 99% of all the atoms in your body!

## SOME MOLECULAR SHAPES

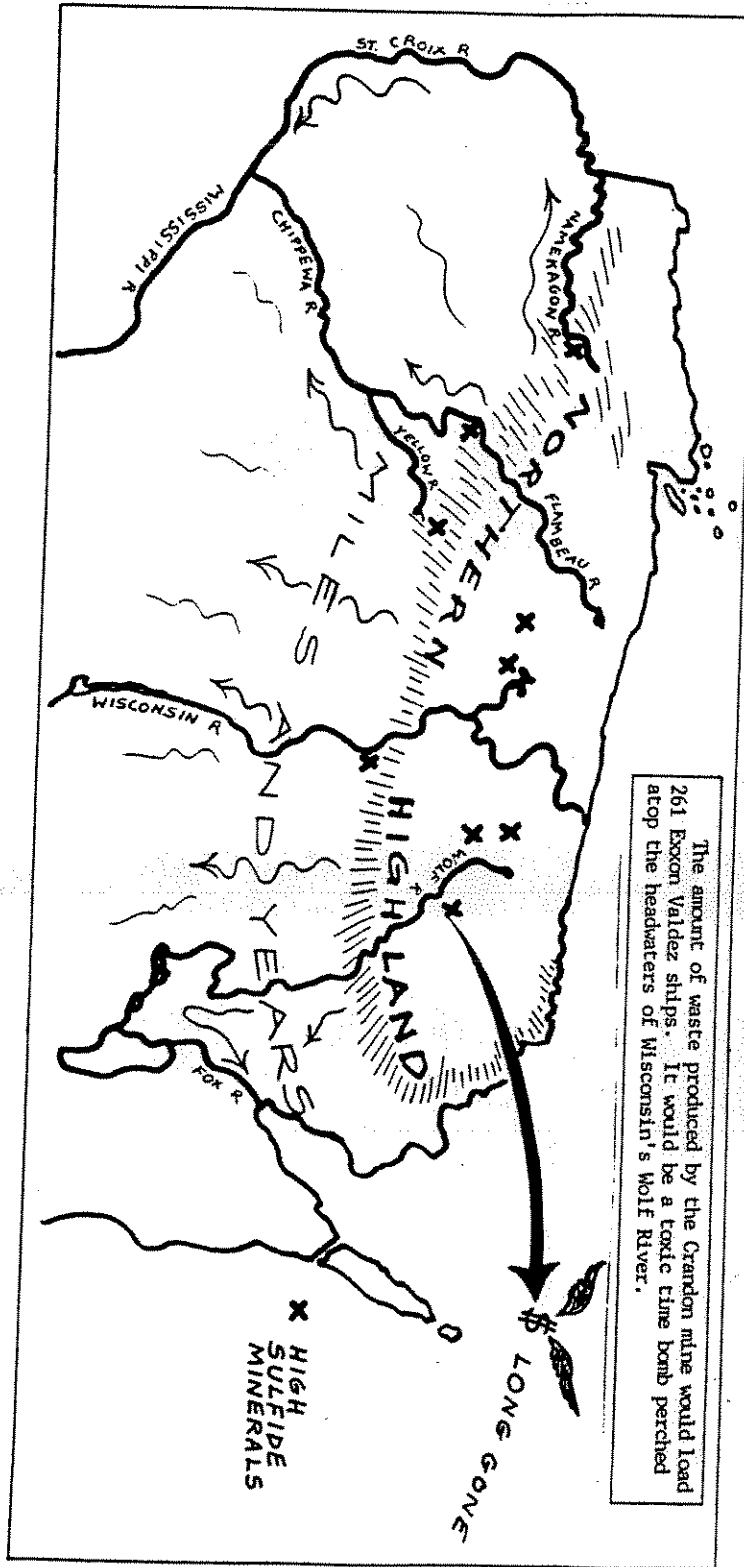


## Arsenate and Phosphate — Chemical Look-Alikes.

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# DUMPING ON WISCONSIN



These elements are part of a long list of elements that would be present in the mine waste. All elements, even the essential ones that we need in trace amounts - can be toxic in large amounts. Many elements are foreign to plants and animals because they were not commonly available or abundant in the environment as life was developing and adapting over time. Non-essential elements may resemble other elements enough to be taken into living tissues from the soil, water or air. They can change or destroy sensitive and balanced life functions.

#### LEAD non-essential

- \* a powerful neurotoxin
- \* can cause behavioral abnormalities like learning disabilities
- \* can cause anemia
- \* in the elderly, bone deterioration can release accumulated lead into the bloodstream, causing risk of kidney problems, memory loss, and cardiovascular disease

#### MERCURY non-essential

- \* simply a poison - all inorganic compounds of Hg highly toxic
- \* can be converted to organic methylmercury,  $\text{CH}_3\text{Hg}^+$ , by bacteria in water - it is fat soluble, long lasting and bioaccumulates
- \* damages the central nervous system
- \* causes auto-immune responses
- \* can cause growth abnormalities in embryos

#### ARSENIC non-essential

- \* lifetime consumption of 50 parts per billion in drinking water gives a person a 1 in 100 risk of developing cancer
- \* bioaccumulates

#### SELENIUM essential

- \* you need only 2 or 3 times what is safe (around 200 micrograms) to go into the toxic range - then it is 5 times more toxic than arsenic
- \* symptoms include; loss of muscle strength, fatigue, dizziness, depression, emotional instability, indigestion, diarrhea, skin sores, hair loss, numbness in fingers and toes, kidney problems, hyperactivity, asthma, attention-span problems

#### SULFUR essential

- \* when oxygen from air and water combines with the sulfur in pulverized ores it makes sulfuric acid - acid solutions increase the mobility of metals in soils, sediments and waters
- \* of the 60 million tons of waste from the proposed Crandon mine, half of it would be acid producing sulfides

#### CADMIUM non-essential

- \* a super toxin
- \* accumulates in the kidneys
- \* can cause emphysema and other lung conditions
- \* in Japan, Cd from mine waste and smelter particulates concentrated in rice and soybean crops to 10 times normal levels - caused bone pain and severe osteoporosis
- \* causes weight loss in babies of work-exposed moms
- \* livestock toxicity 10 parts per billion
- \* can damage immune systems and endocrine systems

#### ALUMINUM non-essential

- \* does not exist free (unbound) in nature
- \* acid rain or acid mine drainage leaches  $\text{Al}^{3+}$  out of soils and into surface and groundwaters
- \* fish and plants greatly damaged by  $\text{Al}^{3+}$
- \* implicated in Alzheimer's disease

#### ZINC essential

- \* excess zinc damages copper metabolism - pregnant women and animals should not routinely be given zinc supplements
- \* zinc has been found to increase the susceptibility of salmon and other fish to lethal ulceration

#### THALLIUM non-essential

- \* very soluble
- \* poisonous to nervous systems - thallium sulfate is a deadly rat poison
- \* enters body cells
- \* can be transported in water for a long distance

#### URANIUM non-essential

- \* can cause mutations in DNA and cell nuclei, damage protein and amino acid mechanisms, damage body tissue, and attack bone marrow

#### COPPER essential

- \* can be toxic to fish - the chronic aquatic toxicity limit is 24 parts per billion

#### COBALT essential

- \* ancient name comes from "kobold" meaning evil spirit - has long been known to be toxic
- \* bioaccumulates
- \* suspected to cause cancer of connective tissues and lungs



## Could Bacterial Mining Be In Wisconsin's Future?

Naturally occurring and genetically engineered bacteria will not reduce the problem of acid mine wastes and could create new bio-hazards.

Single-celled organisms are estimated to account for over half of the total weight of living creatures in the world...yet they are invisible, at least to human eyes. Some of these bacteria are being genetically altered to extract metals from ores.

2000 years ago, Romans working the Rio Tinto copper mine in Spain noticed that fluid running off mine tailings was blue, indicating that it contained dissolved copper salts. They were able to recover the copper even though they didn't know how it got into solution.

In the early 1950's it became known that the copper is in fact leached from mine tailings (crushed ore rock) by a bacterium; *Thiobacillus ferrooxidans*. The bacteria can get energy from the oxidizing sulfide minerals. When an oxygen atom "takes" an electron from a sulfur atom, bacteria gets the energy from the "jolt" given off by the chemical reaction. Sulfur then "lets go" of an iron atom. Some iron atoms are used by the bacteria to capture electronic energy. The combined sulfur and oxygen combines further with water to become acid. The acid is capable of dissolving most metals into water solution.

In 1958 Kennecott Copper Corporation ( owned by Rio Tinto Zinc, named after the Spanish mine and the largest mining company in the world today) got the first patent for a leaching process using the oxidizing bacteria. Poor quality ore is simply dumped outside a copper mine and treated with sulfuric acid to encourage the growth of *Thiobacillus ferrooxidans*. As the microbes chew up the ore, the copper is released and collected from the acid solution flowing into a catch basin.

In the early 1980's high grade ores near the earth's surface were playing out, forcing miners to rely on lower grades deeper in the mines.

In 1986 Gencor Pty) Ltd. opened the first pilot plant to test the bacteria at its Fairview mine in South Africa on sulfide ore containing gold. In the early 1990's Gencor's South African plant

became a commercial operation.

Presently, Gencor is aiding in construction of 4 more plants - 2 in Australia, 1 in Brazil and 1 in Ghana. The Gencor process mixes ore with a bacterial brew in huge stirred reactors.

In February 1994 Newmont Mining Company in Nevada announced a new patented process that brings bio-leaching of gold to the Northern Hemisphere for the first time. This new scheme simply deposits bacterial cultures and fertilizers, which nurture the bacteria, on open ore heaps that rest on an impermeable base.

Some sulfur "eating" bacteria are Archaeobacteria-thermophiles (heat lovers) that are the most ancient and primitive single-celled forms of life on earth. They have thrived inhabiting deep ocean hot springs and hot springs in places more familiar like Yellowstone Park and Iceland.

Bacteria can reproduce every 15 to 30 minutes. They grow until they split into 2. Mutations occur once every million divisions on average. As long as conditions allow single-celled bacteria keep on replicating without stopping.

Uncontrolled cell replication is the hallmark of cancer in more complicated multicelled creatures. Humans have a highly developed body chemistry that controls and times replication and building of cells. Our body chemistry is too complex to adapt quickly to drastic changes and mutations.

Bacteria used in mining needs to be genetically altered to become immune to poisons like mercury, cadmium and arsenic which can slow down their effectiveness.

But the ways by which bacteria become adapted to poisons are so different from the ways higher plants and animals can use, that we must heed a general warning; increasing the number of environmental chemicals increases the variety of resistant bacteria. The ways in which bacteria detoxify their environment sometimes proves lethal for other organisms. For example, mercury in water can be converted to methyl mercury compounds that are fat soluble. They are long-lasting and bio-accumulate in the food chain. They can be found in the meat of contaminated fish.

Technology often causes more problems than it solves. And what about all the acid needed to encourage bacterial growth. The acid mine drainage problem persists!

CLAIRE VANDERSLICE

ALL PEOPLE SHOULD BE CONCERNED ABOUT  
BIOMINING

Mining company spokespersons say that bacterial mining "isn't expected to provoke any concern among environmentalists." The following are some very real concerns:

- (1)LEGAL: Why should naturally occurring organisms, or a process that occurs naturally, be patentable? Companies are applying for patents on Archaeobacteria that live in the hot springs in Yellowstone National Park. These are protected creatures on publicly owned land.
- (2)ECONOMIC: Why couldn't private citizens obtain some pyrite and some Thiobacillus bacteria and make some gold as a cottage industry? They could also market the sulfuric acid as a by-product. Sulfuric acid is the number 1 industrial chemical produced in the U.S. yet Crandon Mining Company said they couldn't find a market for it.. *so it has to go in the landfill.*
- (3)TOXIC LANDFILLS: When the gold and other valuable metals are skimmed off there will be millions of tons of acidic powder containing tons of heavy metals and other toxic chemical reagents left behind.
- (4)BIO-HAZARDS: Bacteria are being genetically engineered to stand up to the presence of heavy metals, such as mercury, cadmium, and arsenic, that poison the microbes and slow down bioprocessing. The ways by which bacteria become adapted to poisons are so different from the ways higher plants and animals can use, that we must heed a general warning; increasing the number of environmental chemicals increases the variety of resistant bacteria. The ways in which bacteria detoxify their environment sometimes proves lethal for other organisms. For example, mercury in water is converted by bacteria to methyl-mercury compounds that are fat soluble, long-lasting and bioaccumulate in the food chain. Mercury converted in this way by bacteria is thus much more dangerous to us. What if, for instance, a bacterium was engineered to methylate cadmium and arsenic and make that available in the water in a form that fish can ingest too?
- (5)ENVIRONMENTAL PROTECTION: Why aren't the products of genetic engineering regulated to protect us?
- (6)TAXPAYERS ARE BEING CHEATED: Why is U.S. taxpayer supported research

into the understanding of Mother Earth not treated and discussed as a common interest among all the members of our community before it is usurped by technological industry to be made into product to be sold to us? Why does tax supported research benefit multinational corporations so richly?

- (7)SPIRITUAL: Humans are part of the web of life. Our ability to think and talk gives us a responsibility to use those gifts to protect the things that give us and all generations that succeed us - clean air, water, and soil. Technology without wisdom has given us oil spills, ozone depletion, global warming, toxic pollution and deforestation.
- (8)HUGE SCALE: The gigantic proportions of the Exxon-Rio-Algom Crandon project proposal threatens 2 watersheds; the beautiful and pristine Wolf River and the mighty Wisconsin River (already burdened by dams and pollution).  
50 MILLION TONS OF HAZARDOUS WASTE ARE GOING TO SIT FOREVER-DUMPED ON THE HIGHEST GROUND IN WISCONSIN-at the headwaters of the Wolf River.  
EXXON's human representatives say "Trust us".  
EXXON's human representatives said "Trust us" in Alaska too!
- (9)PERSONAL: I don't trust a non-living entity with multi-national non-roots.
- (10)SUSTAINABILITY: Technological bigness and power on a finite planet is in question. Appropriate technology is low-impact technology operating on decentralized, small-scale principles; solar energy versus nuclear energy, diverse sustainable farming versus agribusiness, steady-state economics versus the absurd fantasy of never ending growth.
- (11)PRINCIPLES OF DEMOCRACY: The real decisions about technological introduction are made by only one segment of society; the corporate, based strictly on considerations of profit. This is clearly antithetical to the democratic process.

The 50 Highest Volume Chemical "Feedstocks" Produced in U.S. (1985)

- 1 -  $H_2SO_4$  sulfuric acid. By far the most widely used industrial chemical, its production was 79.23 billion pounds in 1985.
- 2 - N the element nitrogen.
- 3 -  $NH_3$  anhydrous ammonia.
- 4 - CaO lime.
- 5 - O the element oxygen. It is preferentially absorbed from air, as is nitrogen.
- 6 -  $H_2C:CH_2$  ethylene. 13,000 tons were produced in 1984. Ethylene is produced directly from crude oil in an advanced cracking reactor process. Exxon and Union Carbide teamed up in 1996 to become one of the largest producers. It is vital to the manufacture of polyethylene, polypropylene, ethylene oxide, ethylene dichloride, ethylene glycols, aluminum alkyls, vinyl chloride, vinyl acetate, ethyl chloride, ethylene chlorohydrin, acetaldehyde, ethyl-alcohol, polystyrene, styrene, polyvinyl chloride (PVC), SBR, polyester resins, trichloroethylene, etc.
- 7 -  $H_3PO_4$  phosphoric acid.
- 8 -  $Na_2O$  sodium hydroxide (caustic soda).
- 9 - Cl the element chlorine. It is not found free in nature. Salt or hydrochloric acid are subjected to electrolysis (an energy-intensive process) to separate out the chlorine, a greenish-yellow gas with a sharp disagreeable smell that is very poisonous. It was first used as a military poison because it was found that "free" chlorine would readily combine with organic chemicals (compounds of carbon). In nature it is rarely or never found combined with organic chemicals. Salt, for instance, is not organic because NaCl, sodium chloride, does not contain any carbon. Free chlorine is essential to the manufacture of carbon tetrachloride, trichloroethylene, chlorinated hydrocarbons, polychloroprene (neoprene), polyvinyl chloride (PVC), ethylene dichloride, chlorobenzene, etc. Threshold of toxicity; 1 part per million in air. People use organochlorine chemicals to kill plants, insects, spiders, fungi, bacteria, nematodes, and each other. They use them to clean clothes, to make plastics and lubricants and refrigerants. They don't stop their chemical actions when people throw them away or burn them. The chlorine chemicals end up in rivers and groundwater

\* Carbon is the active element in photosynthesis and thus occurs in all plant and animal life.

and in the oceans. They evaporate into the air and even go up to disrupt the earth's ozone layer. They also end up in our bodies because we drink them in our water and breathe them in our air. Organochlorine chemicals can be hormone mimics. They are similar in size and shape to hormones, so receptors in cells of the body can mistake them for hormones. Once inside the cell, they can get admittance to the nucleus where they can disrupt the DNA. DNA is the blueprint of instructions for the workings of growth, metabolism and reproduction. Many people are urging a phaseout or ban of these organochlorine chemicals. Alternative products are available for most or all of them.

- 10-  $\text{NaCO}_3$  soda ash.
- 11-  $\text{HNO}_3$  nitric acid.
- 12-  $\text{CH}_3\text{CH}:\text{CH}_2$  polypropylene.
- 13-  $\text{NH}_4\text{NO}_3$  ammonium nitrate (saltpeter).
- 14-  $\text{ClCH}_2\text{CH}_2\text{Cl}$  ethylene dichloride.
- 15-  $\text{CO}(\text{NH}_2)_2$  urea.
- 16-  $\text{C}_6\text{H}_6$  benzene.
- 17-  $\text{CO}_2$  carbon dioxide.
- 18-  $\text{C}_6\text{H}_5\text{C}_2\text{H}_5$  ethyl benzene.
- 19-  $\text{CH}_2:\text{CHCl}$  vinyl chloride.
- 20-  $\text{C}_6\text{H}_5\text{CH}:\text{CH}_2$  styrene monomer.
- 21-
- 22-  $\text{CH}_3\text{OH}$  methyl alcohol (methanol, wood alcohol).
- 24-  $\text{HCHO}$  formaldehyde.
- 25-  $\text{HCl}$  hydrochloric acid.
- 26-  $\text{C}_6\text{H}_4(\text{CH}_3)_2$  xylene (dimethylbenzene).
- 27-  $\text{C}_6\text{H}_5\text{CH}_3$  toluene.
- 28- o,p, and m-xylene (1,4 dimethylbenzene).
- 29-  $\text{CH}_2\text{OHCH}_2\text{OH}$  ethylene glycol.
- 30-
- 31-  $\text{C}_6\text{H}_5\text{CH}(\text{CH}_3)_2$  cumene (isopropyl benzene).
- 32-  $\text{K}_2\text{CO}_3$  potassium carbonate.
- 33-  $\text{CH}_3\text{COOH}$  glacial acetic acid.
- 34-  $\text{C}_6\text{H}_5\text{OH}$  phenol (carbolic acid).
- 35- carbon black.
- 36-  $\text{H}_2\text{C}:\text{CH}:\text{CH}:\text{CH}_2$  1,3 butadiene (vinylethylene).

37 -  $\text{Na}_2\text{SO}_4$  sodium sulfate, anhydrous (salt cake).

38 -  $\text{H}_2\text{C}=\text{CHCN}$  acrylonitrile (vinyl cyanide).

39 -  $\text{CH}_3\text{COOCH}=\text{CH}_2$  vinyl acetate.

40 -  $\text{Al}_2(\text{SO}_4)_3$  aluminum sulfate - alum.

41 -  $\text{H}_2\text{C}-\underset{\text{O}}{\text{CH}}-\text{CH}_3$  propylene oxide.

42 -  $\text{CH}_3\text{COCH}_3$  acetone.

43 -  $\text{C}_6\text{H}_{12}$  cyclohexane.

44 -  $(\text{CH}_3)_3\text{COCH}_3$  methyl-tert-butyl ether (MTBE).

45 -  $\text{TiO}_2$  titanium dioxide.

46 -  $\text{CaCl}_2$  calcium chloride.

47 - sodium silicate (water glass).

48 -  $\text{COOH}(\text{CH}_2)_3\text{COOH}$  adipic acid.

49 -

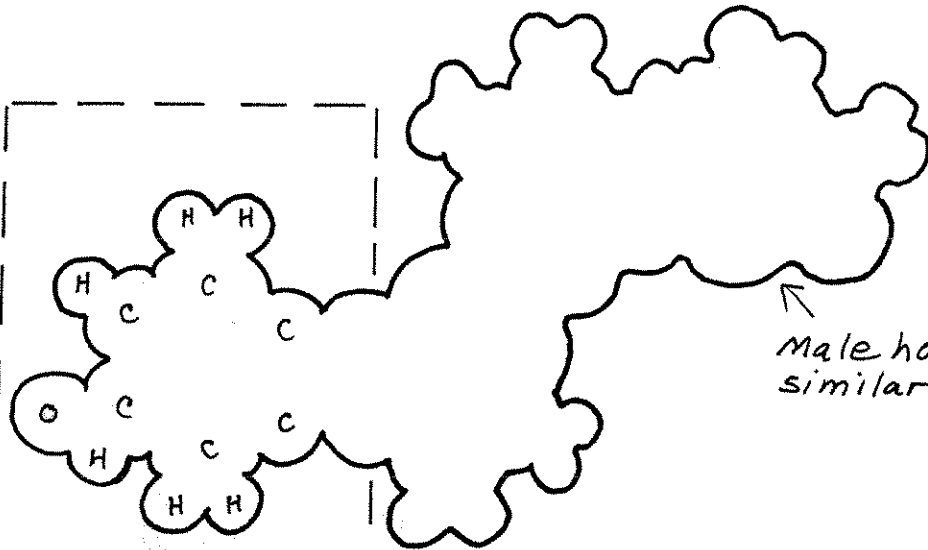
50 -  $(\text{CH}_3)_2\text{CHOH}$  isopropyl alcohol.

from: Hawley's CONDENSED CHEMICAL DICTIONARY Eleventh Edition  
revised by N. Irving Sax and Richard J. Lewis, Sr., pub. by  
Van Nostrand Reinhold Co. New York. 1987.

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# DIOXIN : A HORMONE MIMIC

A FEMALE HORMONE (ESTRADIOL)

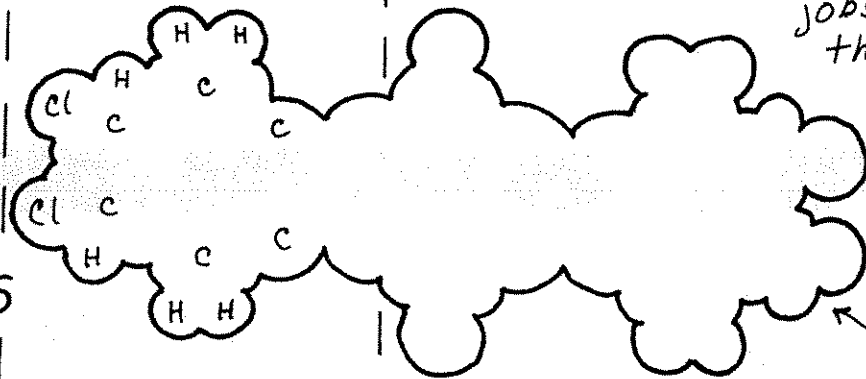


Male hormones look similar.

By mistaken identity, a bungling idiot is allowed to muck around in the cell's DNA preventing real hormones from doing their jobs while damaging the DNA with chlorine.

DIOXIN MIMICS HORMONES

(looks similar but is not the same).



An organochlorine

C - carbon  
H - hydrogen  
Cl - chlorine

Hormones are recognized at receptor sites and are allowed to enter the guarded nucleus of the cell. Their shape is the key to the door. The nucleus holds DNA, the blueprint for all the enzymes that the organism needs in order to do chemistry at body temperature. The enzymes help bring about the chemistry for bodily functions of metabolism, growth, and reproduction.



# BHP's Dirty Deeds

THE SAGA OF ONE OF THE MOST DESPICABLE ABUSES of corporate power in recent history has come to an apparent close.

Through a settlement of a landmark lawsuit filed by Australian lawyers in Australian courts, some measure of compensation has been extracted from BHP, the Australian mining giant which operates the large Ok Tedi copper mine in Papua New Guinea (PNG).

But the company's gambit that it could defeat or at least derail a meritorious suit in Australian courts through absolute abuse of the PNG law-making process succeeded. As a result, the company has managed to forestall any truly just resolution of the conflict it engendered with communities living downstream from the mine, and a **horrific law has been entered on the PNG books. That law will protect other foreign companies operating in PNG and may soon be copied in other countries, at the behest of multinational corporations whose power increasingly matches that of sovereign governments.**

The Ok Tedi mine is one of the world's great mining disasters [see "The Big, Ugly Australian Goes to Ok Tedi," *Multinational Monitor*, March 1996]. BHP refused to build a tailings (rock waste) dam or construct another means to dispose of the enormous amount of waste rock generated at the mine, choosing instead to dump 80,000 tons of completely untreated rock waste into the Ok Tedi and Fly Rivers every day. The resultant siltation and toxic leaching has poisoned and practically killed the Ok Tedi for 120 miles downstream. Tens of thousands of landholders who relied on the rivers for fish, clean water and support of riverside ecosystems have seen their primary means of sustenance destroyed.

In 1994, the Australian law firm Slater & Gordon filed suit against the company on behalf of 30,000 landholders harmed by the downstream pollution.

In June of this year, BHP and Slater & Gordon announced a settlement of the suit, the value of which is estimated at roughly US\$350 million to US\$450 million. The terms of the settlement call for BHP to:

- stop mine tailings from entering the Ok Tedi/Fly River system;
- dredge the Ok Tedi River to relieve the effects of flooding, erosion and deposition of sediment on riverside land caused by the many years of dumping into the River; and
- pay a total of \$120 million to affected villagers.

Although the amount of money involved appears to be substantial, the terms of the settlement constitute only a partial victory for the landholders.

The commitment to stop the tailings dumping, the most important element of the settlement because it should prevent future harms, is rather shaky. BHP has agreed only to submit its favored tailings disposal option to a PNG government inquiry, and to implement the option if it proves feasi-

ble. Slater & Gordon lawyers believe the settlement agreement, enforceable by Australian courts, provides them with the means to ensure BHP carries out the disposal option, but the actual language of the agreement does not inspire confidence.

Even if BHP does abide by the deal, its "preferred option" is to build a 70-mile-long piping system to a downstream dump. This option, estimated to cost between \$250 million and \$360 million, is the cheapest of several alternatives available to BHP. It is also the least environmentally friendly option. Among other problems, it will still allow 40,000 tons of waste to be dumped into the Ok Tedi every day.

The dredging scheme faces the same uncertainty problems as the tailings disposal plan; BHP states it "has under serious consideration" a dredging plan, but does not guarantee it will carry it out. Even if the dredging of the most polluted parts of the Ok Tedi does take place, it will probably be too little, too late. The upper part of the river is almost biologically dead, and unlikely to regenerate any time soon.

The compensation will constitute a lot of money for the PNG plaintiffs, but it is paltry compared to the sums BHP has raked in from the mine (which earned \$120 million last year alone) or to the enormous damage BHP has inflicted on the area.

In any case, money is a poor substitute for the theft of the PNG landholders' way of life. And, unless the compensation dispensation is administered very carefully, the sudden introduction of relatively large money sums in PNG communities which were only recently forced into the cash economy may disrupt the communities still further.

Although the settlement prohibits the PNG landholders and their lawyers from criticizing the agreement publicly, Slater & Gordon lawyers are well aware of the settlement's shortcomings.

They were coerced into settling, however, by a recently enacted PNG law — drafted by BHP lawyers — which makes it a crime to bring suits against resource companies in foreign courts. That law essentially criminalized the plaintiffs' actions in the case against BHP.

BHP was willing to settle because of a constitutional challenge to the law (in PNG courts) which was dropped as a condition of the settlement.

Although still vulnerable to constitutional challenge by lawyers other than Slater & Gordon, the law now stands on the books, a dark testament to BHP's insidiousness and shamelessness. It will protect BHP from an OK Tedi-style suit for its other operations in PNG, and, worse, will afford similar protection to the other mining, oil and timber companies ravaging the PNG countryside. Most alarmingly, it may serve as a dangerous model that BHP or other multinational corporations may try to replicate in other countries. ■

## Grotesque Inequality

THE RICHEST 358 PEOPLE in the world — the global billionaire club — possess assets which exceed the combined income of countries accounting for 45 percent of the world's population.

That is the most startling finding in the United Nations Development Program's (UNDP's) "Human Development Report 1996," which concludes that income and wealth inequality is skyrocketing worldwide.

While almost all industrialized countries have experienced at least slow growth over the last decade and 15 countries, mostly in Asia, have registered spectacularly high growth rates in the last 10 years, 89 developing countries are poorer today than they were a decade ago, according to the report. In 70 developing countries, today's income levels are less than those reached in the 1960s or 1970s.

"The advances [in the high-growth Asian countries] have often been at rates exceeding anything seen since the start of the industrial revolution some two centuries ago," the report says. "The declines have also been unprecedented, far exceeding in duration, and sometimes in depth, the declines of the Great Depression of the 1930s in the industrial countries."

The result of the disparity in growth levels is that income is concentrating in the hands of the global rich. The richest 20 percent of the world's population saw their share of global income rise from 70 percent to 85 percent in the past 30 years. The share of the poorest 20 percent has dropped from 2.3 percent to 1.4 percent.

"The imbalances in economic growth over the past 15 years are clear enough. But if allowed to continue well into the next century, they will produce a world gargantuan in its excesses and grotesque in its human and economic inequalities," the report concludes.

Domestic inequalities are staggering as well, the report finds. Among the rich countries, the report finds high inequalities in Australia and the United Kingdom — where the richest 20 per-

cent earn 10 times more than the poorest 20 percent — and in the United States and Switzerland — where the richest earn nine times more. Among poor countries, the disparities are greatest in Latin America. In Guatemala and Panama, the richest 20 percent earn 30 times more than the poorest 20 percent; in Brazil, the richest earn 32 times more. Income inequality has also increased dramatically in recent years in Eastern Europe and the former Soviet Union.

The report shows that internal inequality is increasing in those countries — including Brazil, Chile, Guatemala, the United Kingdom and the United States — which already exhibit the greatest concentration of wealth.

A central theme of the report is that, contrary to longstanding economic dogma, income and wealth inequality actually harms growth. "The new insight is that an equitable distribution of public and private resources can enhance the prospects for further growth," the report states.

The report does not romanticize growth, however. It criticizes policymakers "mesmerized by the quantity of growth," and warns of the danger of jobless growth, ruthless growth (where new wealth is concentrated in the hands of the rich), voiceless growth (growth without democracy), rootless growth (causing people's cultural identity to wither) and futureless growth

(accomplished at the expense of natural resource depletion).

The overarching purpose of the UNDP's annual human development report is to promote a broader measure of human well-being than narrow economic standards, and to encourage policymakers to assess their performance by the broader standard.

The Human Development Index (HDI) is a composite figure based on life expectancy at birth, educational attainment and real income. The 1996 report ranks Canada atop the list, with Cyprus and Barbados first among developing countries. After Canada, the top countries in the HDI ranking are, in order, the United States, Japan, the Netherlands, Norway, Finland, France, Iceland, Sweden and Spain.

The report analyzes human development and growth in the last several decades to conclude that, while there is not an absolute link between the two, they mutually reinforce one another in a "virtuous circle."

"Short term advances in human development are possible — but they will not be sustainable without further growth. Conversely, economic growth is not sustainable without human development," says Richard Jolly, chief author of the report and special adviser to the administrator of the UNDP.

But while concluding unequivocally that "healthy, well-educated people make an economy more productive," the report is just as firm in asserting that "the development of human capabilities is an end in itself."

— Robert Weissman

## BHP Strikes in Dominica ...

ROSEAU, DOMINICA — Following its reluctant settlement with landholders in Papua New Guinea over damage caused by its Ok Tedi copper mine, BHP is quietly planning another copper mine in another small developing country on the opposite side of the planet.

Until six months ago, few citizens of Dominica, a tropical island nation in the eastern Caribbean, had ever heard of BHP, Australia's largest mining com-

pany and one of the world's largest copper producers, or Ok Tedi. Now many Dominicans fear that BHP will replicate in their country the destruction of ecology and lifestyles it wrought in the Fly River watershed of Papua New Guinea.

Dominica is a mountainous island of volcanic origin, only 290 square miles in area. Its population of about 75,000 people comprises a deeply religious and agrarian society with cultural influences

## THE FRONT

from West Africa, Amerindians and French and English colonizers.

"This mine is the greatest threat to Dominica since Columbus," says Atherton Martin, president of the Dominica Conservation Association. "We are just courting a major environmental disaster to even consider mining here."

More than two thirds of Dominica is covered by tropical forests, the largest and last remaining area of primary oceanic rainforest in the Caribbean, with plant diversity alone of more than 1,200 species. It is these ecological assets — the forests, rivers, lakes, waterfalls and marine life — that allow Dominica to promote itself as a premier ecotourism destination and postcards to proclaim the country "the nature island of the Caribbean ... unspoiled ... untouched ... natural!"

BHP has applied for exploration permits covering 10 percent of Dominica's land surface, an area of 75 square kilometers centered on protected rainforest. The permits would allow BHP to cut roads and drill in two important forest reserves if its application is approved. Dominicans believed their rainforests to be protected until a new Mines and Minerals Act was rushed through Parliament without public discussion earlier this year.

BHP assisted the government in devising a mining law by providing examples of mining laws in other countries in the region and preparing a draft exploratory license at the government's request, according to company spokesperson Steadman Ellis. Ellis says the company has been "open and straightforward" about the assistance provided to the government, providing copies of material submitted to the government to the DCA and others.

Phillip Pyle, BHP's exploration manager for the western hemisphere, defended BHP's operations in the *Trinidad Guardian*, saying that mining "has a bad reputation but it's only exposing materials which normally lie below the earth's surface. All of man's activities have their own impact, but we anticipate a mine would cause minimal surface disturbance."

"We feel the project doesn't mean we'd be spoiling the natural beauty of

Dominica," he added. "When a mine is finished, soil and vegetation are restored."

With high rainfalls (up to 10 meters a year in the central highlands), steep terrain, highly erodible soils, seismic activity (at least four live volcanoes, with the last lava flow in 1985) and a hurricane every 15 years on average, Dominica presents substantial tailings and chemical disposal challenges.

A major accident at a large mine in tiny Dominica could be devastating. "Environmental disasters of the scale we see in Papua New Guinea and with the Omai cyanide spill in Guyana would wipe out Dominica," warns Martin. "The threat of BHP's proposed mine is much more direct and enormous than anything we have faced before."

A copper mine operated by a multinational company with an annual profit 15 times larger than Dominica's national economy would also drastically alter the development path of the entire country. The main economic sector in Dominica is agriculture, particularly bananas and coconut products, and nature-based tourism is a new and rapidly growing industry. The forest reserves are an integral part of the natural attractions for tourists, and 2,000 direct and indirect jobs in the tourism industry could be jeopardized if a copper mine in the forests compromised Dominica's "nature island" image.

In addition to encompassing some of Dominica's most diverse rainforests, BHP's proposed exploration area partly covers and is directly upstream of the Carib territory, the lands of the last surviving indigenous Amerindian culture in the Caribbean. Exploration and mining could degrade three of the country's major rivers with siltation and acid drainage, two of which border the Carib lands and are used by the 3,400 Caribs for drinking, washing, fishing and agriculture.

"It will be very bad for the Caribs if the forest is damaged; we rely on it for our waterflow and canoe building," Carib Chief Hilary Frederick says. "In the final analysis it means the Caribs will be diminished."

Ellis says BHP has established a dialogue with the Caribs to incorporate their concerns and participation into

the exploration process.

More generally, Ellis says, "it is premature to judge the company's intentions in Dominica." The company is only preparing to engage in an exploration process, not a development one. If BHP discovers a significant ore deposit in Dominica, he says, then it would be possible to weigh the potential benefits and risks, including environmental dangers and threats to the Caribs. "All stakeholders" would have a chance to express their informed views then, he says.

Moreover, he says, Ok Tedi has taught the company a lesson. At Ok Tedi, "we got some things wrong" and had to fix them after the fact. "We don't want to do it again," he says. As a result of Ok Tedi, "we think we will pay more attention [to environmental and indigenous rights issues] than most companies, not the reverse."

Many Dominicans — led by the Dominica Conservation Association and the island's ecotourism industry — are not convinced. They are pressuring their government and considering legal action to prevent the issue of exploration permits, and to ensure that mining by BHP or any other company does not occur. Along with the Australian Conservation Foundation and the Berkeley-based industry watchdog, Project Underground, they are appealing directly to the shareholders of BHP that if they must invest in Dominica, to invest in sustainable rather than destructive development.

The DCA's Martin will attend BHP's annual shareholder's meeting in Sydney in late September.

"Consider that what [BHP shareholders] are going to gain in Dominica is at the expense of an entire nation, an entire people, and one of the last remaining tropical environments in the world," says Martin. "If that is what shareholders want as a legacy, then go forward with the mining in Dominica, but over our dead bodies. I believe there is a bond that exists between the people of Dominica and our natural rivers, waterfalls, lakes, forests and soils, that cannot and will not be broken."

— Mark Horstman  
Mark Horstman is a Councillor of the Australian Conservation Foundation.

## ... and BHP Strikes in Canada

**T**ORONTO — Think of it as Klondike II, only this time, it's diamonds.

A Canadian Environmental Assessment Review Panel gave the green light to North America's first diamond mine, projected to be the third-largest diamond find in the world, on June 21. Australian mining company BHP is scheduled to begin construction of the mine later this year in anticipation of commercial production in 1998.

The \$17 billion find is located near Lac de Gras, 300 kilometers northeast of Yellowknife in Canada's Northwest Territories. It is expected to earn BHP \$500 million per year, a figure comparable to the total current value of the Northwest Territories' mining and exploration industry.

In an area where unemployment hovers at 17 percent, the mine is expected to provide 650 permanent jobs over its 25-year life span, making it the largest private employer in the Territories.

The project has also spurred a flurry of spin-off mining projects as smaller companies stake dozens of claims nearby. Six future mines are already on the drawing board for the region over the next 10 to 20 years, including planned projects by British conglomerate RTZ and South African industry giant De Beers Consolidated Mines.

The region's mayors, local shopkeepers and the territorial government are among the mine's cheerleaders. Yellowknife Mayor David Lovell was "quite pleased" with the panel decision. "We need an industrial base to support the population in the Northwest Territories," he says. "And that's going to have to be [resource] extraction."

But while they generally support opening a diamond mine in the region, environmentalists, indigenous leaders and scientists are alarmed at the lack of scrutiny and the pace with which the approval process proceeded.

"The environmental review was not comprehensive, rigorous or fair," said the Ottawa-based Canadian Arctic Resources Committee in a letter to federal Environment Minister Sergio

Marchi following the ruling. The group points to the absence of land claims settlements for Native groups, the lack of a rigorous technical review of the project, the limited scope of the panel and the need for effective monitoring of mining operations.

On July 23, the World Wildlife Fund (WWF) Canada filed for judicial review of the panel's procedures.

The proposed site lies in the migration path of the Bathurst caribou herd, the largest free-roaming herd in the Territories. This sub-arctic wilderness is also home to grizzly bears, wolves and other species.

BHP plans to drain — or "dewater" — five lakes, covering 890 hectares, in order to access the diamond-bearing rock, and it would dump 826 million tonnes of waste rock annually into a sixth lake.

BHP contends that the environmental effects of the mine are "predictable and mitigatable," according to Karen Azinger, manager of external affairs at BHP Diamonds, the BHP subsidiary that owns 51 percent of the project (Vancouver-based Dia Met Resources owns 29 percent, and the two people who discovered the site, Charles Fipke and Stewart Blusson, each own 10 percent). "Diamond mining is the most benign form of mining that there is," she says.

But scientists have complained that the company's environmental impact study was shoddy, and that the scope of the environmental assessment panel's review was inadequate.

David Schindler, an aquatic ecosystems expert at the University of Alberta, says BHP's environmental impact assessment is "superficial" and "totally inadequate [in assessing] the effects of the mine on the environment."

"Frankly, we don't have enough left in Canada to write off another region of lakes and fish," Schindler adds.

The federal government has also not reached a land agreement with Native Dene peoples who reside on land where the mining will take place. Without such agreements, Native groups are worried that they risk becoming an

"embittered minority" as new residents move into the area, drawn by mining development. In addition, they are concerned that industrial development will not be balanced with conservation of the ecosystem, and that they will not receive any revenues from the mining activity.

"Our people are the ones who are going to be here a hundred years from now, having to cope with what gets left behind," says Dene Chief Felix Lockart.

The federal government's Department of Indian Affairs has rejected Native claims to any part of the 4,000-kilometer BHP site. Beaulieu says the Department has a conflicting mandate, since it oversees both aboriginal issues and Northern development.

The other major aboriginal group involved, the 3,000-member Dogrib nation, also supports the development of diamond mining in the region, but wants to sign a joint-venture agreement to help construct the mine site.

BHP is negotiating impact benefit agreements with preferential hiring, scholarships and training provisions for Natives with both the Dene and the Dogrib. But the key issue for Natives is enforcement of these agreements, since there were no such provisions in the Review Panel's decision.

"I don't have faith in their intentions," says Dene Chief Don Balsillie.

BHP's poor track record in dealing with indigenous people in Papua New Guinea concerns many Native leaders. The company dumps 80,000 tons of mine tailings daily into the Ok Tedi River, poisoning rivers used by tens of thousands of indigenous people.

One of the PNG indigenous leaders, Alex Maun, testified at the Canadian environmental hearings. "We can't drink the water" in the Ok Tedi area, he said. "The river is dead."

"Up until now, we have only heard about BHP's reputation as a good corporate citizen," said Kevin O'Reilly, a spokesperson for the Northern Environmental Coalition, after Maun's testimony. "We are utterly shocked. We must be more determined than ever to see this mine become the most stringently regulated in Canada."

— Aaron Freeman

# The Big, Ugly Australian Goes to Ok Tedi

by Aviva Imhof

AUSTRALIA'S LARGEST COMPANY, BHP, has long conducted environmentally destructive mining operations near the Ok Tedi and Fly rivers in the remote Western Province of Papua New Guinea (PNG) with little public scrutiny. That suddenly changed in 1995, when the "Big Australian," as the company calls itself, helped draft a bill that eliminates the rights of PNG citizens adversely affected by the mine to seek compensation in court. Now BHP is paying a heavy price for its actions, as the outside world takes a hard look for the first time at the destructive effects of the company's mining operations on the people whose rights BHP sought to strip.

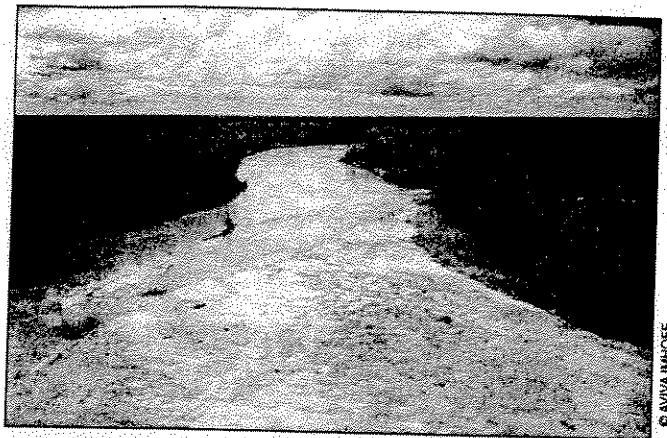
BHP's Ok Tedi copper and gold mine is located on Mount Fubilan in the Star Mountains adjacent to the West Papuan border. This remote and geologically unstable region receives about 10 meters of rainfall annually and is home to thousands of tribal residents. Ok Tedi is the third largest open-cut copper mine in the world, and accounts for 16 percent of the country's export earnings. The mine is owned by BHP (52 percent), the PNG government (30 percent) and Metall Mining Corporation (a Canadian subsidiary of German Metallgesellschaft) (18 percent). In the mid-1970s, BHP organized the consortium, Ok Tedi Mining Limited (OTML), which manages the mine. In 1987, BHP assumed total control over OTML's operations, which are expected to continue through 2010.

Thanks to recent increases in world copper prices, Ok Tedi generated \$120 million in earnings last year, accounting for 13 percent of BHP's total profits and making Ok Tedi the fifth-largest source of BHP earnings. Although it has been a big money maker in its 11 years of operation, OTML did not pay any taxes to the PNG government until October 1995, when it made a \$3.75 million payment.

## Long, dangerous tail

The heightened international scrutiny of its operations that followed its effort to have legislation protecting the company has created a public relations problem for BHP,

*Aviva Imhof is a campaigner with Sydney-based Aid/Watch Australia.*



The Ok Tedi river.

because it has operated the Ok Tedi mine in a fashion that would not be tolerated in Australia or any other industrialized country.

The mine dumps 80,000 tons of tailings (rock waste) containing copper, zinc, cadmium and lead into the Fly and Ok Tedi Rivers every day. Originally, the PNG government made OTML's operations conditional upon the construction of a tailings dam, which would have filtered out much of the waste now dumped in the rivers. But after the original tailings dam was destroyed by a landslide in 1984, OTML made a successful pitch to forge ahead without a tailings dam, exacting a predictable toll on a once-pristine river system.

This circumvention of PNG environmental laws and regulations is not an isolated event. Repeatedly, BHP has been able to shape the rules to meet its own operating needs, often enjoying exemptions from PNG's environmental regulations. A detailed report released by the Australian Conservation Foundation (ACF) in 1992 found that "There is no routine independent assessment of the compliance monitoring nor of the interpretation of data. This 'in-house' approach means that OTML is not publicly accountable for its environmental performance in any meaningful manner."

In 1991, OTML's own reports revealed that fish stocks in the upper Ok Tedi had declined between 50 percent and 80 percent from pre-mine levels. ACF reported the next year

## BHP's Double Standard

**B**HP REACTED ANGRILY to a recent letter from U.S. Senator Alfonse D'Amato to the company's chair, Brian Loton, asserting that a Pakistan-Iran pipeline deal the company is involved in could draw sanctions if legislation now pending before the U.S. Congress passes. The legislation would impose penalties in the United States on foreign companies that do business with Iran, by limiting their access to U.S. capital markets.

BHP denied reports that the deal was close to being signed, but BHP managing director John Prescott told the *Australian Financial Review*, "If the U.S. has a law which affects our operations we will respect that law." BHP's maintains substantial U.S. holdings, including the recently acquired Magma Copper, purchased for US\$3.2 billion.

The company's main point of contention with the anti-Iran legislation was its international application. BHP said it "strongly opposed" extra-territorial laws, with Prescott stating, "As a matter of principle we [BHP] don't think countries should pass laws for international application."

Prescott's comments appeared to flatly contradict BHP's active support and involvement in drafting Papua New Guinea's new extra-territorial law restricting PNG citizens' right of redress in foreign courts. Prescott himself admitted during contempt proceedings against BHP in Australia that the company's lawyers worked on preliminary drafts of PNG's new extra-territorial law.

— Ned Daly

that the first 70 kilometers of the river was "almost biologically dead and species diversity over the next 130 kilometers had been dramatically reduced. Fertile river bank subsistence gardens, plantations and approximately eight square kilometers of forest have been destroyed." ACF also found that the sediment flowing into the Fly River from the mine has elevated copper levels in fish and bottom sediment.

"We used to drink, wash and fish in the river," says Alex Maun, a spokesperson for Ok Tedi landowners. "But when the mining began in 1984, the river became polluted — it is only caused by the mining." As a result, 30,000 landowners downstream from the mine are unable to earn any income from the sale of fish and garden produce.

In the process of damaging the area's agriculture, fishing and forest systems, the massive mine has inflicted social as well as ecological hardships. Since the mine opened, nearby villagers have seen their subsistence lifestyles enveloped by the cash economy, their communities demoralized through increased alcohol consumption, and river transport, upon which they have traditionally relied heavily, disrupted.

BHP counters that it has improved living standards by building schools and hospitals in the area. As a result, says BHP spokesperson Tony Wells, "there is clearly widespread support amongst local people for the project."

But locals say that while some residents of the area may have benefited from BHP-supported facilities, they are hardly a replacement for the clean water and intact forests that

were central to their lives. Others dispute that BHP has made any significant contribution to the area. "There are no schools in my village, no hospital in my village," says Alex Maun. "In my village, we were given \$3,000 a year to be shared by each person. This amounted to \$20 a person."

### Above the law?

**S**eeing to discipline a company that has operated with a virtual exemption from numerous PNG environmental laws, the Melbourne, Australia-based law firm of Slater and Gordon, acting on behalf of Rex Dagi and 30,000 villager landholders in the Fly River basin, sued BHP in Australian and PNG courts in 1994. In a writ filed in the Victorian Supreme Court in Australia and in 900 writs in the National Court of PNG, the plaintiffs claim that environmental damage from the Ok Tedi mine has polluted rivers and damaged their way of life. They are seeking unspecified damages for loss of amenity (quality of life) and ability to derive existence from the land polluted by the Ok Tedi mining operations. On November 19, 1995, overcoming the first procedural hurdle for the landowners, the Victorian Supreme Court ruled that it had jurisdiction to hear these claims. The trial, now awaiting the hearing of an appeal over the court's jurisdiction over the landowners' claim, may take place in late 1996 or early 1997.

In an unprecedented response to this suit, in August 1995, BHP drafted legislation for the PNG Parliament that subjected anyone who sued BHP to fines of up to \$75,000. Even more remarkably, the bill also applied the same fines to anyone who attempted to challenge the constitutional validity of the proposed law in PNG courts. The bill made it an offense to commence compensation proceedings against BHP, to assist a person to do so or to give evidence at compensation proceedings.

In an attempt to seduce the landowners, BHP offered to establish an \$82 million fund to pay out compensation and benefits to plaintiffs over the life of the mine. This package would provide \$180 per landowner per year over the mine's remaining 15-year life.

In September 1995, BHP was found in contempt of the Victorian Supreme Court for its part in drafting the legislation, but this decision was later overturned by the Victorian Court of Appeal on a technicality. The state attorney-general is now considering whether to bring new contempt of court charges against BHP for the incident.

The company also struck out in the court of public opinion in Australia, where activist groups and citizens alike expressed outrage at the Big Australian's attempt to circumvent the court system. BHP's actions "fl[y] in the face of common law and Australia's human rights obligations," says Jeremy Hobbs, executive director of Community Aid Abroad, Oxfam's Australian affiliate.

PNG citizens were also furious at the BHP attempt to strip away landowner rights. "If Papua New Guinea is to survive, then land holders must be allowed to access the courts using general principles of the law of tort and damages," says Brian Brunton, a former PNG judge who is now a lawyer with the PNG-based Individual and Community Rights

## Inside the Mind of BHP

**M**ULTINATIONAL MONITOR GAINED A RARE INSIGHT into corporate damage control efforts in the wake of the magazine's most recent prior coverage of BHP. An internal company memorandum reveals the company's efforts to counteract negative coverage in the *Monitor*, and provides an interesting perspective on the company's attitude to media attention and citizen protests.

As international attention has increasingly focused on BHP and its behavior in Papua New Guinea (PNG), the company has cranked up its public relations machine. When *Multinational Monitor* named BHP as one of the ten worst corporations of 1995 [see "Shameless: 1995's Ten Worst Corporations," *Multinational Monitor*, December 1995], BHP was ready to respond.

The *Monitor* story generated at least one reporter call to BHP, from James Kennedy, a reporter for the Washington, D.C.-based *Daily Environment Report*.

Kennedy spoke with BHP public relations representatives Roger Nelson and Bob Wunder. Nelson and Browder summarized their conversation with Kennedy in another conversation, with BHP consultant Joe Browder, who formerly worked for Friends of the Earth. The Nelson-Wunder-Browder discussion is recounted in a January 4, 1996 memorandum that was obtained by *Multinational Monitor*.

Much of the memorandum describes an amusing attempt by the parties to figure out exactly what *Multinational Monitor* is, and to determine its relationship with consumer advocate Ralph Nader, who has criticized BHP for its activities in PNG. (Nader founded *Multinational Monitor*, but the magazine operates independently of him.)

Some portion of the memorandum describes BHP's substantive responses to the claims made in the December *Monitor* article, concerning BHP's pollution of the Ok Tedi River and the company's efforts to influence the PNG legislature. "In the conversation, I think, Bob, we could say that we largely let him [Kennedy] lead," Nelson says in the memorandum. "You made a fairly crisp packaged statement, and then

he responded with some further questions."

Nelson stated that he told reporter James Kennedy that BHP had in fact drafted language similar to that which appeared in the PNG legislation restricting PNG citizens' right to sue foreign companies abroad or to sue BHP in PNG courts, but not the actual language of the legislation. After explaining that much of the language BHP had drafted was for contractual, not legislative purposes, Nelson admitted that the company had at least begun efforts to draft legislative language to limit PNG landholder rights. "It happens that some of our technical level lawyers were drafting language along those lines," he says

in the memorandum, but "the draft language document was suspended immediately upon it coming to the attention of management as to how the document would impact the people."

The BHP representatives also apparently told Kennedy that BHP's mine is not causing serious environmental damage in PNG. "Bob explained the sedimentation and how that leads to the overbank flooding and how this rainfall will eventually flush the material down," Nelson says in the memorandum. "Bob, you talked about how [the rock waste is] physical and it's not toxic, that it's not toxic material at all. ..."

More interesting than the corporate flacks self-congratulatory description of their efforts at spinning reporter Kennedy is their subsequent discussion of the public relations strategy of U.S. mining company Freeport McMoran. Freeport operates a huge gold mine in Irian Jaya, the western, Indonesian-controlled portion of the island which makes up most of Papua New Guinea.

Freeport has come under heavy attack from citizen activists in recent years for its operations in Irian Jaya, and has responded with an unusually hysterical and high-

profile campaign. Freeport's campaign reached feverish pitch after activists succeeded in convincing the Overseas Private Investment Corporation to withdraw insurance coverage of Freeport because of its dismal environmental record in Irian Jaya. Freeport has taken out numerous full-page newspaper advertisements, the company has withdrawn support from

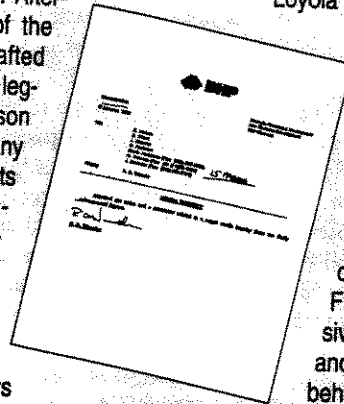
Loyola University in response to student protests there, and company chief executive Jim Bob Moffett has responded in harsh terms to personal attacks on him.

The BHP memorandum expresses dismay at Freeport's overly aggressive response to criticism, and worries that Freeport's behavior may affect popular perceptions of BHP, another mining company doing business on the same island.

Consultant Joe Browder describes how BHP might function as an intermediary with government officials to help defuse some of the pressure on Freeport: "[I]f it looks like BHP has the kind of across-the-border collegial relations with Freeport folks to be able to offer any kind of discreet, quiet help in dealing with the professionals who run AID [U.S. Agency for International Development] programs and that sort of thing, so Freeport is understood not to be quite the monster that it's being portrayed to be, too, that's something that if you all decided was in the company's interest we might be able to offer as a way of lowering the temperature of the whole issue."

Importantly, Browder says in the memorandum, "And if Freeport comes to think that maybe the government isn't out to destroy it after all and stops this huge campaign, I think that's very much in our interest." He adds, "If they make this a big issue, it's only going to spill over onto us and have us having to do clean-up work at a minimum."

— Robert Weissman



Advocacy Forum. "To take these rights away from landholders is to subsidize foreign mining and resource companies at the expense of landholders. We believe that such a move would lead to long-term instability in PNG."

While acknowledging it played some role in the legislative process, BHP refuses to accept any blame for its actions. "BHP has had discussions with the PNG government about the legislation," says company spokesperson Tony Wells. But, he notes, "any legislation is ultimately the responsibility of the PNG government."

The immense outcry partially defeated the Big Australian's attempt to rewrite PNG laws in accordance with its own interests. In December, the PNG parliament passed a version of the legislation that was cleansed of the offending criminal sanctions. The legislation gives landowners six months to decide between pursuing legal action in Victoria or accepting government compensation for damage to gardens and crops from the mine. The compensation package remains at the original figure of \$82 million for 30,000 landowners. An important provision of the legislation is a stipulation that the compensation is reduced or eliminated altogether if BHP is forced by the government to build any waste containment facilities. In other words, the landowners themselves will pay for any tailings dam BHP might construct.

"We support the PNG government's compensation package and will implement that," says BHP's Wells. "This is a general compensation package which recognizes the impact of the mining operations on the Ok Tedi landowners. It is separate from any claims from economic loss such as those in the Victorian Supreme Court."

The compensation package was not the PNG government's only response to the Ok Tedi landowners' legal actions. In December, the PNG parliament also passed the Compensation (Prohibition of Foreign Legal Proceedings) Act. This Act makes it illegal for landowners affected by any resource project in PNG to pursue any future legal action for compensation in a foreign country. The government is currently delaying proclamation of the Act due to Australian Foreign Minister Senator Gareth Evans' protestations that it breaches various trade and commercial agreements between Australia and PNG.

It is clear that while BHP and the PNG government have been forced to back down a little bit in the current case, they are determined not to allow a repeat performance of the Ok Tedi debacle.

Despite attempts to distance itself from the Ok Tedi controversy, the Australian government did play a role, if only by default. Australia does not regulate the activities of BHP and other Australian-based companies in developing countries to restrain them from converting their economic clout into improper leverage over foreign governments. In light of the Ok Tedi experience, Australian environmental groups are calling on the Australian government to require Australian companies to comply with Australian environmental regulations when operating abroad.

The Australian public and the media have widely condemned BHP's actions. The company is responding to a bar-

## A Tailings Tall Tale?

**B**HP has always claimed that it discarded plans to build a tailings dam at Ok Tedi only after its initial effort at dam-building was destroyed by a landslide, demonstrating that it was infeasible to construct a dam in the area.

Engineer Bill Townsend, who worked for the Papua New Guinea (PNG) government corporation Mineral Resources Development Corporation from 1981 to 1984, the period during which the Ok Tedi mine project was planned and constructed, disputes this claim.

Townsend claims the evidence strongly suggests that BHP and its joint venture partners at Ok Tedi (operating through the consortium Ok Tedi Mining Limited, OTML) were never serious about building a tailings dam.

It is true, Townsend acknowledges, that OTML did begin construction of a dam, though mostly access roads rather than the dam itself. But construction, he says, began even though dam design had not been completed and geological features of the dam site had not been mapped. Nor had OTML presented a design plan to the government for approval and revision.

The landslide which provided OTML's alibi for abandoning the dam was in fact caused by the consortium's initial construction work, Townsend says.

It would have been possible, Townsend believes, to have safely constructed a dam within a few hundred meters of the original dam site. The constructor of the dam, Bechtel, stated immediately after the landslide that the dam could have been built on the same site, just 200 meters upstream, he says, an assessment shared by other experts who analyzed the issue after the landslide.

"BHP has a huge number of people at work on public relations and legal aspects," of the Ok Tedi project, says Townsend. "They would rather spend \$10 million a year on legal jeremiahs than on environmental protection."

— Robert Weissman

rage of negative publicity with a multi-million dollar media campaign in Australia and PNG. At BHP's annual meeting in Melbourne in September 1995, BHP management, faced with 1,800 shareholders with questions inside and more than 100 protesters outside, tried to justify its lead role in the controversy. Toeing the company line, Managing Director John Prescott refused to accept responsibility for the PNG legislation, claiming, "In the final analysis, it is the sovereign government of Papua New Guinea that has the accountability and responsibility in this matter." BHP has also emphasized its claims that revenues from Ok Tedi have funded substantial infrastructure and local employment, in addition to generating 20 percent of the country's foreign exchange.

BHP's behavior in PNG is an extreme example of what can happen when powerful corporations are given free rein in developing countries desperate for foreign capital. Too often, environmental standards and human and civil rights get traded away. ■



# BHP DIAMONDS

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BHP is Australia's largest company. BHP recently acquired Magma Copper in the U.S. for \$3.2 billion.

"BHP is talking with De Beers about marketing gemstones" from the 1998 Lac de Gras mine in Canada's N.W. Territory.

"BHP is proceeding cautiously as the company has substantial assets in the U.S. where cartels such as De Beers are prohibited from operating."

Oct 7, 1996 Northern Miner

North America's 1st diamond mine is projected to be the 3rd largest diamond mine in the world (The Lac de Gras - \$17 billion find)

Multinational Monitor Sept. 1996

Webster's New World Dictionary

cartel

1. a written challenge, as to a duel
2. a written agreement between nations at war, especially as to the exchange of prisoners
3. an association of business firms, etc. for establishing a national or international monopoly; trust

monopoly

1. exclusive control of a commodity or service in a given market, or control that makes possible the fixing of prices.
2. such exclusive control granted by a government.
3. exclusive possession or control of something.
4. something that is the subject of a monopoly.
5. a company that has a monopoly.

trust

(a) a combination of corporations, constituting a monopoly, in which the stockholders turn over their stock to a board of trustees, who issue trust certificates to them and pay them dividends.

(b) any association of industrialists, business firms, etc.

for establishing a monopoly by price fixing, ownership of controlling stock, etc.

BHP Diamonds, a subsidiary (i.e. a company (subsidiary company) controlled by another company which owns most of its shares) of BHP owns 51% of the project (Isa de Gras, NW Terr.)  
29% owned by Vancouver based Dia Met Resources  
10% Charles Fipke } discovered the site  
10% Stewart Blusson }  
100%

ONE MILLION TONS  
OF THE CRANDON ORE WASTE

CONTAINS: (THERE WOULD BE  
55 MILLION TONS  
OF IT)

365 ACRES OF IT - 90 FEET  
DEEP

SULFUR

860,000 TONS (86%)

MOSTLY COMBINED

AS PYRITE (FOOL'S GOLD):

PYRITE 45%

SULFUR 41%

IRON

MANY OF THESE CHEMICAL  
ELEMENTS ARE TOXIC IN  
PARTS PER MILLION OR  
PARTS PER BILLION

SILICON

COPPER

LEAD

ZINC

137,630 TONS

ALUMINUM

MAGNESIUM

POTASSIUM

ARSENIC

CALCIUM

2369 TONS: (.002369%)

TITANIUM 660 TONS

FLOURINE 730 TONS

MANGANESE 490 TONS

PHOSPHORUS 120 TONS

CHLORIDE 120 TONS

SELENIUM 110 TONS

SILVER 58 TONS

NICKEL 46 TONS

CHROMIUM 27 TONS

CYANIDE 5 TONS

MERCURY 37,80 #

CADMIUM?  
(IS IN SPHALERITE)  
ZINC ORE

\*information gleaned from 1986 Environmental Impact Survey  
on Effon Proposed Crandon  
Mine  
a reasonable guess of what  
incomplete information seemed to be  
saying.

Some chemicals used as reagents or in ore floatation:

"Aero" American Cyanamid - floatation agents, flocculants, frothing foaming agents - thickener (fumed silica)

calcium sulfide - ore dressing and floatation agent

carbon disulfide - POISON - floatation agent - FIRE, EXPLOSION RISK

cyanogen bromide - RAT POISON - reagent in gold extraction process

ethylene dichloride - TOXIC, CARCINOGEN (used in production of vinyl chloride) ore floatation

formaldehyde - TOXIC, CARCINOGEN - recovery of gold and silver

2-mercaptoethanol - TOXIC - floatation agents

mercuric sulfate - TOXIC - extraction of gold and silver from roasted pyrites

potassium cyanide - POISON - extraction of gold and silver from ores

potassium hexyl xanthane - TOXIC - floatation agent

potassium hydrosulfide - separation of heavy metals

"RTV" GE polymers - silicone rubber compounds - thickener

sodium cyanide - TOXIC - ore floatation - extraction of gold and silver from ores

sodium sulfide - FIRE AND EXPLOSION RISK, STRONG IRRITANT TO SKIN AND TISSUES - liberates TOXIC hydrogen sulfide on contact with acids - sulfiding oxidized lead and copper ores preparatory to floatation

sulfur chloride - MILITARY POISON - extraction of gold from its ores

diisopropyl dixanthogen - TOXIC - floatation reagent

CMC HAS NOT LISTED WHAT CHEMICAL REAGENTS (ALL OF THEM) WOULD BE USED IN THE PROPOSED EXXON-RIO-ALGOM OWNED CRANDON MINE PROJECT.