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Oral Presentation

Submission from Norm Gurr

In the Matter of

Bruce Power Inc. – Bruce A and B Nuclear Generating Station

Request for a ten-year renewal of its Nuclear Power Reactor Operating Licence for the Bruce A and B Nuclear Generating Station

Commission Public Hearing – Part 2

May 28-31, 2018

Exposé oral

Mémoire de Norm Gurr

À l'égard de

Bruce Power Inc. - Centrale nucléaire de Bruce A et Bruce B

Demande de renouvellement, pour une période de dix ans, de son permis d'exploitation d'un réacteur nucléaire de puissance à la centrale nucléaire de Bruce A et Bruce B

Audience publique de la Commission – Partie 2

28-31 mai 2018

To Interventions

Louise Levert

Senior Tribunal Officer, Secretariat Division

Canadian Nuclear Safety Commission / Government of Canada

louise.levert@canada.ca / Tel: 613-996-9063, 1-800-668-5284

From Norm Gurr

Southampton Ontario

Bonjour Louise

I am attempting to send you some of my files and notes to follow. With a prayer or two to stop what we are naively into.

I do not write this as a protest or argument. I write it as almost a course similar to what I taught. I have had waterfront property here for decades and I followed my interest in the geology since I saw oil wisps seeping through the rocks some 70 years ago. I am 87 years of age. I will not be here if and when ???

And I have not been able to do a lot to get this together because I was in hospital and somewhat laid up in the last few weeks. I am trying to send you documents I have gathered over time for teaching geology and periglacial geomorphology. I hope you see in them what is going on and gather some experts to create a report on this.

FRANKLY. YOURS IS TO PROTECT CANADA FROM FOOLS AND IDIOCY.

I write this to give you Information and data about what is going on. It is there from many sources in governments here and in the USA NASA CERN, Universities, Governments, and scientists. There is no argument about provable facts. As you read through, you may come to the conclusion that crimes may have been created (Intentionally or unintentionally). Protecting the public and environment is above all else. This Nuclear stuff is created by governments with set rules. You know better than me.

If the nuclear people have not had this documentation, I ask why? or they have had it and ignored it which is worse.

If they disagree, explain why this documentation is wrong.

This is all not like tiddlywinks.

It is like we have been invaded by alien forces. Ask Chernobyl and the many other victims, “Is the enemy us?”

The word is “RISK”. Why are we RISKING when there is absolutely no need? There is not one reason to have nuclear with many other perfect means existing to create electricity

Why would we never give a pile of hand grenades to children to toss around?

Yet that is what we are doing as a world of people. And some have blown up or fizzed as here on a few occasions.

We entered this with no plan of what to do with spent fuels, and other material. It is extremely dangerous to the point it must be guarded and watched. Not just now but for hundreds of thousands of years. Who will do this in future decades and centuries? Douglas Point sits there for decades and we spend money to repair and maintain it with no idea about its removal.

We have huge amounts of spent fuel sitting there. We have the largest nuclear plants in the world with no idea of the disposal.

Why does Ontario have the highest of electric costs? What are Quebec and other provinces doing to have lower costs? We are the only province with nuclear? Why does Canada even have nuclear?

It has created a huge self-made problem.

I am going to try to send you a lot of documentation if I can. I am not a great expert in computers.

Whether I attend a meeting or not is not the point. You ae obviously highly intelligent and caring and you can understand what I am sending. I apologize for the lack of organizing it. But you all need to create a study based on what I am saying.

THE REALITY

WE ARE ALL CANADIANS. Even the Nuclear interests. We are here, one and all to protect not only us but every person and bit of life in North America. It is Canada first, not a job or personal money.. I hope they can see it and work with it, even if it means the end of the reactors

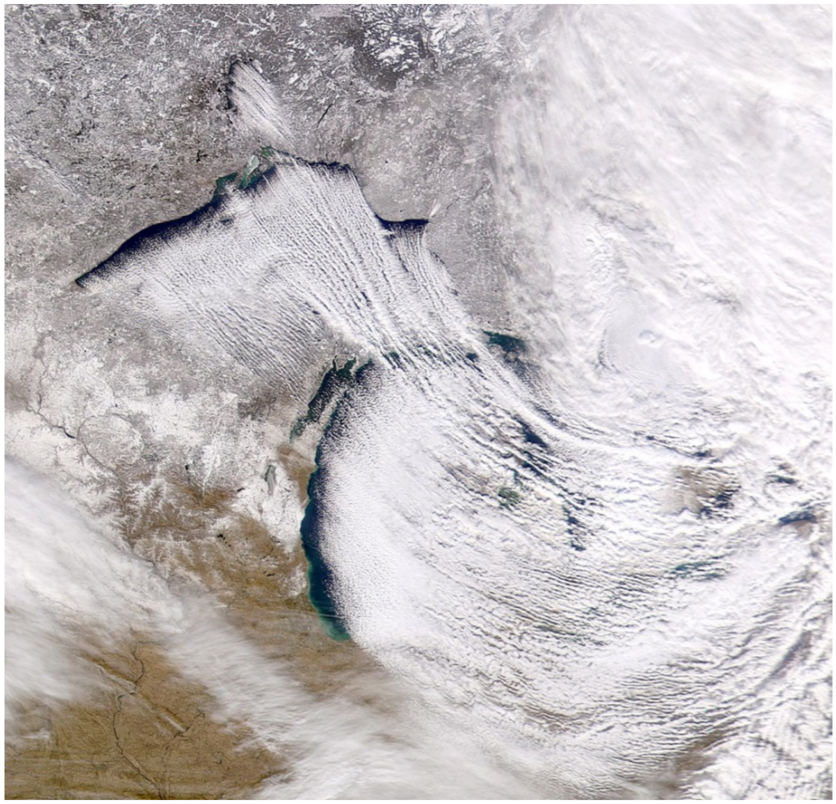
I throw the ball to you and the nuclear people to decide, not what is about money, or knowledge or prestige or jobs, but what we must do to protect each other from these hand grenades called radio activity. WE ARE PLAYING INSANITY NOW. HOW DARE WE RISK EARTH?

I suggest you work with the experts (especially in the States like the USGS, CERN, University of Michigan in the Northern Campus, the oil Debby Stabenow their elected to

Washington representative and natural gas people etc. who know.

The sooner we get this material out of here, the better. It is the worst place on earth to have nuclear.

ARE WE REALLY THIS STUPID?



Is there anything in the OPG and Bruce Reports that says "this picture"?

These are fellow Canadians we are serving.

Our Charter of Rights says:

"Everyone has the right to life, and security of the person and the right not to be deprived thereof."

HAVING NUCLEAR BREAKS THIS LAW.

HOW?

Answer this

Government enacts laws to protect us. They stop risk in hundreds of ways. We cannot speed in our cars because we RISK having an accident.You cannot fire a gun down the street Because you RISK hitting somebody

Why are we putting people AT RISK of losing everything, being ill and dyng and creating

massive exclusion zones using nuclear?Ask Chernoble or Fukoshima if there was a **RISK.**

MORE IMPORTANTLY NOW

Where are the environmental reports that reflect the geology of Ontario as shown in these documents?

Where are the reports that shows the aftermath **RISK** of an accident at these plants from many situation?

Why are we allowing spent fuel to lie all over the world as a **RISK**? Would you be allowed to store dangerous chemicals in your garden? Yet thisissitting there on the shores and worse a giant bowl with tunnels. Cracks and huge aquifers

Here especially it is the worst place in the anywhere for nuclear?

There is no plan to get rid of it? Just let it sit there as a risk.

Why is Douglas Point still there and being repaired and mantained?

I startle you by saying,

“WE HAVE NO NUCLEAR PLANTS”.

They are worn out and we are spending huge sums to keep them operating for a few decades. Why are we not looking at far better choices for creating electricity?

Neuclear material lasts radioactive. Who looks after it in centuries to come? Is there a RISK to future generations?

It is insane that we have to guard these plants and materials at huge costs. It will require guarding forever. Who pays?

What is the cost of dismantling nuclear plants and storing their remains. Have

Canadians been told or is this part of what is going on.

As Ontario's electric rates soar. As its rates are among the highest in North America. And we borrow to pay. Yet no one seems to say it is for the cost of repairing nuclear.

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THIS DOCUMENT IN NOT OPINION. It is reports that were created by scientists such as NASA, CERN, Universities, Governments.

THIS DOCUMENT PROVES WITH CLEAR EVIDENCE THAT THERE IS NOT ONE REASON WHY CANADA HAS NUCLEAR PLANTS..

Everyone has the right to life, and security of the person and the right not to be deprived thereof.

All must assure that people are not put at any potential risk. Laws and actions by all levels of governments do that. Is that not what legislation and enforcement does?

Are there consequences for governments and anyone who fails to assure this?

This is not a protest. It is PROTECT. It is for all of us to be good Canadians {On guard for thee}

It is a presentation of documents.

The documents seem to show that the nuclear interests including OPG and Bruce Nuclear are lacking

Any basis for having a nuclear generator and storing radioactive material must be highly detailed and accurate. Almost everything they say is false compared to the enclosed material.

EXPERTS ARE CITED.

As you read my report, and check out all of the citations and understand the geology ASK, " Is there any truth in it?"

IN ORDER TO JUSTIFY PUTTING NUCLEAR WASTE HERE AND EVEN NUCLEAR PLANTS, I THINK WHAT IS IN THIS IS CHALLENGED BY THE INFORMATION PRESENTED.

THE FOLOWING STATEMENTS ARE MADE BY PEOPLE WHO ARE WITH OPG AND BRUCE.

ARE THEY TRUE OR FALSE?

NUCLEAR IS AS SERIOUS AS IT GETS.

THERE NUST BE ACCURATE, AND HIGHLY DETAILED REPORTING.

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THEIR STATEMENTS

1. *"The host rock under the Kincardine site is four times the strength of concrete, and it would take 1 million years for one molecule of water to pass one meter in this rock".*

WRONG WRONG WRONG Visit the Niagara Gorge or Flower Pot Islands

2. *Chemical analysis shows that the water in the rock has been there since the formations were created. WRONG WRONG WRONG. There is no report on Karst and large aquifers*

3. *It is not a matter of convenience but a matter of science. It is not about money over safety. Where are these science reports?*

WHERE IN THEIR SCIENCE?

4. The Panel's Environmental Assessment called the geology of the area "highly suitable. Not true. EXPLAIN HOW.

5. *You can look at this geographically or geologically," Powers said. "Geographically, is located 1.2 kilometers from the lake? Geologically, it is 450 million years from the lake."*

NO NO NO. It destroys thousands of miles of occupation by people. They lack any understanding of snow and rain from the Lake Huron site and flowing into the depths of the Lake and far beyond.

6. Taken together, the rocks of this unique formation provide a natural barrier that scientists from around the world agree is perfect for permanently and safely isolating waste. WHO SAYS WITH PROOF?

7. OPG assumes that some kind of institutional control over the _abandoned repository_ would last for up to 300 years. MUCH LONGER = WHO LOOKS AFTER IT? GUARDS IT? Stop destruction by the return of an ice age?

8. Nobody in other places like Northern Ontario will take this material. CANADA HAS HUGE TRACTS. THEY ARE CALLED CROWN LANDS. THE NORTH IS MASSIVE IN AREA AND MOST NEVER HAS ANYBODY ON THEM. THERE ARE SAFE REMOTE PLACES IN SOLID HARD ROCK.

9..The material does not need managing in the deep hole. IT HEATS UP EXPLODES AND HAS TO HAVE MONITORING AND

ONGOING EXTINGUISHING AVAILABLE. WE ARE STUCK WITH THE DAMNED STUFF. FOREVER. It requires monitoring and guarding.

10. The Bruce site has a remarkable history of safety, NEVER.

11. Safe operation, handling and storage are tops with OPG and Bruce Nuclear. NEVER Have there been accidents.

12. « Ontario's nuclear advantage: is low-cost electricity, jobs & growth; health & clean air.

WITH RADIO ACTIVITY SITTING THERE???? ONTARIO COSTS ARE HIGHEST, JOBS REQUIRE LOW HYDRO COSTS TO COMPETE AND CREASTE JOBS IN EVERY INDUSTRY. The costs of storing it in remote areas in deep repository are ignored with guarding it forever.

13. The nuclear industry is honest and open. NOT QUITE. YOU DECIDE.

14, The rock was formed more than 450 million years ago. It has remained intact despite two mountain *formations and nine ice ages. Above the host rock rests 200 meters of impermeable shale.* *NOT TRUE*

15. Taken together, the rocks of this unique formation provide a natural barrier that scientists from around the world agree is perfect for permanently and safely isolating waste. Deep Geologic Repository: NEVER NEVER NEVER – IT IS THE WORST. Who is saying that with what science?

16. A Matter Of good Science *ASK WHERE IT IS. This has good science.*

17, *Teams of geologists have documented why the features of the rock are ideal*: WHO? WHERE IS IT?

- 18 *It's predictable. Horizontally layered, unformed sedimentary shale and limestone formations are spread over large distances.* YES BUT AS THIS SHOWS BASHED UP< WATER LOGGED > VERY DIVERSE.
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- 19. *It's a natural barrier with extremely low permeability.* WRONG THE VERY OPPOSITE. It is highly permiable
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- 20. *It's stable. The DGR is located in a seismically quiet area comparable to the Canadian Shield.* NEVER> The Canadian Shield is a solid blob of

igneous material – not in layers as the sedimentary area as in Southern Ontario and is not dissolved as the sedimentary material is.

-
- 21. *It's isolated far from water. The near surface and groundwater aquifers are well isolated from the proposed DGR*. NEVER AS THIS REPORTS DOCUMENTS SHOW. They lack any understanding of what happens with a spill.
- There are no reports of the Chernobyl. And Japanese and a number of other disasters.

22. *There is a minute amount of water in the rock surrounding the site. But after careful study, scientists found the water is ancient and has properties of evaporated seawater. This means it has not been in contact with the surface for hundreds of millions of years* WRONG ON ALL POINTS THE VERY OPPOSITE It is a maze of cracks and tunnels with flowing water. It sits on massive aquifers that dwarf the amount of water in the Great Lakes. This is an area of Karst. Any ancient materials in water are from dissolved materials.

And it must be guarded forever. Nuclear does not know how reactors can be removed – or where to put waste, so it sits for decades at all places in the world near the reactors There is no proper storage anywhere.- It is supposedly guarded to stop accidental discovery, vandalism, use in bombs. Employees war etc., (both newer and old reactors.) And it must be guarded forever. Who pays and

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<u>Read this and check off the many alternatives with their advantages</u>

<u>We are told that "*This is ideal material to store nuclear in and on and operate reactors*",</u>

www.alamy.com - DGTMAF

As one mayor of a town here said “We have benefitted in this area because of the nuclear plant. There are 4000 jobs. It is basic to our high incomes in our municipality. We therefore owe it to Ontario to take the risk and bury the radioactive material here. We will sacrifice our properties, life style, health and lives if there is a spill”. What if there is? Where is the due diligence? Does anyone believe that there will never be a leak at the Bruce Nuclear or stored nuclear material? If there is one, what happens and what is OPW plans to deal with it.

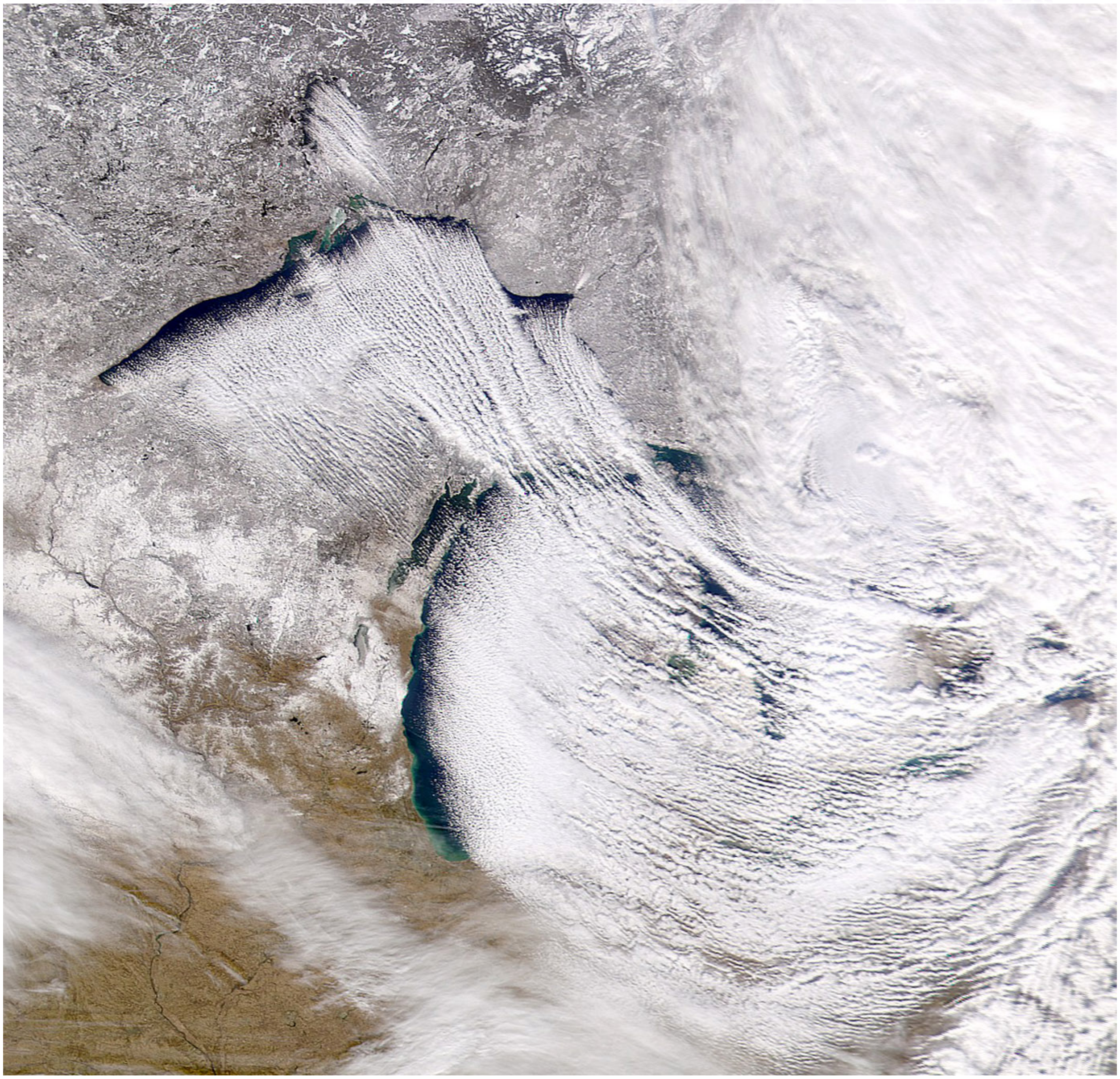
The problem is that it does not affect just the shoreline of Lake Huron. As you will see: It affects all of America.

ANY MISHAP WILL WIPE OUT ALL OF NORTH EAST NORTH AMERICA.

HOW COME?

AS YOU WILL SEE AS THE SONG SAYS,

"THE ANSWER IS BLOWING IN THE WIND"



IF THERE IS A NUCLEAR SPILL INTO LAKE HURON OR LAKE ONTARIO WHERE DOES IT END UP?

THIS PICTURE IS SOMETHING THAT HAS NOT BEEN CONCIDERED. IT IS ONE REASON WHY THE GREAT LAKES ARE THE WORST PLACE IN THE WORLD FOR NUCLEAR

AND THEY HAVE NOT INICATED WHAT IS UNDER THESE PLANTS IN CRACKS, TUNNELS KARST. AND VAST SEAS (AQUIFERS}

DO WE ALL UNDERSTAND HOW DANGEROUS RADIO ACTIVE MATERIALS ARE?

As this shows, THERE IS NO WORSE PLACE ON EARTH for this highly, easily spread, most dangerous of stuff. We have been fortunate so far. Lucky? This document describes a lot of scientific geology material that has not been presented to authorities but can be seen. You need to ask, after checking this out, if there has been misleading information? What are the legal responsibilities? Have there been any criminal actions? This is about protecting all that provides the great life we have in North America. Included are the outcomes of not so uncommon accidents.

Is what is under the nuclear plants common knowledge?

Bruce Nuclear lies within the large geological formation called the Michigan Basin. Few seem to know it exists.

What is presented is different to the OPG the Bruce and Nuclear, Government and Nuclear Interests

Reports. PLEASE READ THEM AND THIS DOCUMENT.

DECIDE WHAT IS THE TRUTH?

So let us firstly look at how the Michigan basin became.

THE AMAZING GEOLOGICAL HISTORY OF THIS AREA.

IT IS ABSOLUTELY ESSENTIAL TO COMPREHEND. IT TELLS YOU WHAT IS THERE, HOW IT GOT THERE, AND WHY NO NUCLEAR MATERIAL SHOULD BE ANYWHERE NEAR THERE.

EXPERTS ARE CITED. You can see for yourself

Everything is checkable through the USGS, Michigan Universities, NASA, CERN and other geologists from which this has mainly come.

The history of the formations is key evidence.
WHAT IS UNDER ONTARIO? HOW DID IT BECOME?

No one can deny the following: "The land under this location of Ontario Bruce Nuclear Plant and the proposed storage location is atop some of the oldest sedImentary formations on earth. It is called the Michigan Basin. The surrounding lands in the South of Ontario where the Pickering and Dallington Nuclear Plants are located in similar geological sedimentary formations.

AS YOU WILL SEE THAT ANY NUCLEAR MATERIAL GETTING INTO THIS FORMATION AND THE LAKES.

There has been a number of nuclear releases around the world. How much land has been lost? Jobs? Life style? Deaths? Money?

WILL IT BE DEVESTATING TO NORTH AMERICA?

IT COULD BECOME UNINHABITABLE.

WHY? As a start let us understand

What is under Southern Ontario

Earth began to form 4,000 millions [4 Billions] of years ago. Do we fathom unvelievably long periods of time?

Over these almost mind boggling lengths of time rocks and gases amassed together from space. And they coalesced with heavier materials gathering in the core. MATERIAL THAT UNDERGOES NUCLEAR ACTIVITIES GATHERED THERE AS WELL. AND THEY PRODUCES HEAT OF 11,000 DEGREES FAHRENHEIT, This is HOTTER THAN THE SURFACE OF THE SUN. HEAT IS CREATED THROUGH THE DECAYING OF RADIOACTIVE ISOTOPES LIKE POTASSIUM 40, URANIUM 238, 235, AND THORIUM 232. These isotopes radiate intense heat.

THE CREATION OF EARTH

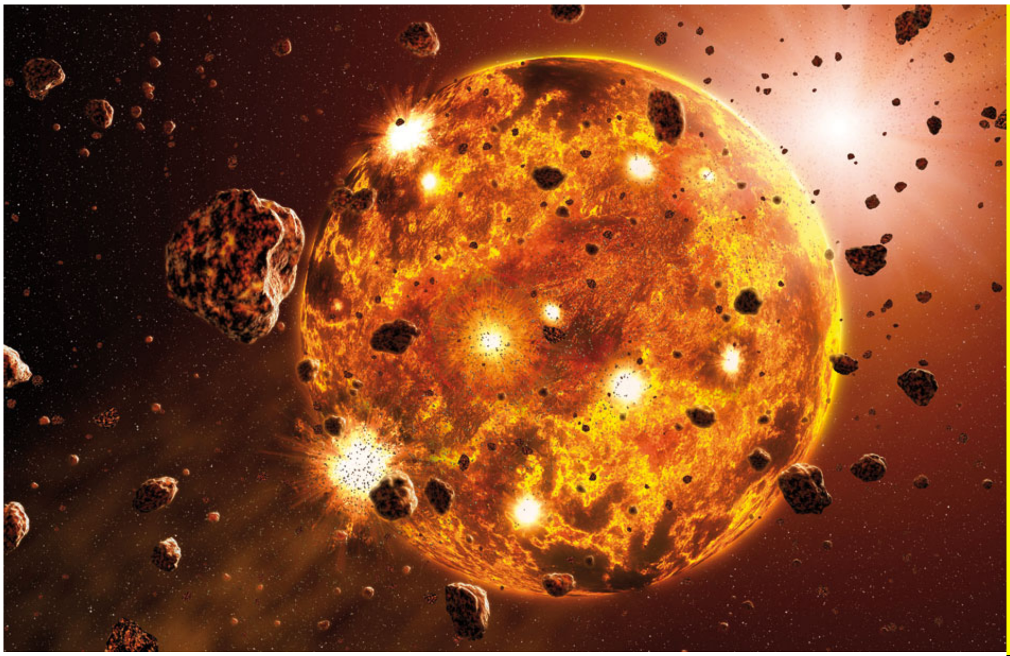
IN ORDER TO SEE THAT NUCLEAR MUST NOT BE HERE

IT IS ESSENTIAL TO UNDERSTAND THIS

IT IS OUR SECOND SUN WE NEVER THINK ABOUT

WHAT WAS HAPPENING TO THE EARTH FOR OVER 4 BILLION YEARS

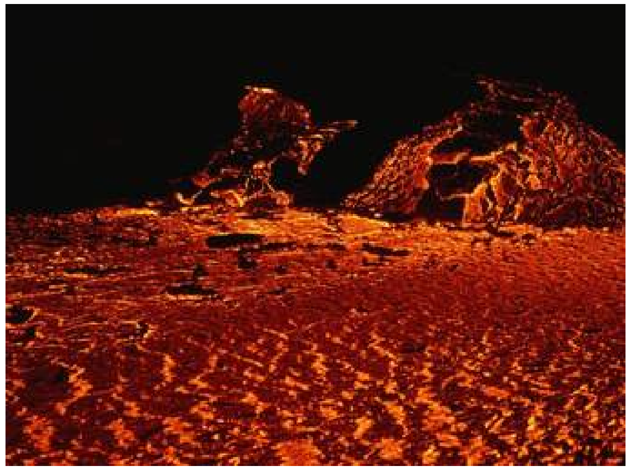
OVER HUNDREDS OF MILLIONS OF YEARS THE



EARTH BECAME

Rocks and gases smashed together and earth gradually increased in size.

It evolved in a mass of boiling material (extemely hot lava). The atmosphere was uncomprehendably hot and unbreathable for those hundreds of millions of years.



It was lacking of oxygen. According to NASA, Earth's earliest atmosphere was likely composed of only hydrogen and helium, two of the most abundant substances in the universe. This process as it progressed resulted in the formation of a lava ball and the first Earth's atmosphere. It was somewhat like the sun in appearance. But it was very different. Under us is Earth's second sun. Like an orange peel off the surface (the crust) and you would be shocked by boiling mass. We do not realize what is so close below us. Or has unimaginable pressures. These are so intense the inner core under the gravity of 6378 kilometers of mateial is intensely hot with radiation decay that it becomes solid. WHAT IS BELOW US?

As you read my report, and check out all of the citations and understand the geology ASK, " Is there any truth in it?"

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WRONG WRONG WRONG AS SCIENTISTS SAY.

4. *Chemical analysis shows that the water in the rock has been there since the formations were created.* WRONG WRONG WRONG

4. *It is not a matter of convenience but a matter of science. It is not about money over safety.*

WHERE IS THEIR SCIENCE? DOES IT EXIST? What about what is in this document if not science?

4. The Panel's Environmental Assessment called the geology of the area "highly suitable." WHO? EXPLAIN HOW.

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scientists found the water is ancient and has properties of evaporated seawater. This means it has not been in contact with the surface for hundreds of millions of years WRONG ON ALL POINTS THE VERY OPPOSITE It is a maze of cracks and tunnels with flowing water. It sits on massive aquifers that dwarf the amount of water in the Great Lakes. This is an area of Karst. Any ancient materials in water are from dissolved materials.

And it must be guarded forever. Nuclear does not know how reactors can be removed – or where to put waste, so it sits for decades at all places in the world near the reactors There is no proper storage anywhere.- It is supposedly guarded to stop accidental discovery, vandalism, use in bombs. Employees war etc., (both newer and old reactors.) And it must be guarded forever. Who pays and how?

===

RESPONSE BEGINNING

I point out many things to you, not confrontationally, but to ask that you publically review the whole issue of Nuclear. The public have a right to know a lot more than is public.

This report is not comprised of opinions. It is factual with data and statements of many sciences, including at CERN, NASA, UNIVERSITIES ETC..

I ask you to compare what is here to what OPG, Bruce Nuclear and the Nuclear Industry is saying.

Is there any reason to justify it when there are far cheaper better options and electicity costs are among the highest in Canada.

The very foundation of approving nuclear with Douglas Point was supposed to be based on safety with highest quality assessments. Do they contain the kinds of material in this paper.

Are there far safer, cleaner,and cheaper choices to provide electricity? You BET

WE ARE TOLD THAT WE HAVE THESE REACTORS, THEY must be reused and CANNOT BE CLOSED.

WRONG. **WE HAVE NO NUCLEAR REACTORS**. HOW COME? THEY ARE WORN OUT AND REQUIRE BILLIONS OF

DOLLARS IN EXPENDITURES. ==

Instead spend on other means like the in our northern 2000 Northern river sites.

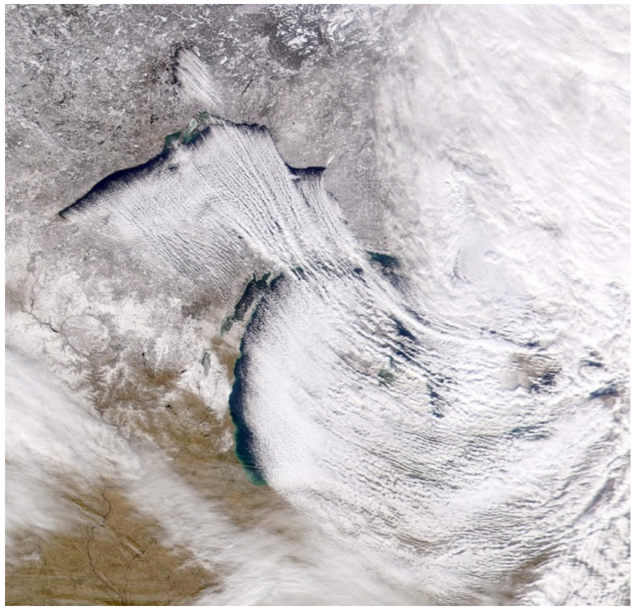
What is causing the high cost of Ontario electricity? Is it not the cost of repair on the 3 reactors complexes? How long will they last. THEY ARE WORN OUT IN A FEW SHORT YEARS? Dams are forever.

What is the cost of removing them and spent fuels How and Where to? No one seems to understand what the consequences are if acceded.

Read about the numerous accidents and problems. WHY? NORTH AMERICA WOULD BE GONE FOREVER

HOW COME?

"THE ANSWER IS BLOWING IN THE WIND"



IF THERE IS A NUCLEAR SPILL INTO LAKE HURON OR LAKE ONTARIO WHERE DOES IT END UP?

There are many errors in their reports that they would like to use to justify the governments having nuclear or storing it where it is in Ontario. It does not guarantee safety of the people nor the environment. In fact accidents have and can end up in horror. And odds are it will happen.

Any spill event could destroy North East America

THERE ARE FAR CHEAPER SAFER AND LONGER LASTING WAYS OF PROVIDING ONTARIO'S ENERGY.

I am a retired Toronto principal and scientist with a special interest and knowledge of Geology and especially in this area.

I question almost every aspect of what the OPG and Bruce Nuclear believe.

I feel I must stand up for Canada and its special people.

The following photo is typical of what is under this South Ontario Bruce Nuclear location. It is what is also under the Pickering Darlington plants.

MATERIAL LIKE IN THE NEXT PICTURES IS UNDER THE NUCLEAR SITE. HOW DID IT BECOME?

We are told that "*This is ideal material in which to store nuclear in and on and to operate reactors*".

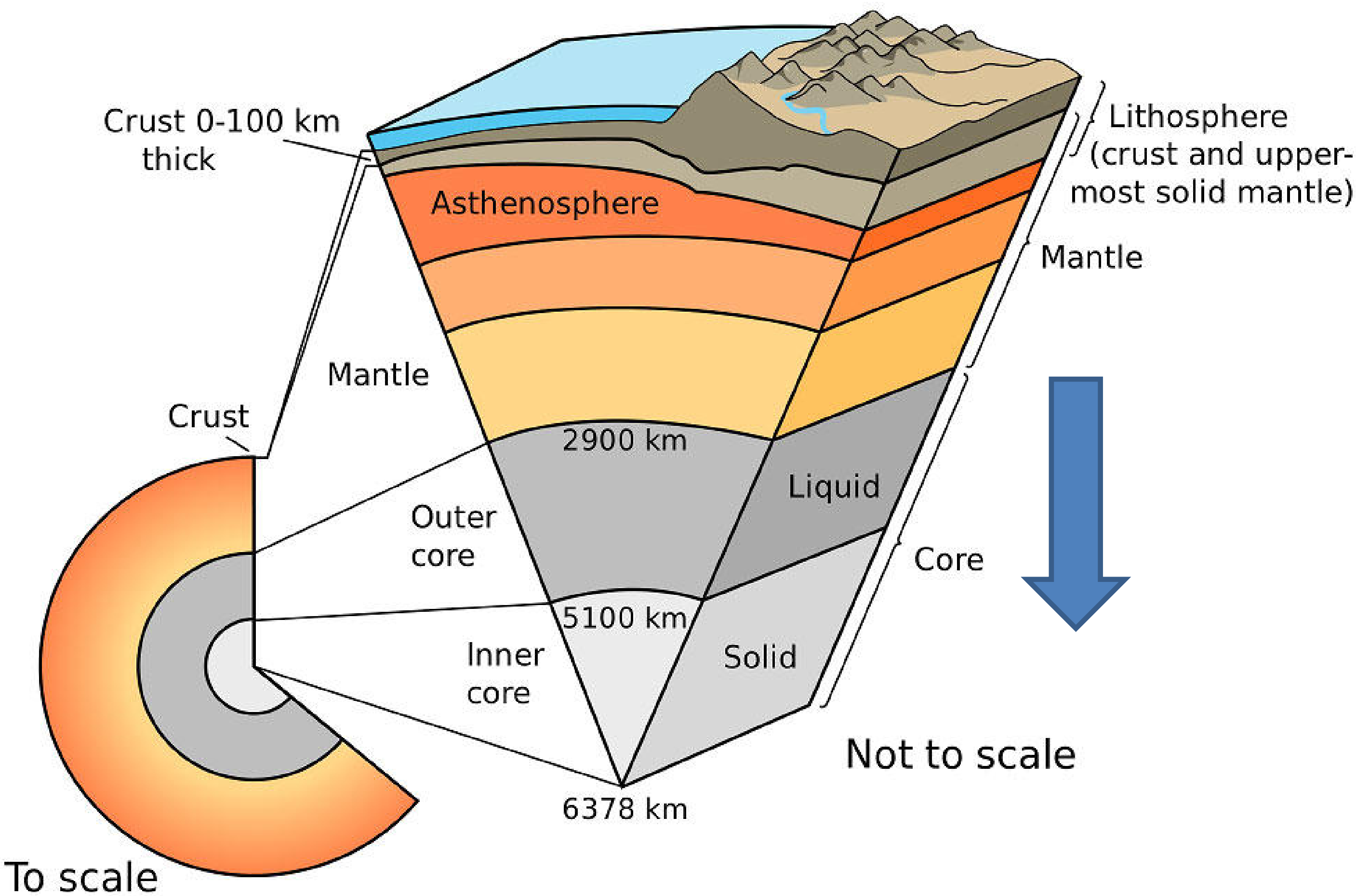
As one mayor of a town here said "We have benefitted in this area because of the nuclear plant. There are 4000 jobs. It is basic to our high incomes in our municipality. We therefore owe it to Ontario to take the risk and bury the radioactive material here. " THUS - We will sacrifice our properties, life style, health and lives if there is a spill".

4000 JOBS OVER MILLIONS OF LIVES, and America gone forever THEY SAY MAKES SENSE.

What is not understood is that ramifications go much further.

The problem is that it does not affect just the shoreline of Lake Huron. As you will see:

ANY MISHAP COULD WIPE OUT ALL OF NORTH EAST NORTH AMERICA.



The Earth's radius is about 4,000 miles (6,400 kilometers). The main layers of its interior are in descending order: crust, mantle and core. The crust thickness averages about 18 miles (30 kilometers) under the continents, but is only about 3 miles (5 kilometers) under the oceans. It is light and brittle and can break. It is where most earthquakes originate.

The mantle is more flexible - it flows instead of fractures. It extends down to about 1,800 miles (2,900 kilometers) below the surface.

EARTH BECAME! == A boiling mass of plazma

Accretion is the accumulation of particles into a massive object by gravitationally attracting more matter. Rocks and gases smashed together and earth gradually increased in size.

It evolved in a mass of boiling material (extemely hot lava as the picture below). According to NASA, Earth's earliest atmosphere was likely composed of only hydrogen and helium, two of the most abundant substances in the universe. This process as it progressed resulted in the formation of a lava ball and the first Earth's atmosphere. The atmosphere was uncomprehendably hot and unbreathable for those hundreds of millions of years. It was lacking of oxygen..

If you could go back in time, for billions of years, the earth was a boiling mass of lava.

IT WAS SOMEWHAT LIKE THE SUN IN APPEARANCE. BUT IT WAS VERY DIFFERENT. THE SUN HAS ACTIVE NUCLEAR ACTIVITIES. THE EARTH WAS (AND STILL IS} DECAYING NUCLEAR MATERIAL PRODUCING UNBELIEVABLE HEAT} KEEP IN MIND THAT AS WE STORE NUCLEAR MATERIAL IT PRODUCES HEAT. THE EARTH WAS BOILING PLASMA (LAVA) BEFORE THE CRUST SLOWLY DEVELOPED. THIS 10,000 DEGREE MATERIAL IS STILL THERE (NOT FAR UNDER OUR FEET).

Study Area

Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, NPS, AAFC, NRCan

Additional publication details

Publication type:
Report
Publication Subtype:
USGS Numbered Series
Title:
Hydrogeologic framework of the Michigan Basin regional aquifer system
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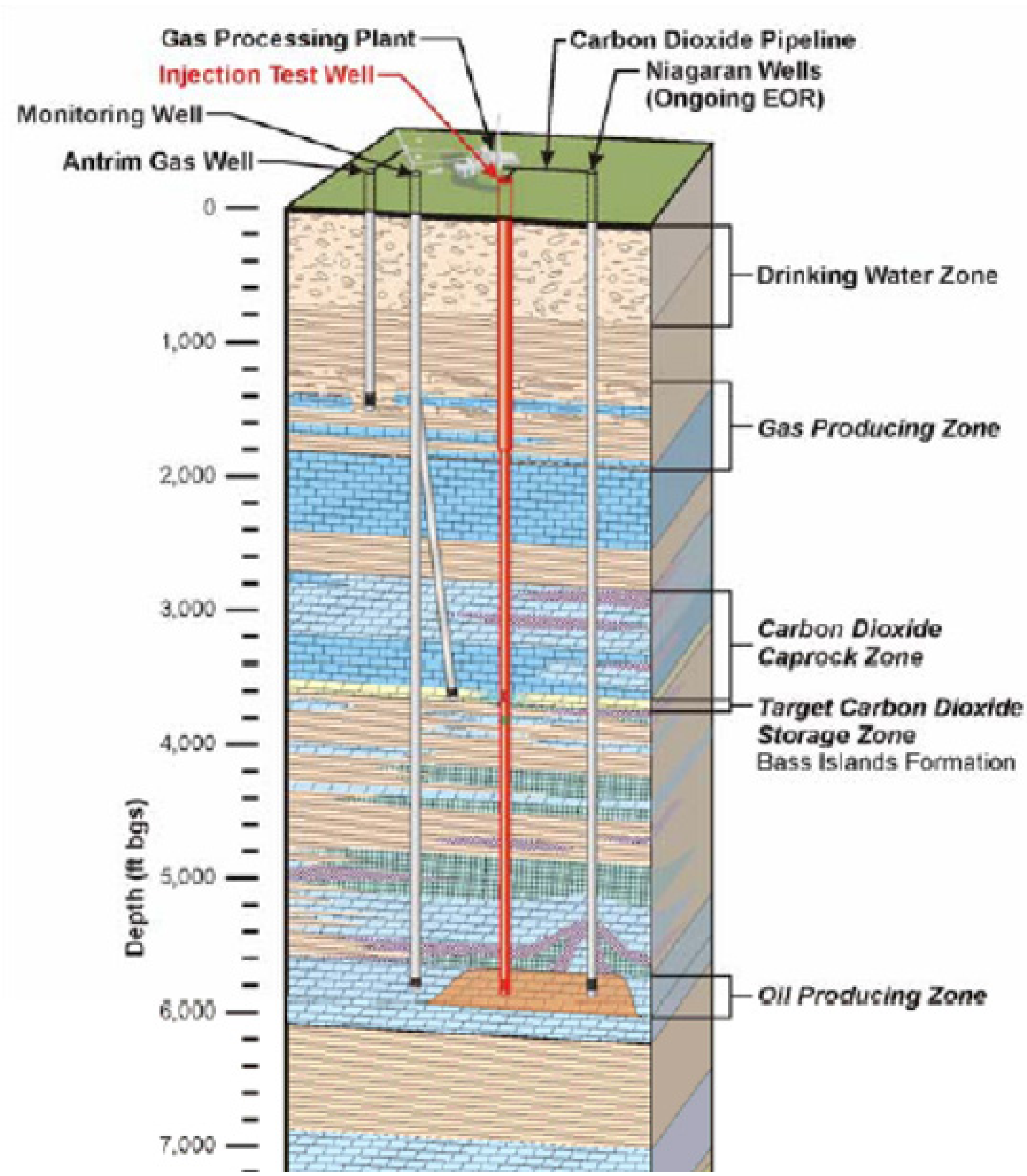
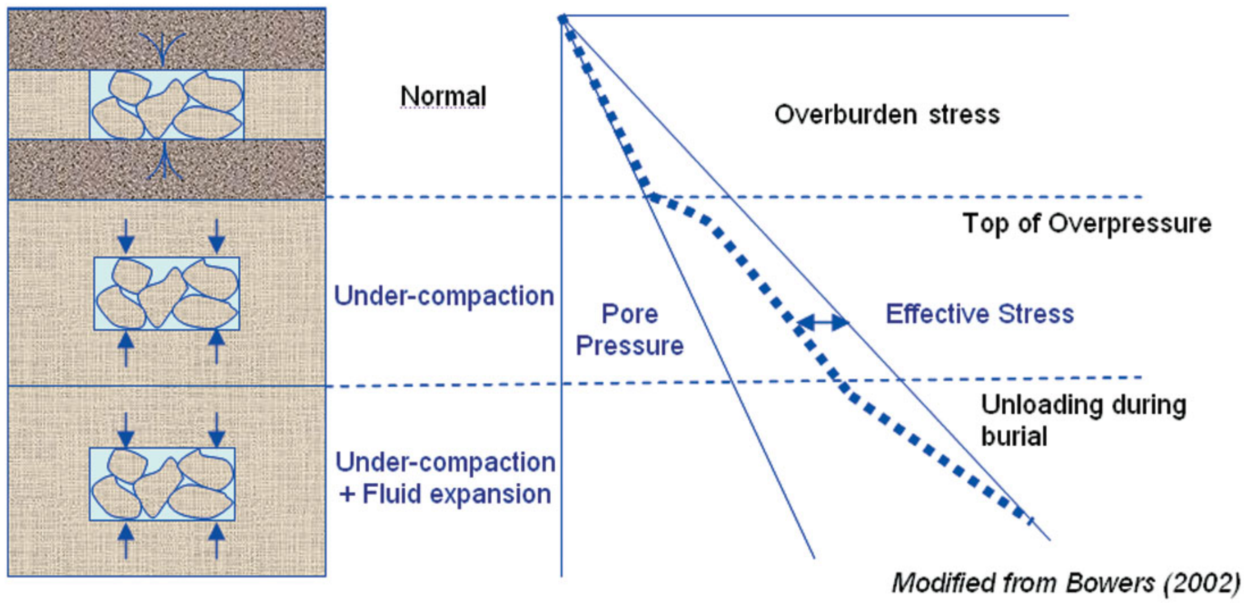
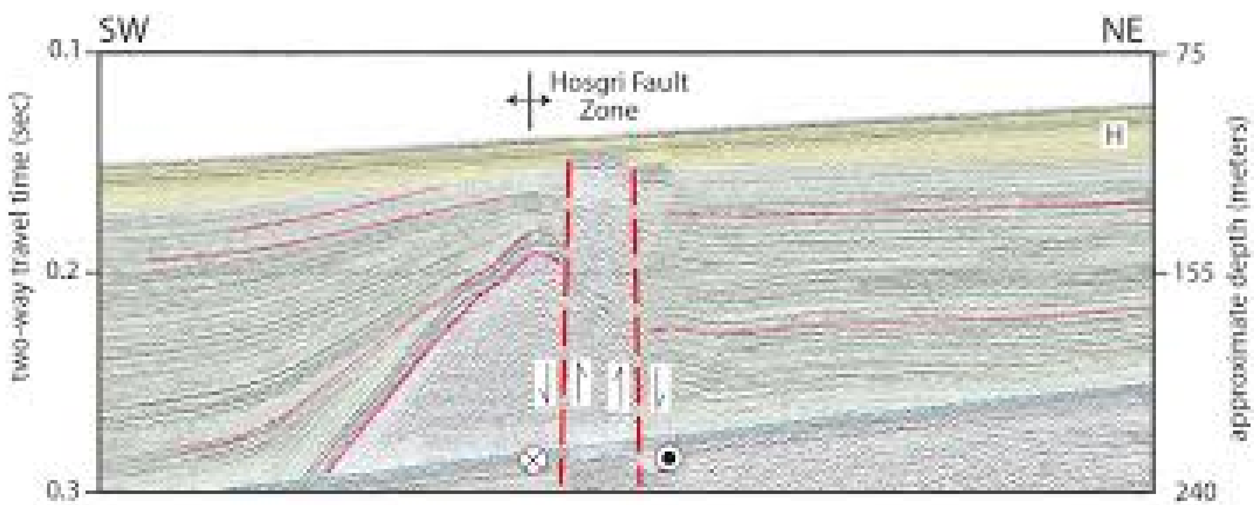
Part of the use the United States uses is as follows. See the underground water areas. God forbid radioactive matter flows into this.



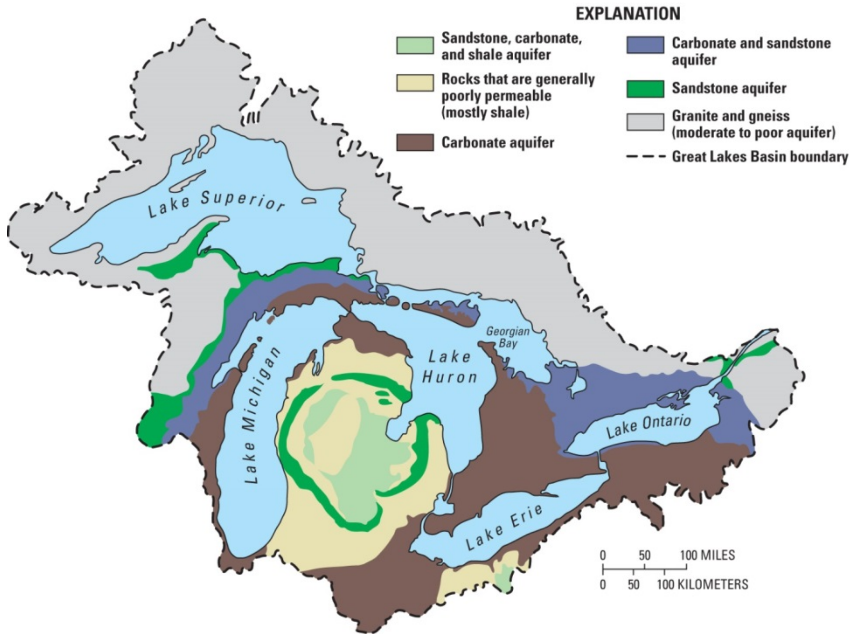
Note that the area has huge areas of water in the cracks and where materials have dissolved. The nuclear plants and proposed storage is atop a deep down sea as it were. It is believed by some that there is more water in the earth's crust than in the oceans. Make no mistake, this area is not solid rock. The OPG say "It is stable".

These rocks have been under massive pressure from those layers that were above. There has been the numerous ice ages and thus there was the weight of ice as I will point out, The earth moves. And these materials shatter, move and crack. What happens when there is water under pressure?





This shows the seas deep under the nuclear complexes



THESE DEEP AND IN MANY CASES MOVING AQUAFERS?"

Aquifers in sandstone are more widespread than those in all other kinds of consolidated rocks (fig. 4). Although the porosity of well-sorted, unconsolidated sand may be as high as 50 percent,. During the process of conversion of sand into sandstone (lithification), compaction by the weight of overlying material reduces not only the volume of pore space as the sand grains become rearranged and more tightly packed, but also the interconnection between pores (permeability). The deposition of cementing materials such as calcite or silica between the sand grains further decreases porosity and permeability. But most of the porosity in these consolidated rocks consists of secondary openings such as joints, fractures, and bedding planes. Ground-water movement in sandstone aquifers primarily is along bedding planes, but the joints and fractures cut across bedding and provide avenues for the vertical movement of water between bedding planes.

Sandstone rocks above grouund showing breaks and cracks

Figure 103. The St. Peter Sandstone is a fine- to medium-grained, friable, quartzose sandstone.

Figure 106. The Prairie du Chien Group is an unevenly bedded, algal dolomite.

WE

do not know the comlexities of water flows which varies area to area. The diaram indicates that.

What would happen to any nuclear material that is spilled? How many states wold it flow under?

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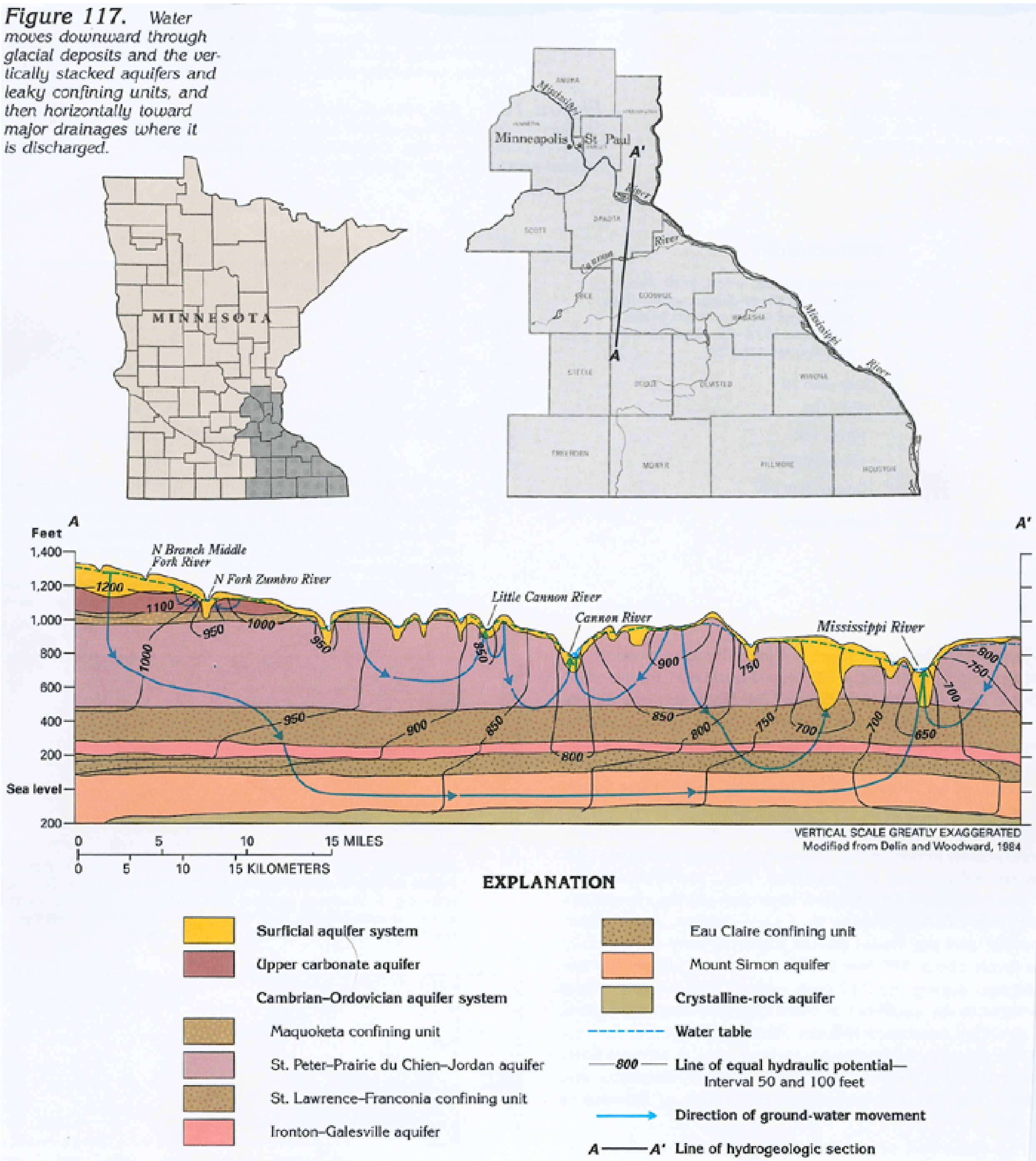
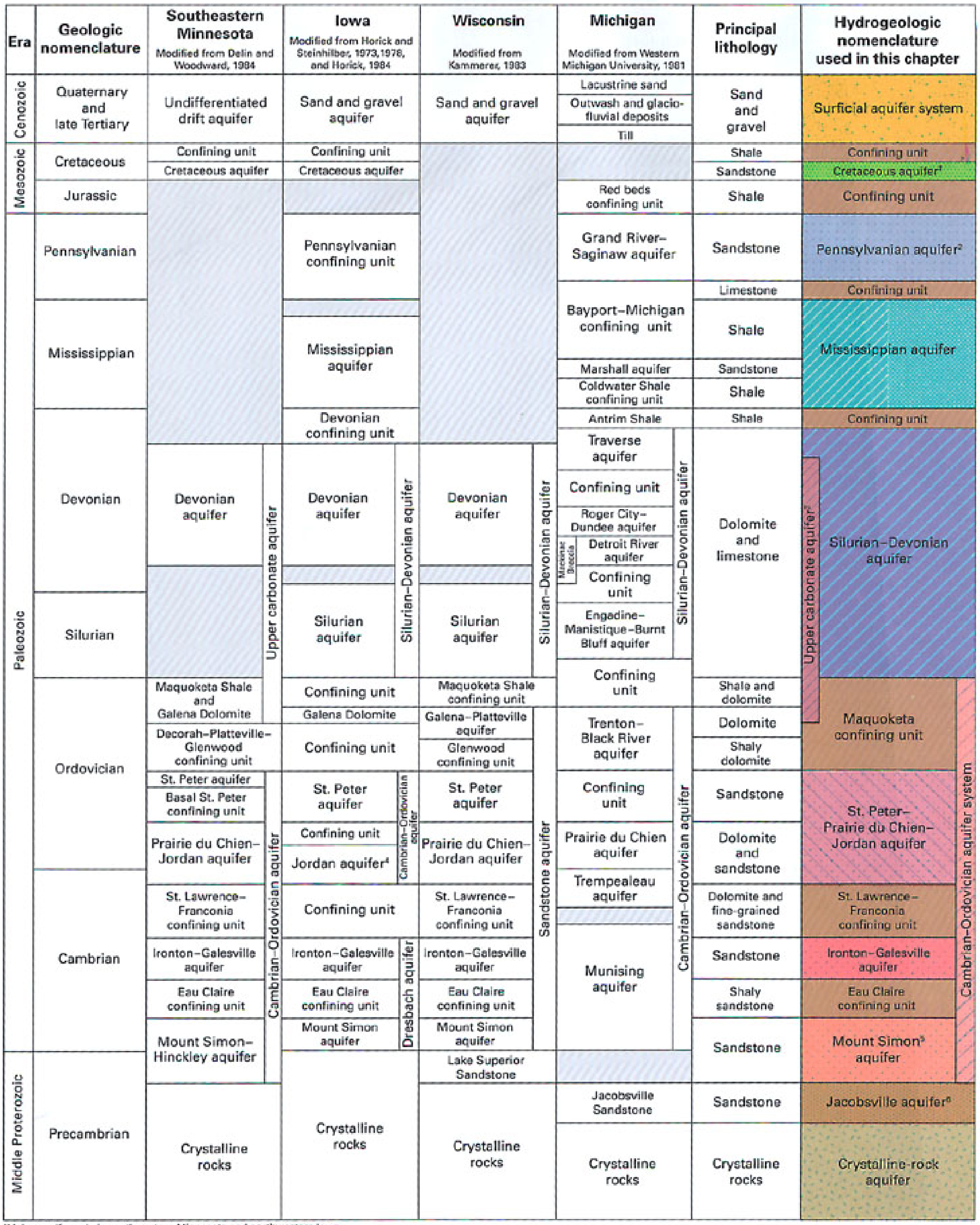


Figure 117. Water moves downward through glacial deposits and the vertically stacked aquifers and leaky confining units, and then horizontally toward major drainages where it is discharged.

Many sandstone aquifers are parts of complex interbedded sequences of various types of sedimentary rocks. Folding and faulting of sandstones following lithification can greatly complicate the movement of water through these rocks. Despite all the above limitations, however, sandstone aquifers are highly productive in many places and provide large volumes of water for all uses. There seems be major seas under Bruce County surface. There are many in other areas

The Cambrian-Ordovician aquifer system in the north-central United States is composed of large-scale, predominantly sandstone aquifers that extend over parts of seven States and three segments of the Atlas. The aquifer system consists of layered rocks that are deeply buried where they dip into large structural basins. It is a classic confined, or artesian, system and contains three aquifers in descending order, these are the St. Peter-Prairie du Chien-Jordan aquifer (sandstone with some dolomite), the Ironton-Galesville aquifer (sandstone), and the Mount Simon aquifer (sandstone). The aquifers are named from the principal geologic formations that comprise them. Low-permeability shale and dolomite compose the Maquoketa confining unit that overlies the uppermost aquifer and is considered to be part of the aquifer system. Wells that penetrate the Cambrian-Ordovician aquifer system commonly are open to all three aquifers, which are collectively called the sandstone aquifer in many reports.

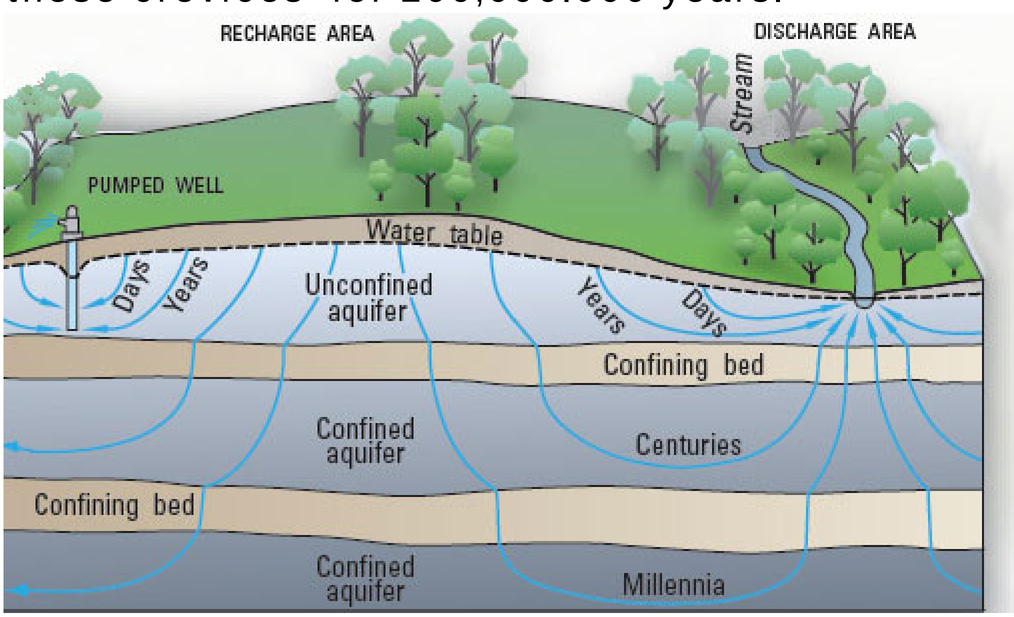
It is complex with uncountable kinds of rocks as the following shows



[1]Major aquifer only in southwestern Minnesota and northwestern Iowa.
[2]Major aquifer only in the Lower Peninsula of Michigan.
[3]Major aquifer only in southeastern Minnesota.
[4]Includes lower part of the Prairie du Chien Group and the Jordan Sandstone.
[5]Major aquifer includes the Hinckley Sandstone of Precambrian age in southeastern Minnesota.
[6]Major aquifer only in part of the Upper Peninsula of Michigan.

Figure 8. *The numerous aquifers and confining units that have been named in the four States of Segment 9 are grouped into the sequence of hydrogeologic units shown in the column on the right. The gray area represents missing rocks.*

The rocks of the aquifer system are exposed in large areas of northern Wisconsin and eastern Minnesota, adjacent to the Wisconsin Dome, a topographic high on crystalline Precambrian rocks. From this high area, the rocks slope southward into the Forest City Basin in southwestern Iowa and northwestern Missouri, southeastward into the Illinois Basin in southern Illinois, and eastward toward the Michigan Basin, a circular low area centered on the Lower Peninsula of Michigan. The configuration of the top of the Mount Simon sandstone (that forms the Mount Simon aquifer) is shown The map shows that this aquifer, which represents the lower part of the Cambrian-Ordovician aquifer system, is buried to depths of 2,000 to 3,500 feet below sea level in these structural basins. The configuration of the tops of the overlying Ironton-Galesville and St. Peter-Prairie du Chien-Jordan aquifers are similar to that of the Mount Simon aquifer. The deeply buried parts of the aquifer system contain saline water. Probably some have had water in these crevices- for 200,000.000 years.



The water can move either toward surface streams where it discharged as base flow, or downgradient, toward the structural basins, into deeply buried parts of the aquifer where it discharged by upward leakage into shallower aquifers. Many of the wells in the Chicago-Milwaukee area obtain water from all three aquifers of the aquifer system, and the water-level decline map, accordingly, is a composite map that shows the effects of withdrawals on the entire system. The point is what happens to nuclear material if it gets into these systems, The declines extended outward for more than 70 miles from the pumping centers in 1980. Movement of water in the aquifers was changed from the natural flow direction (eastward toward the Michigan Basin) to radial flow toward the pumping centers. Beginning in the early 1980's, withdrawals from the Cambrian-Ordovician aquifer system decreased as some users switched to Lake Michigan as a source of supply.

The ground-water flow system of the Cambrian-Ordovician aquifer system is summarized. Water from precipitation moves downward through surficial deposits of glacial drift, Some of the water moves horizontally along short flow paths to local streams,. Some water moves in a similar fashion along flow paths of intermediate length and discharges to larger streams. Some of the water continues to percolate downward through successively deeper confining units into successively deeper aquifers. Water in these deeper aquifers moves laterally over long distances and eventually discharges to major rivers, such as the Mississippi River. A small part of the water moves down the regional hydraulic gradient, perpendicular to the plane of the section shown in and toward deeply buried parts of the aquifer system. This deep, regional flow discharges by upward leakage to

shallower aquifers or is captured by pumping.-------------------------
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VERTICAL SEQUENCE OF AQUIFERS

The vertical sequence of aquifer systems, aquifers, and confining units; consequently, no one location has a total representation. They are discussed in descending order from geologically youngest to oldest. The vertical sequence of aquifer systems, aquifers, and confining units in each of the four States of Segment 9 is shown in the correlation chart), and the sequence of aquifers in consolidated rocks is shown in

The surficial aquifer system consists of permeable, sorted and stratified sand and gravel deposits of glacial origin (aquifers) that commonly are interbedded with less permeable till (confining units). Because of its permeability and extent throughout most of the segment, the surficial aquifer system is hydraulically connected with nearly all bedrock aquifers. The bedrock aquifers are exposed at the land surface only in small areas; generally, they are covered by the surficial aquifer system, which provides an important component of storage from which water percolates downward to the underlying aquifers.

The Cretaceous aquifer is a sandstone unit in Cretaceous rocks and is present primarily in western and southwestern Minnesota and in northwestern Iowa). The aquifer is underlain by Precambrian crystalline rocks throughout much of its extent but overlaps onto rocks of Pennsylvanian through Cambrian age toward the south. The Cretaceous aquifer is hydraulically connected with many of the older bedrock aquifers where they subcrop under the Cretaceous rocks. In parts of northwestern Iowa, the Cretaceous aquifer is underlain by a confining unit of Pennsylvanian The Pennsylvanian aquifer is a sandstone unit in Pennsylvanian rocks, and is present only in the central part of the Lower

Peninsula of Michigan. In places, the aquifer is overlain and confined by red shale of Jurassic age (red beds confining unit, The aquifer is underlain by a confining unit that consists mostly

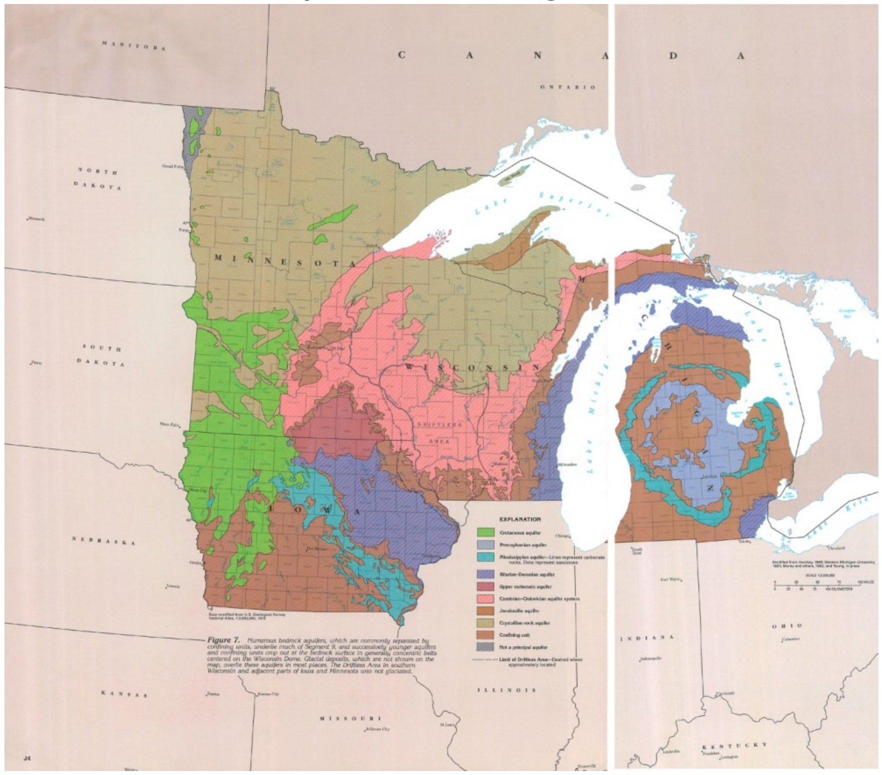


Figure 7. *Numerous bedrock aquifers, which are commonly separated by confining units, underlie much of Segment 9, and successively younger aquifers and confining units crop out at the bedrock surface in generally concentric belts centered on the Wisconsin Dome. Glacial deposits, which are not shown on the map, overlie these aquifers in most places. The Driftless Area in southern Wisconsin and adjacent parts of Iowa and Minnesota was not glaciated.*

of limestone and shale of Pennsylvanian and Mississippian ages (Bayport-Michigan confining. The Pennsylvanian aquifer is most productive where it is overlain by the surficial aquifer system.

The Mississippian aquifer in Iowa consists of dolomite and forms the bedrock surface in the central and the southeastern parts of the State and. In southwestern Iowa, the aquifer is overlain and underlain by shale confining units.

In the Lower Peninsula of Michigan, the Mississippian aquifer consists of sandstone and forms the bedrock surface in a circular pattern that reflects the structural basin). In most places, the aquifer is overlain by the Bayport-Michigan confining unit, which consists mostly of limestone and shale of Mississippian and Pennsylvanian ages and which hydraulically separates the aquifer from the overlying Pennsylvanian aquifer. The Mississippian aquifer is underlain by the Coldwater Shale confining unit, which consists of shale of Devonian and Mississippian ages. The contact between the Mississippian aquifer and the Coldwater Shale confining unit generally marks the base of freshwater in bedrock aquifers underlying the Lower Peninsula.

The Silurian-Devonian aquifer consists mostly of dolomite and limestone in which fracture permeability has been enhanced by solution and extensive karst development. The aquifer is present in eastern Iowa, the eastern part of Wisconsin, the southern part of the Upper Peninsula of Michigan, and the Lower Peninsula of Michigan and . In Iowa, the aquifer forms the bedrock surface in the northeastern part of the State; in the southern and western parts, the aquifer is overlain by a confining unit of Devonian-age shale. The aquifer forms the bedrock surface throughout the area of eastern Wisconsin adjacent to Lake Michigan, in the southern part of the Upper Peninsula of Michigan, and in the northern and the southeastern parts of the Lower Peninsula. In the rest of the Lower Peninsula of Michigan, the aquifer generally contains where it is overlain by the Coldwater Shale confining The upper carbonate aquifer, which consists of Ordovician dolomitic shale and dolomite and overlying Devonian dolomite in southeastern Minnesota, is an extremely productive aquifer that extends a short distance into northern Iowa. The permeability of the aquifer has been substantially enhanced by extensive karst development. The aquifer is underlain by shaly dolomite of Ordovician age that forms the lower part of the Maquoketa confining unit. This confining unit also underlies the Silurian-Devonian aquifer.

The Cambrian-Ordovician aquifer system consists of three aquifers separated by two leaky confining units and is capped by the Maquoketa confining unit). This aquifer system is present in parts of each of the four States and. In Minnesota and Michigan, the aquifer system is called the Cambrian-Ordovician aquifer. In Iowa, the upper part is called the Cambrian-Ordovician aquifer system, and the lower part is called the Dresbach aquifer. In Wisconsin, the aquifer system is called the sandstone aquifers.

In parts of Minnesota, Iowa, and Wisconsin, the Cambrian-Ordovician aquifer system crops out at the land surface in the Driftless Area . Elsewhere, the aquifer system crops out at the land surface only in small areas; it is generally overlain by either the surficial aquifer system or younger bedrock aquifers.

The Maquoketa confining unit, which is the uppermost confining unit of the Cambrian-Ordovician aquifer system consists of shale and dolomite of Ordovician age. Only the lower part of the confining unit is present in southeastern Minnesota and northern Iowa where the Maquoketa Shale and the underlying Galena Dolomite form the lower part of the upper carbonate aquifer. In Wisconsin, Minnesota, and the Upper Peninsula of Michigan, the Galena-Platteville aquiferwhich consists of dolomite of Ordovician age, is areally extensive but generally yields water only in small quantities and is not considered to be a major aquifer.

The St. Peter-Prairie du Chien-Jordan aquifer consists of an upper sandstone unit of Ordovician age (St. Peter Sandstone), a middle dolomite unit of Ordovician age (Prairie du Chien Group), and a lower sandstone unit of Cambrian age (Jordan Formation) and forms a major aquifer in southeastern Minnesota, northern Iowa, southern and eastern Wisconsin, and the Upper Peninsula of Michigan. Although the three units generally function as one aquifer, geologic conditions cause the significance and the relation of the units to change areally. For example, in Minnesota, the upper sandstone unit is locally separated by the shaly basal St. Peter confining unit from the underlying dolomite. In Iowa, rocks that are stratigraphically equivalent to the upper unit of the Prairie du Chien Group form a confining unit that separates the St. Peter aquifer from the lower part of the Prairie du Chien Group and the underlying sandstone. In Michigan, the upper sandstone unit is thin and not permeable. Where either all three units are in direct contact, as in Wisconsin, or the middle and the lower units are in direct contact, as in Iowa, the aquifer is extremely productive. The St. Peter-Prairie du Chien-Jordan aquifer is underlain and confined by the St. Lawrence-Franconia confining unit throughout its area of occurrence.

The St. Lawrence-Franconia confining unit, which is present in Minnesota, Iowa, and Wisconsin (consists of a dolomite and a fine-grained sandstone of Cambrian age In Michigan, some of the rocks that comprise the confining unit in the other three States are absent, and the remaining sandstone is sufficiently permeable to be included in either the St. Peter-Prairie du Chien-Jordan aquifer [called the Prairie du Chien and the Trempealeau aquifers in Michigan or the Ironton-Galesville aquifer [called the Munising aquifer in Michigan Where present, the St. Lawrence-Franconia confining unit functions as a leaky confining unit.

The Ironton-Galesville aquifer consists of medium- to fine-grained sandstone of Cambrian age and is present in all four States; in Michigan, the aquifer is equivalent to the upper part of the Munising aquifer. In Minnesota, Iowa, and Wisconsin, the Ironton-Galesville aquifer is overlain by the St. Lawrence-Franconia confining unit, and, except in Michigan, the aquifer is underlain by the Eau Claire confining unit.

The Eau Claire confining unit, which is present in Minnesota, Iowa, and Wisconsin, consists of a shaly sandstone of Cambrian age; in Michigan, the sandstone is sufficiently permeable to be considered part of the Munising aquifer. Where present, the confining unit functions as a leaky confining unit between the overlying Ironton-Galesville aquifer and the underlying Mount Simon aquifer.

The Mount Simon aquifer consists of a medium- to fine-grained sandstone of Cambrian age and is the lowermost aquifer of the Cambrian-Ordovician aquifer system The aquifer is present in all four States, although in Michigan, the aquifer is equivalent to the lower part of the Munising aquifer. In Minnesota, the aquifer includes the underlying Hinckley Sandstone of Precambrian age and the aquifer is called the Mount Simon-Hinckley aquifer. Also, in all four States, the aquifer overlies the crystalline-rock aquifer.

The Jacobsville aquifer consists of a sandstone of Precambrian age adjacent to Lake Superior in the Upper Peninsula of Michigan and A small part of the aquifer extends inland as far as Iron County, in Wisconsin. The aquifer is underlain by the crystalline-rock aquifer

The crystalline-rock aquifer which is the lowermost aquifer in the segment, consists of fractured crystalline rocks of Precambrian age. Although the crystalline rocks extend throughout the segment, they are not considered to be an aquifer except in northern Minnesota, northern Wisconsin, and part of the Upper Peninsula of Michigan where they are not deeply buried Although the crystalline rocks yield small to moderate quantities of water from fractures in the upper part of the rocks, few fractures are at depth; thus, the rocks form an impermeable boundary at the base of the aquifer sequence.

GROUND-WATER QUALITY

The natural chemical quality of water from the principal surficial and bedrock aquifers in the four-State area generally is suitable for most uses. The quality, however, is variable as indicated by the broad range of concentrations of a given dissolved constituent; for example, maximum and minimum dissolved-solids concentrations for 152 analyses of ground-water samples in Michigan differed by a factor of 100. Freshwater in each of the aquifers is predominantly a calcium magnesium bicarbonate type; that is, calcium and magnesium ions constitute more than 50 percent of the cations, and bicarbonate ions constitute more than 50 percent of the anions. In areas or aquifers or both where dissolved-solids concentrations are greater than normal, the proportions of sodium, sulfate, and chloride ions also are large. Aluminum, boron, iron, fluoride, titanium, radium-226, and hydrogen sulfide also are present in large concentrations in some parts of the four States.

Saltwater (water with dissolved-solids concentrations in excess of 1,000 milligrams per liter) underlies much of western and extreme northeastern Minnesota, nearly all of Iowa, small parts of eastern Wisconsin, and the Lower Peninsula of Michigan. Much of this saltwater is present at depths of less than 1,000 feet.

The chemical quality of natural ground water is primarily affected by the mineralogy of aquifer materials and the length of time that the water is in contact with these materials; for example, a plot of the relation of boron and sodium to rock types in Michiganshows the differences that occur from contact of the water with various aquifer materials. Water deep within an aquifer, as well as that near the end of a long flow path, has generally been in contact with aquifer materials for a long time, which results in large concentrations of dissolved constituents. In general, water in outcrop and recharge areas of aquifers is the least mineralized, but water in deep, confined parts of aquifers where the water movement is sluggish tends to be the most mineralized.

The chemical nature of ground water is characteristically related to dissolved-solids concentrations, as illustrated by data from Michigan in. As dissolved-solids concentrations increase, the percentages of sulfate, chloride, and sodium ions increase, the percentages of calcium and bicarbonate decrease, and the percentage of magnesium ions is about the same.

Because ion concentrations increase along flow paths, a progressive change that occurs in the water chemistry can be mapped as hydro chemical facies, or classification of waters based on their dominant cations and anions. A hydrochemical-facies map of water in the combined St. Peter-Prairie du Chien-Jordan and Mount Simon aquifers of the Cambrian-Ordovician aquifer system for the western part of Segment 9 is shown in In unconfined recharge areas of the Cambrian-Ordovician aquifer system in southeastern Minnesota, northeastern Iowa, and most of Wisconsin and the Upper Peninsula of Michigan, calcium magnesium bicarbonate water prevails due to the short flow paths and the carbonate-rich minerals in the aquifer system.

In southwestern Minnesota and northwestern Iowa, a calcium sodium sulfate bicarbonate water is present in the Cambrian-Ordovician aquifer system. It probably has its source as recharge from the overlying Cretaceous aquifer where the oxidation of pyrite might be the source of the sulfate.

The water chemistry evolves from a calcium sodium sulfate bicarbonate water to a sodium calcium sulfate bicarbonate water farther downgradient, possibly due to ion exchange of sodium for calcium by clay minerals in the aquifer system. In east-central and southern Iowa, the water further evolves to a sodium-mixed anion water, again possibly due to a continued ion exchange (sodium for calcium).

Calcium sodium sulfate chloride water in east-central Wisconsin might be the result of updip migration of brines derived from evaporite deposits in the Michigan Basin during Pleistocene glaciation. The updip migration might have resulted from the depressing of the aquifer system by glacial ice. Farther downgradient toward Michigan, the water evolves to a sodium sulfate chloride water, which possibly is due to ion exchange (sodium for calcium).

FRESH GROUND-WATER WITHDRAWALS

Ground water is a reliable source of water for nearly 13 million people (or nearly 61 percent of the population of Segment 9. Water systems are approximately evenly divided between public water-supply systems and private (domestic) water-supply systems. Ground water is the source for nearly all public water-supply systems in small cities (less than 10,000 population) and supplies nearly 100 percent of the unincorporated rural areas.

Total fresh ground-water withdrawals, by county, during 1985 in the four States of Segment 9 are illustrated in. Large withdrawals in counties of each State are related to large population centers or concentrations of industry or both. Many large cities located adjacent to major rivers or the Great Lakes (for example, Milwaukee, Wis.)

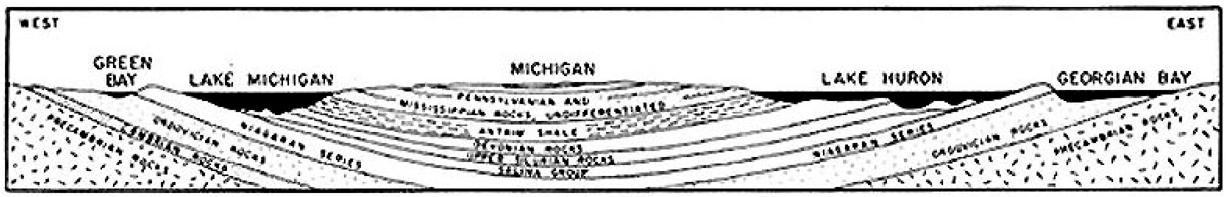
withdraw surface water for public supply; their effect is not indicated on the map.

A trend of increasing withdrawal of ground water for all use categories in the four-State area is indicated by data from the seven-county Minneapolis-St. Paul metropolitan area of Minnesota and from Wisconsin. The trend toward increasing withdrawals has been confirmed by a 1987 compilation of water-use data throughout the country by the U.S. Geological Survey.

The freshwater withdrawn from principal aquifers in the four-State area during 1985 is shown in The diameters of the circles are proportional to the rate of freshwater withdrawal from each aquifer. The surficial aquifer system, which is present throughout most of the four-State area, supplied water at a rate of about 2.5 times as much as the next largest producing aquifer and nearly 1.5 times as much as all other aquifers combined during 1985. The Cambrian-Ordovician aquifer system is the next largest producer and supplied water at a rate of about 2.5 times the third largest producer, the Silurian-Devonian aquifer. The lesser producing Cretaceous, Pennsylvanian, Mississippian, upper carbonate, and combined Jacobsville and crystalline-rock aquifers are limited in areal extent or do not underlie population or industrial centers or both with large water demands. Total withdrawal from all aquifers during 1985 was 2,545 million gallons per day.

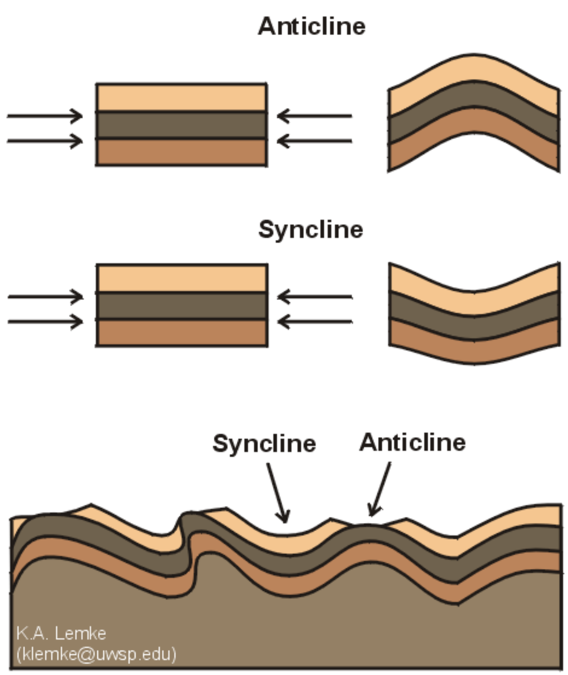
Thus the area under the proposed sight and existing reactors sits atop 5 miles of yearly layers of materials. The layers of materials coalesed. How string would the material and joints be?

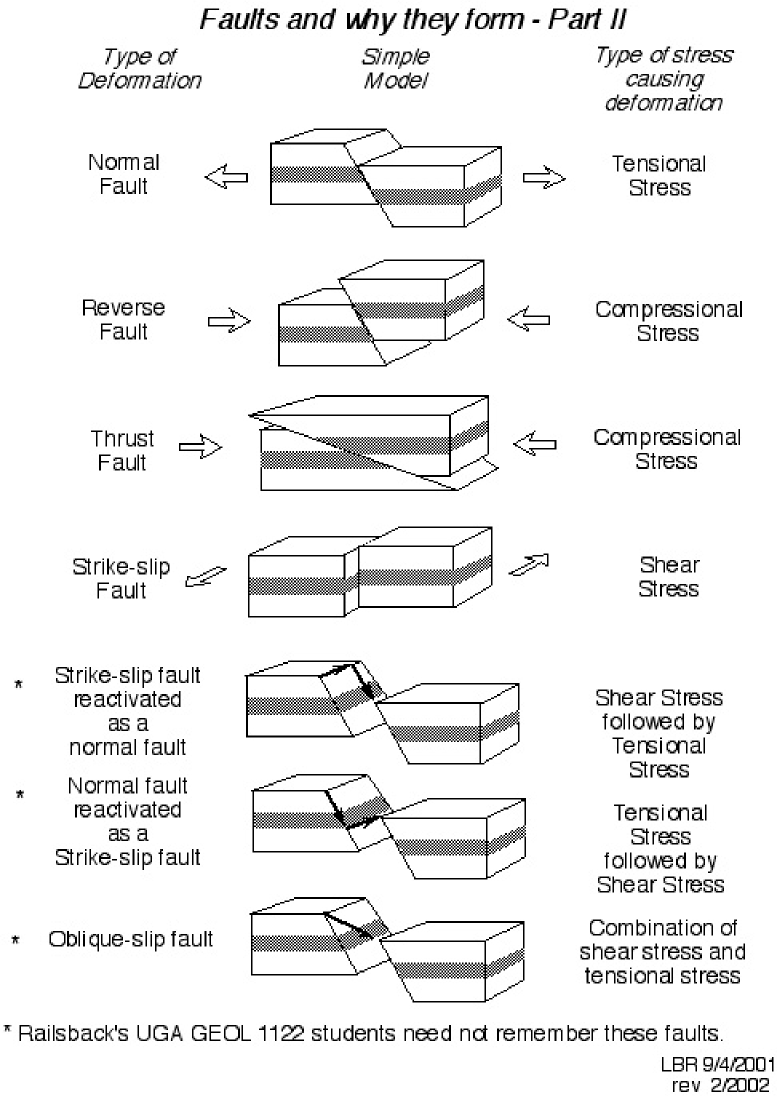
As the following from a Michigan Report states, “This whole Michigan Basin is composed of relatively weak rocks.” Observe it youself and compare it to Ignious rocks that were melted into liquid and made slid rocks with no cracks, They are made of muds and dead plant and animal materials later. There are major salt beds as we see with the mine at Goderich, And other materials formed as well. So you can see in the diagram how the basin is formed from the Niagaraa Escarpment to the escarpment in Wisconsin.



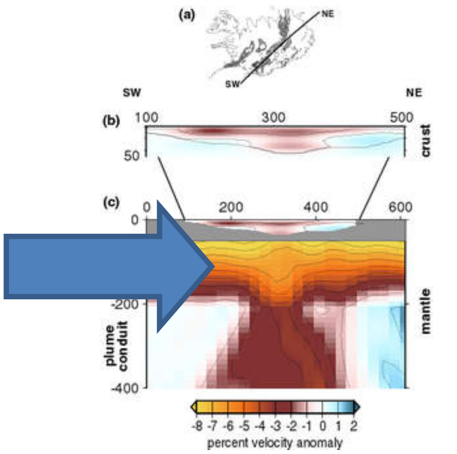
Geologic cross section of the Michigan sedimentary rock basin, showing Lakes Michigan and Huron lying in zones occupied by relatively weak rocks of the Antrim shale and the Salina group, Green Bay and Georgian Bay lying in zones of weak Ordovician rocks, and the escarpment of the Niagaran dolomite which separates the lakes from the bays.

Make no mistake, Do you not believe that through 600,000,000 years with being part of a continent that has drifted half way around the world, bumping and sliding o a mantle of boiling would not be mashed up and faulted.



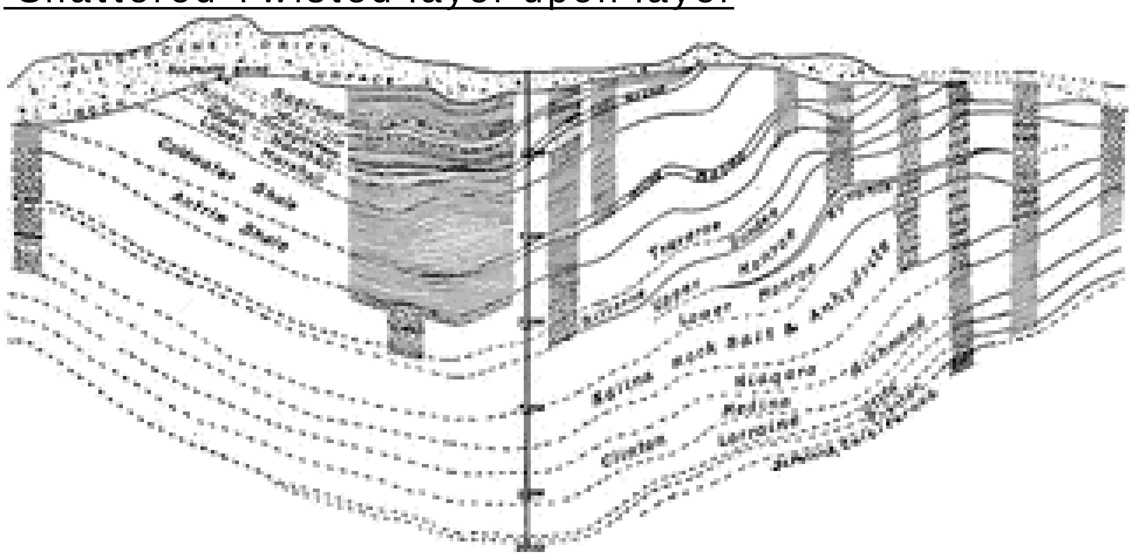


What the next shows is that there is no uniormity across the basin. It was laid down through 600 million years of many changes in climates. Heights of land around that prvided the material and the development of life forms, Then the is the 200,000,000 years it has existed since then, ---600,000.000 years on a moving atop mollten materials. What does that do to these layers?



Crust moving atop lava in mantle rising from the core.

Shattered Twisted layer upon layer



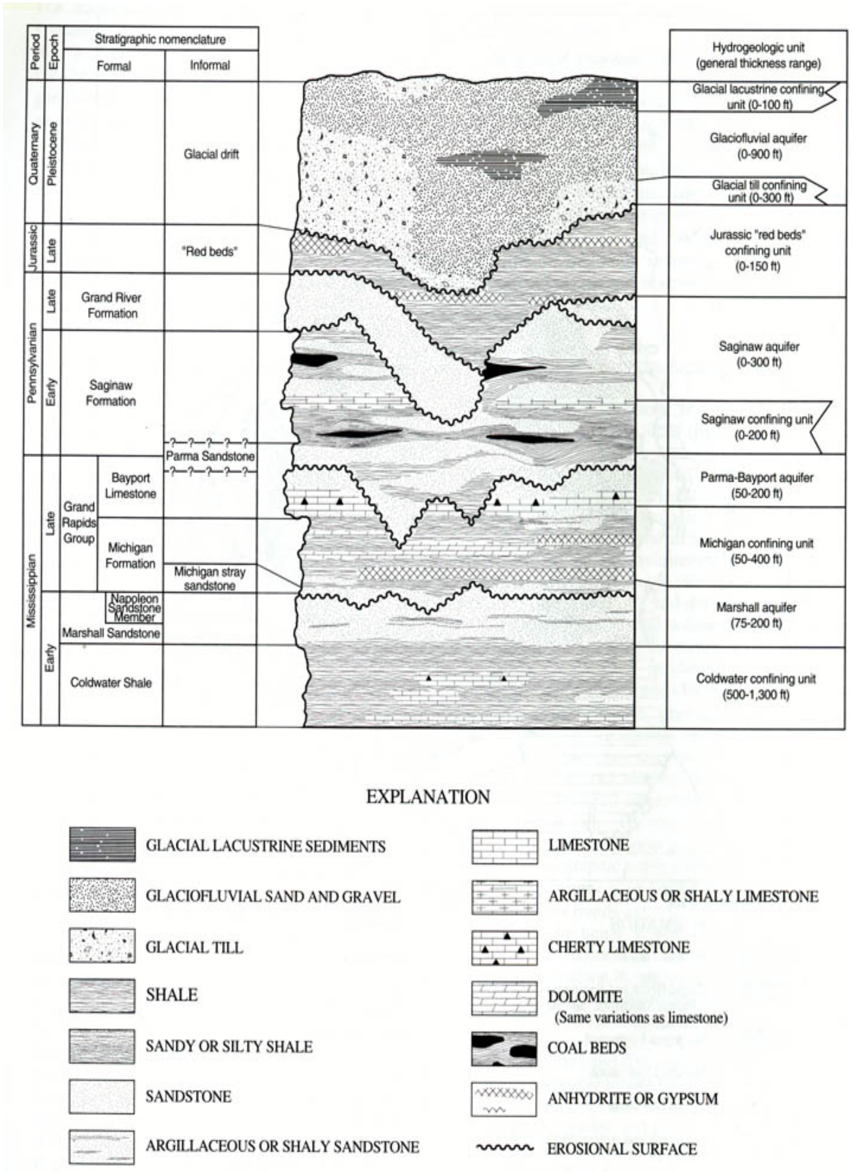


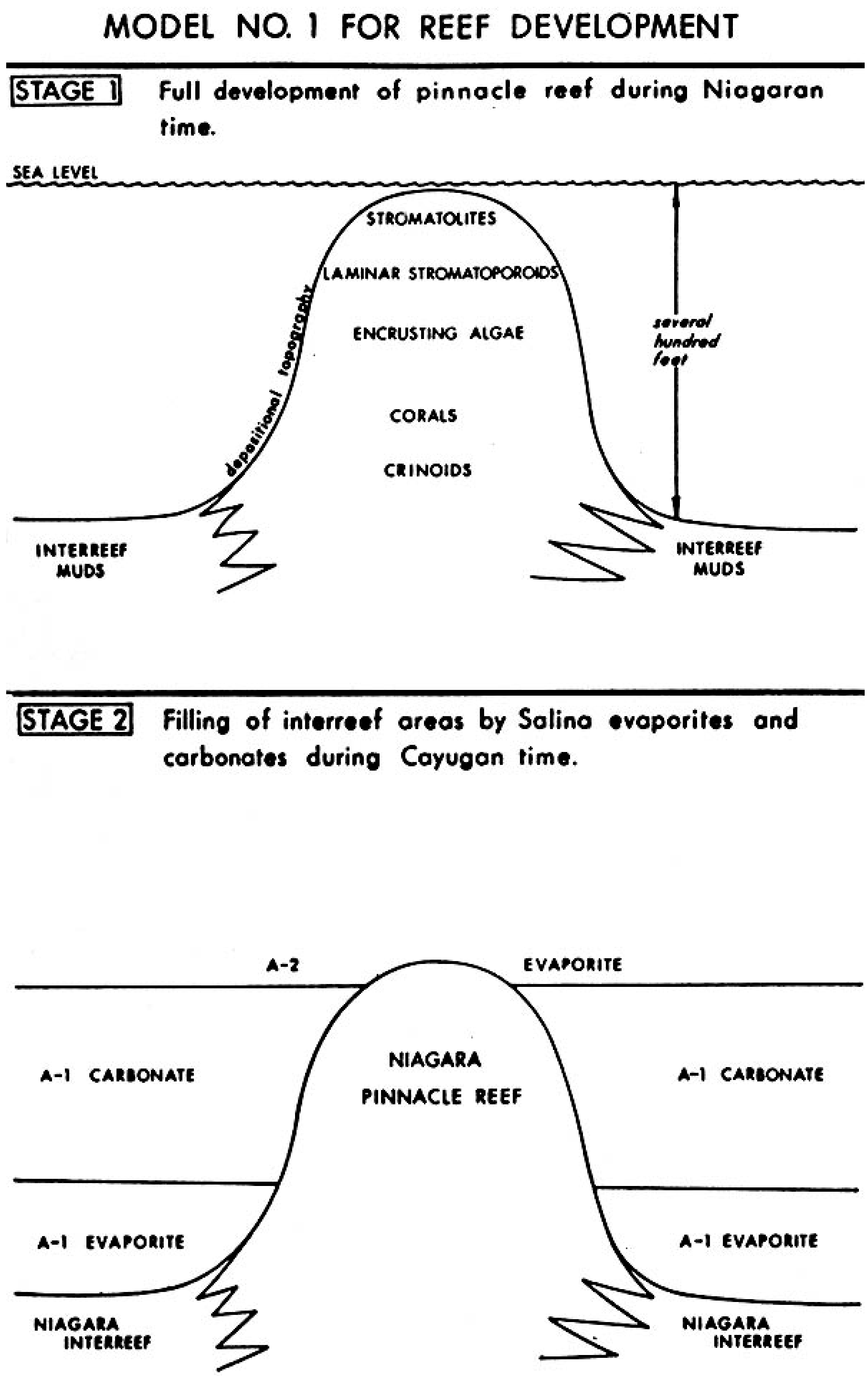
FIGURE 5.—Mississippian through Pleistocene stratigraphic nomenclature, hydrogeologic units, and rock units in the central Lower Peninsula of Michigan. (Modified from Michigan Geological Survey, 1964.)

This material comes mainly from USA government and university sources. What is under Bruce needs intensive explorations.

THESE ROCK LAYERS ARE VERY DIFFERENT TO EACH OTHER. AND COMPLEX. There are many different kinds of layers under the 3 nuclear locations depending on circumstances of things in each period over 6,000,000 years. We may find salt, oil gas at different depths. That is up to 5 miles down

Some layers are harder, Some softer. Some disolve easily in water (like salt). Some have no adhesion to each other. Much came from the erosion of nearby mountains washed into the sea. Others from volcano ash others from a large variety of flora and fauna.

Thus various minerals from the ancient mountain's igneous rocks formed by volcanic activity rising from the hot melted layers deep in the earth's crust were made over by various erosion processes into different sediments. The hard minerals like quartz collected together as sand, and being heavy, were not carried so far out to sea. They built up coarse and fine rocks which we call sandstones. Other minerals were broken up into fine clay and silt muds that were carried far from shore. But the silt eventually settled on the sea floor and compacted to a rock we call shale. There certain chemical reactions caused lime to be precipitated and in places to build up great thicknesses of lime mud that eventually solidified into a rock known as limestone. (Easily dissolved) Other chemical reactions caused iron minerals to be formed which in turn settled to the bottom of shallow seas, and later in the geological history dolomite, gypsum and salt crystallized out of the sea water to form great beds of these materials. The Goderich Salt Mine is massive and deep. And there are masses of these salt formations along our shores and in the depths. Coral reefs are



Created.

Reefs are but individual formations

among other formations that were created in different periods. There many different layers with none life at the bottom,

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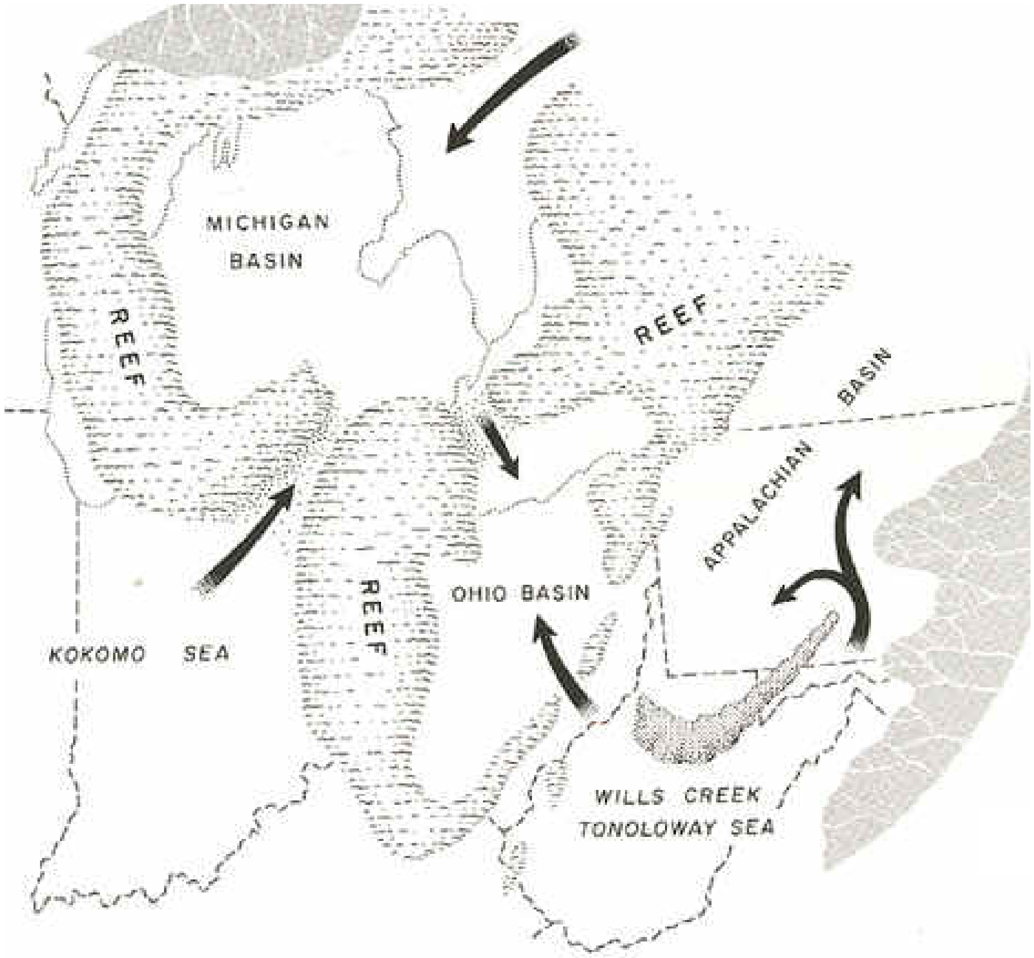
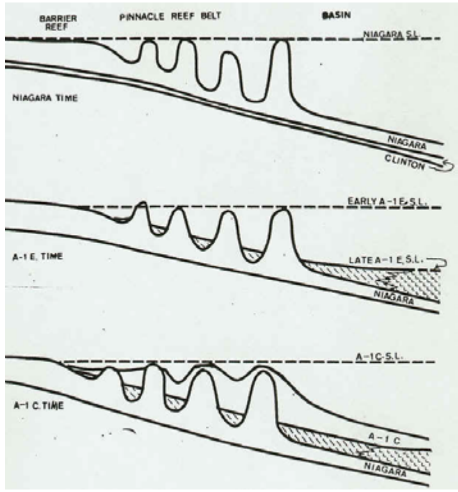


The scientists that do the remarkable research are amazing. They look at these materials and are able to see what it was like millions of years ago. As an examination of this, I include the research of

Randy Schaetzl, Professor of Geography - Michigan State University.

Below are some models and detailed diagrams of just how these reefs (bioherms)

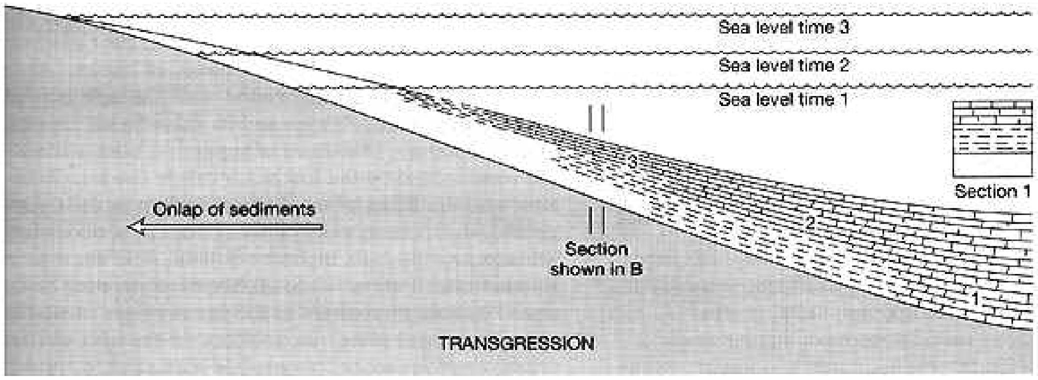


developed and what they look like in cross-section.

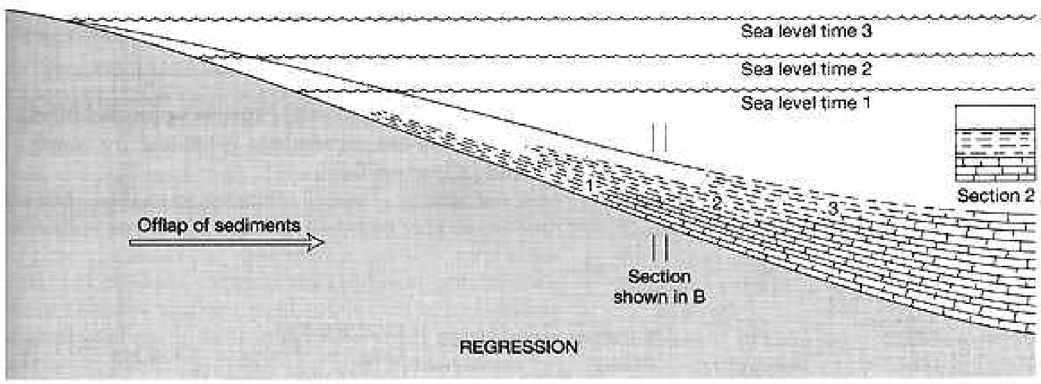
Over millions of years. What goes in between reefs?

Beds of this can be different depending on variety as the next shows.

Thus the complexity is amazing



(a)

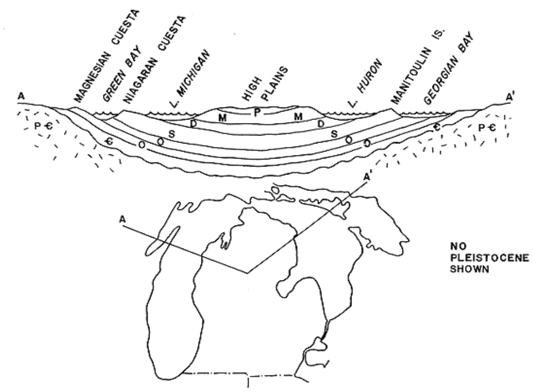


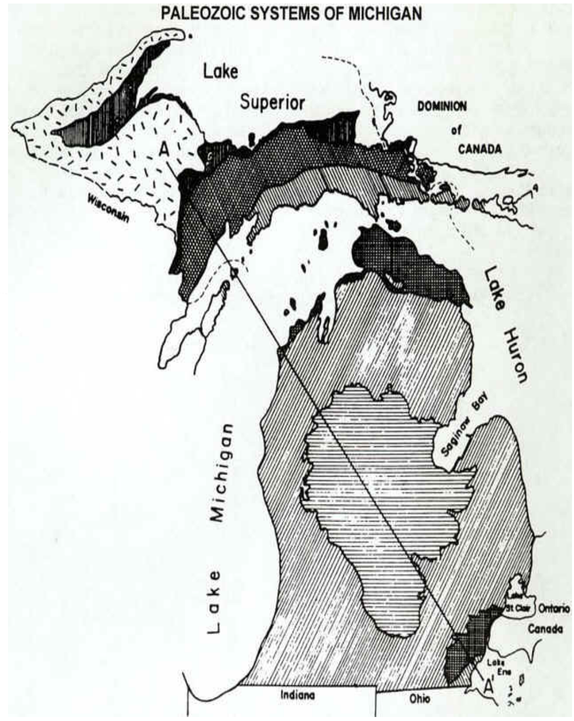
(b)

Transgression (the sea moving onto the land) and regression (the opposite) are important concepts to know when discussing sedimentary rocks. Transgression and regression were very important parts of the depositional environments of the Michigan basin during the Paleozoic. During transgression, the rate of sea level rise is greater than the rate of sediment supply, resulting in onlap of sediments ("a" right). Typically, we then see rocks that change from sandstones to shales to limestones, as we move upward in the rock column.

During regression, the rate of sediment supply exceeds the rate of sea level rise, or the sea level falls, causing offlap of sediments ("b" right). In this case, the rock column is (from bottom to top) limestone, shale, sandstone.

There is a marked contrast between the old, resistant Precambrian and Cambrian rocks of the western half of the Upper Peninsula and the sedimentary rocks of the rest of Michigan (see below).





The limestones, sandstones and shales, which dominate the Michigan Basin of the lower peninsula, are approximately 500 million years old, some perhaps less. The sediments that form these sedimentary rocks were deposited on the bottoms of ancient seas, and the rock layers are piled on top of each other like saucers. The edges of the sedimentary rocks (Continuation of the Niagara Escarpment circle) appear at or near the surface in northern Michigan-for example, near the Straits of Mackinac. In the center of the basin, they are about 14,000 ft (4,267 m) thick.

Some of the layers of material under our Ontario region are remains of coral that grew and changed over the eons. But there also many other rock forms that were laid down over the various eras.

What exactly does a pinnacle reef, or biotherm, look like? The diagrams show that a pinnacle reef is a tall, cylindrical mass of lime and limestone, coral and other carbonaceous materials. Very soft and dissolvable, There are a number of materials we use that are exracted from the basin. There is oil and gas

 The Sifto salt mine in Goderich, Ontario is the largest in the world. It extends five kilomeaters under Lake Huron. Salt extends both south of Bruce Nuclear and north. Southampton once had a salt well. Dolomite is also a very abundant material in the formation

Seen from above, after quarrying, the reef would look like this (below).

The scientists that do the remarkable research are amazing. They look at these materials and are able to see what it was like millions of years ago. As an examination of this, I include the research of

Randy Schaetzl, Professor of Geography - Michigan State University.

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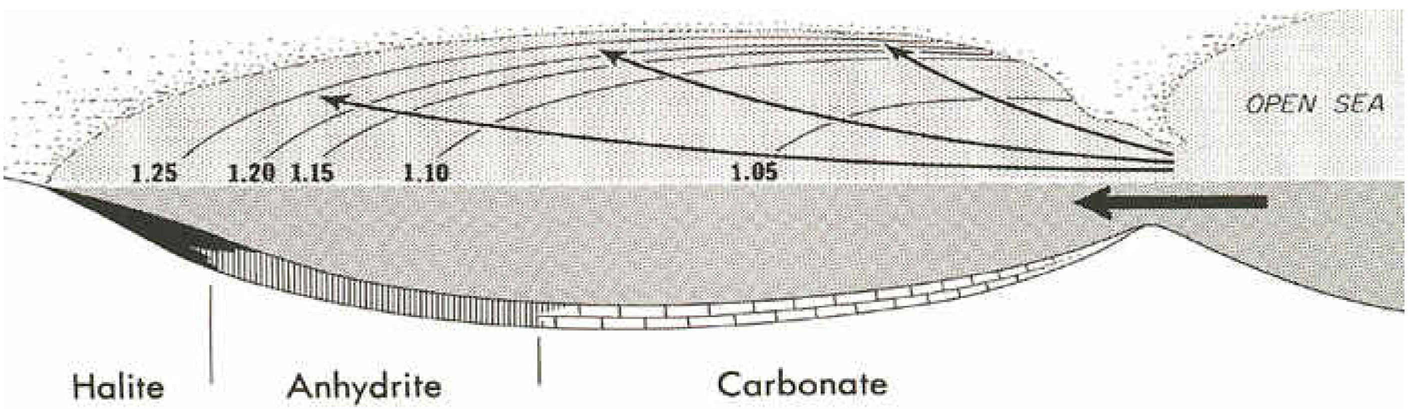
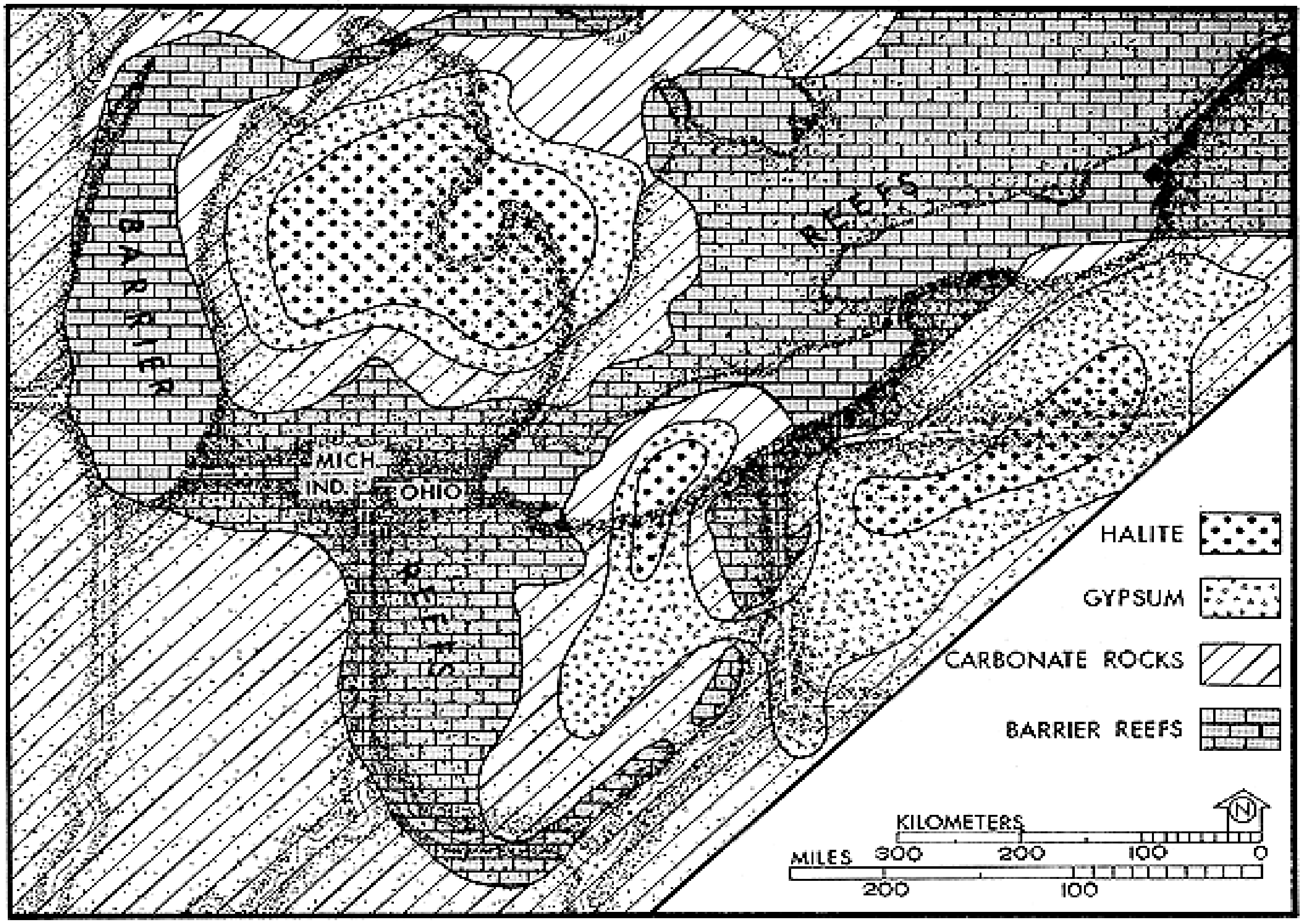


In this way, salt concentrations in the Michigan Basin grew, until gypsum ($CaSO_4$€$2H_2O$), anhydrite ($CaSO_4$), and finally rock salt (NaCl) were precipitated on the underlying carbonates. An aggregate thickness of 600 m of gypsum and salt accumulated in the basin, with one bed of salt nearly 150 m thick. It would take a column of sea water nearly 1000 km deep to form a layer of salt 600 m thick. Great thicknesses of anhydrite and gypsum are also present. The deposition of this immense volume of salt took perhaps 15-20 million years and ended about 390 million years ago. You see below that there is reef material under depth at the nuclear site



The map below shows the North American Silurian reef system. The dots represent Silurian reefs. During the mid-Silurian, pinnacle reefs surrounded the edges of the Michigan basin. Each reef extended up, vertically, from the sea floor, some 200+ meters. They commonly are up to a km in width. Today, these reefs are important oil and gas "traps", and because the limestone, the reefs themselves (when close to the surface) are important sources of limestone.

HOW HARD IS THE MATERIAL? ASK THE NIAGARA RIVER.

THIS FOLLOWING IS WHAT IS SAID IN THE OPG AND BRUCE NUCLEAR REQUEST TO BUILD THE STORAGE FACILITY

ASK THE NIAGARA GORGE

The host rock under the Kincardine site is four times the strength of concrete, and it would take 1 million years for one molecule of water to pass one meter in this rock.

The rock was formed more than 450 million years ago. It has remained intact despite two mountain formations and nine ice ages. Above the host rock rests 200 metres of impereable shale.

Taken together, the rocks of this unique formation provide a natural barrier that scientists from around the world agree is perfect for permanently and safely isolating waste. Ask the USGS scientists and others

DO YOU DOUBT THAT THIS ROCK IS SOFT AND EASILY DISSOLVABLE? LOOK NO FURTHER THE NIAGARA RIVER.

THE NIAGARA GORGE WAS CUT OUT IN JUST 7000 YEARS

7,000 years ago, this area, Wintergreen Flats was the site of the start of the ancient water fall. Water had flowed south through New York State before this. The land changed. Water started flowing into Lake Ontario. It did not erode down creating a valley. The overhanging rock you see eroded. At the top it is harder than that underneath. Thus the material underneath erodes. The start is named the

'Stern of the Great Eastern'. *A view of*

the Ottawa. There was a Niagara Falls like waterfall over the escarpment north of the Bruce Peninsula between Lake Huron Georgian Bay. The *the infant gorge start along the face of the Niagara*

Gorge

Is it hard or soft and easily breakable? Look no further than the Niagara Gorge. Just 7,000 years ago, water began to flow down what is now the Niagara River from Lake Erie to Lake Ontario.

The edge of the escarpment was located near Niagara Glen Terraces.

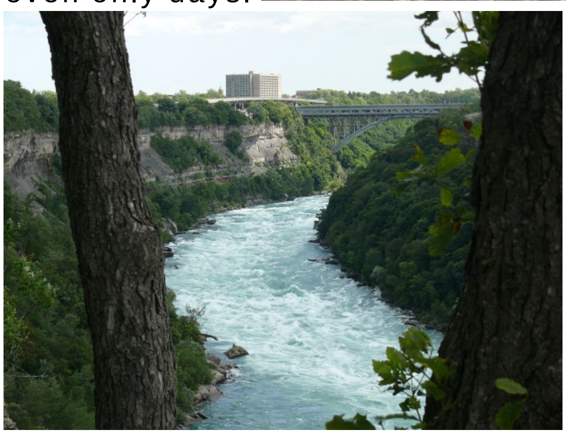
14 - 12 thousand years ago	Wisconsin Glacier cover - retreats
12 thousand years ago	Niagara Falls begins
12 - 11 thousand years ago	Lower Great Gorge
10 - 6 thousand years ago	Whirlpool Rapids Gorge
6 thousand years ago	modern Lake Erie
5 thousand years ago	Upper Great Gorge

The Niagara Gorge exists because it is eroded up by the river force to the falls location now. It cut 11 kilometers (7 mi.) from downstream in 7000 years, (A mile every thousand years.

. Then the falls reached the whirlpool location.

It was a brief and violent encounter: a geological moment lasting only weeks, maybe

even only days. 



When it was all over, it left behind a 90-degree turn in the river we know today as the Whirlpool, and North America's largest series of standing waves we know today as the Whirlpool Rapids.

The falls then re-established at about the area of the Whirlpool Rapids Bridge and resumed carving its way through solid rock to its present location.

This material under the Nuclear sites is the same material.

Picture of whirlpool. Imagine Niagara Falls at this point before cutting back up river. It hit a crumbled section of material as you can see behind the bowl. It all collapsed in days before changing direction. And continued eroding. You see it is still cutting back inspite of a lot of water diverted into elecricity generation stations in both countries. a

Flower pot islands. How strong and eternal?

THIS IS THE BASE OF OUR NUCLEAR PLANTS AND PROPOSED STORAGE AREAS.

THIS IS MATERIAL THAT OUR DANGEROUS NUCLEAR MATERIAL IS LOCATED UPON.

NEXT: WE LIVE ON TOP OF AN UNSEEN HUGE SEA.

The Michigan Basin has an ancient sea. Those who live in South West Ontaio have a sea under them. And water from millions of years ago is still there in some places. And water from the surface percolates down and water creeps up to the surface as well. Many rely on it.

WE do not imagine that there are thousands of feet of this water under much of Ontario.

I include the following USA scientific report because I have not been able to finds a Canadian one. I see no reason why similar formations to those described here would not be done for Ontario. The area around and under the proposed nuclear storage area has to have extensive aquifer systems at a number of depths below the surface and being of various thicknesses. If so, any nuclear spill from the plant. Douglas Point or storage on the surface would quickly be in the flow to the lake or substructures. Movements, collapses, dissolved material