

Seeking God in Einstein's Universe The Children of Earth

Aileen A. O'Donoghue

God's Grandeur

THE WORLD is charged with the grandeur of God.
It will flame out, like shining from shook foil;
It gathers to a greatness, like the ooze of oil
Crushed. Why do men then now not reck his rod?
Generations have trod, have trod, have trod;
And all is seared with trade; bleared, smeared
with toil;
And wears man's smudge and shares man's smell:
the soil
Is bare now, nor can foot feel, being shod.

God's Grandeur

And for all this, nature is never spent;

There lives the dearest freshness deep down
things;

And though the last lights off the black West went

Oh, morning, at the brown brink eastward,
springs—

Because the Holy Ghost over the bent

World broods with warm breast and with ah!
bright wings.

Gerard Manley Hopkins

Star Birth Region

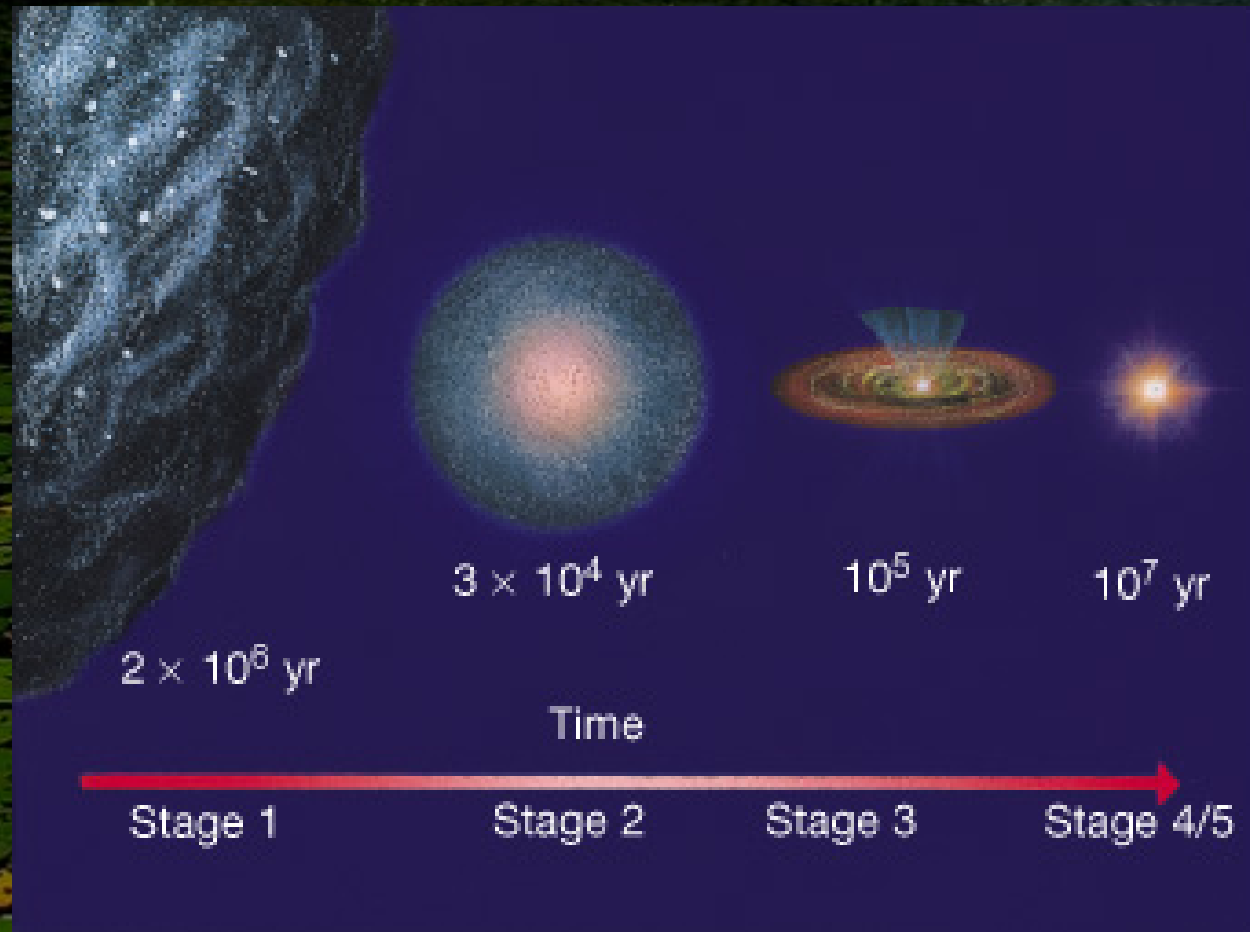
Giant, hot, young stars
illuminate nebula

Great
Orion Nebula

Thick, dusty disks
protect forming stars &
planetary systems

Starbirth

☆ Interstellar cloud fragments collapse under gravity to form stars.



Products Of Stellar Fusion

☆ Early universe was
75% H, 25% He

All other elements
are the products
of stars!

Substance of Life

☆ Life requires H, C, O, & N

🌍 All elements of life came from stars that lived AND DIED before the sun formed.

🌍 Sun is a 2nd or 3rd generation star
 ⤵ 1st stars were pure hydrogen and helium)

“We are the matter of the
cosmos contemplating itself.”

- Carl Sagan

Planetary Nebulae

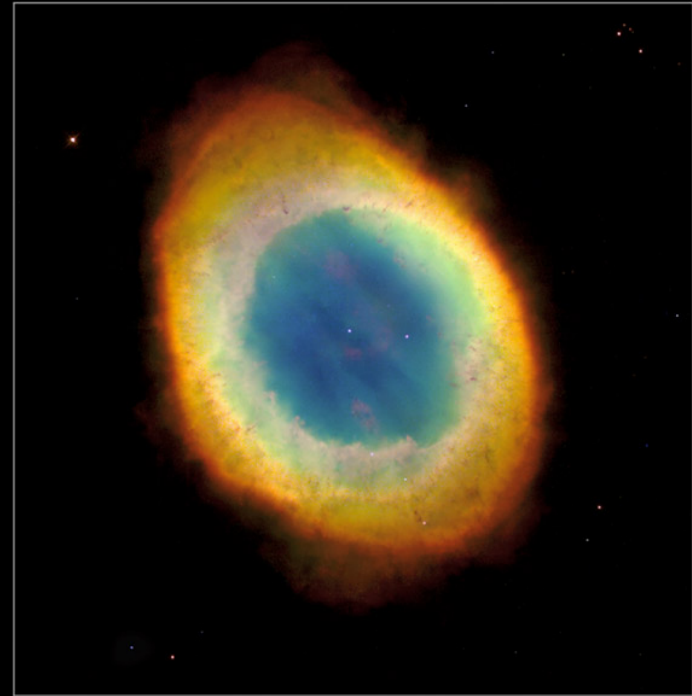
☆ The source of common heavy elements (lighter than iron) ... C, O, N, Ca, K, P, etc.



Henize 1357 • Stingray Nebula
PRC98-15 • ST ScI OPO • April 2, 1998
M. Bobrowsky (Orbital Sciences Corp.) and NASA

HST • WFPC2

Ring Nebula



Hubble
Heritage

PRC99-01 • Space Telescope Science Institute • Hubble Heritage Team (AURA/STScI/NASA)

Iron

☆ Iron is the most stable element

🌐 ABSORBS energy in fusion

🌐 ABSORBS energy in fission

When iron core begins to fuse

✂ energy is absorbed by reaction

✂ core cools ... contracts

✂ outer layers begin to fall in

✂ star implodes ...

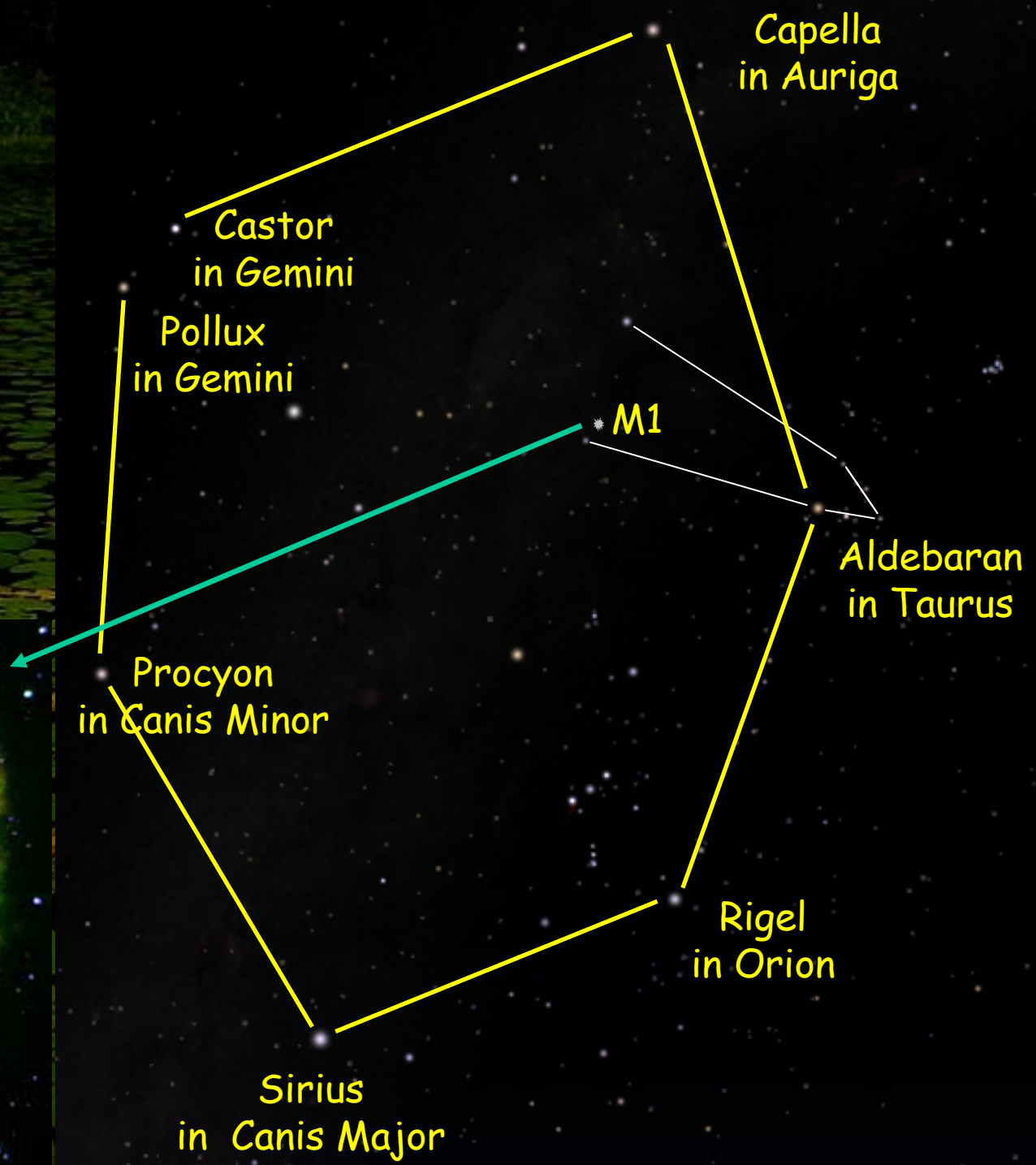
outer layers bounce off dense inner core

✂ star explodes ...

Supernova



Crab Nebula Supernova Observed in 1054 by Chinese & Anazazi



"... Bathe yourself in
the ocean of matter;
plunge into it where
it is deepest and
most violent; struggle
in its currents and
drink of its waters.

"For it cradled you long
ago in your preconscious
existence; and it is that
ocean that will raise you
up to God."

Teilhard de Chardin

The Milky Way Galaxy

Sun ~ 30,000 ly
from center

Galactic Year

~225,000,000 yr
(Sol is ~22)

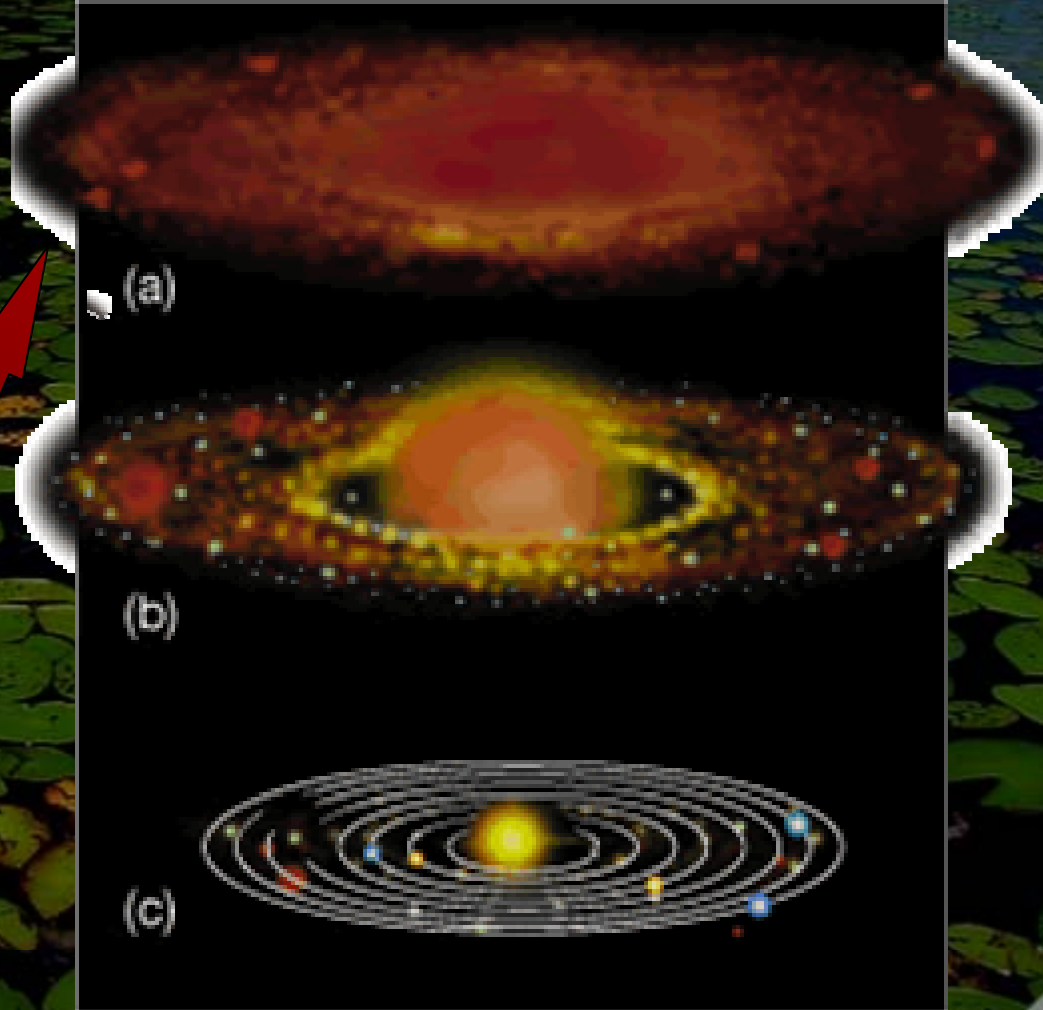
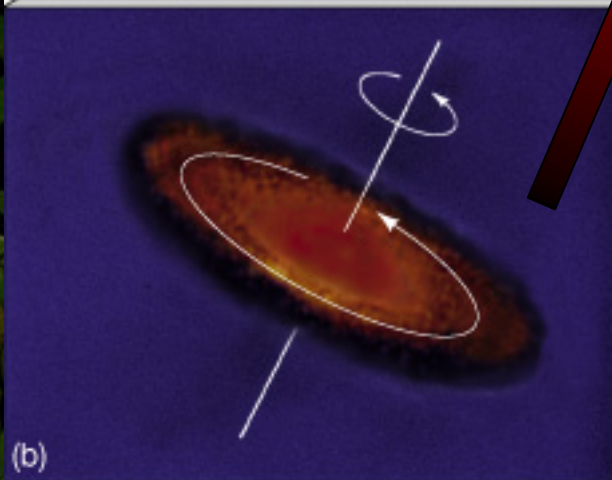
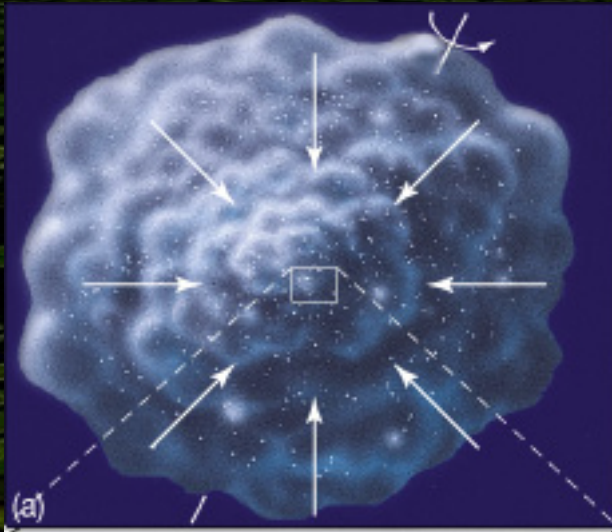


M87, a galaxy much like the Milky Way

<http://www.eso.org/outreach/press-rel/pr-1999/pr-18-99.html>

Solar System

☆ Sun & Planets formed from interstellar clouds collapsing under gravity



Earth

☆ Active, living planet

› Layered

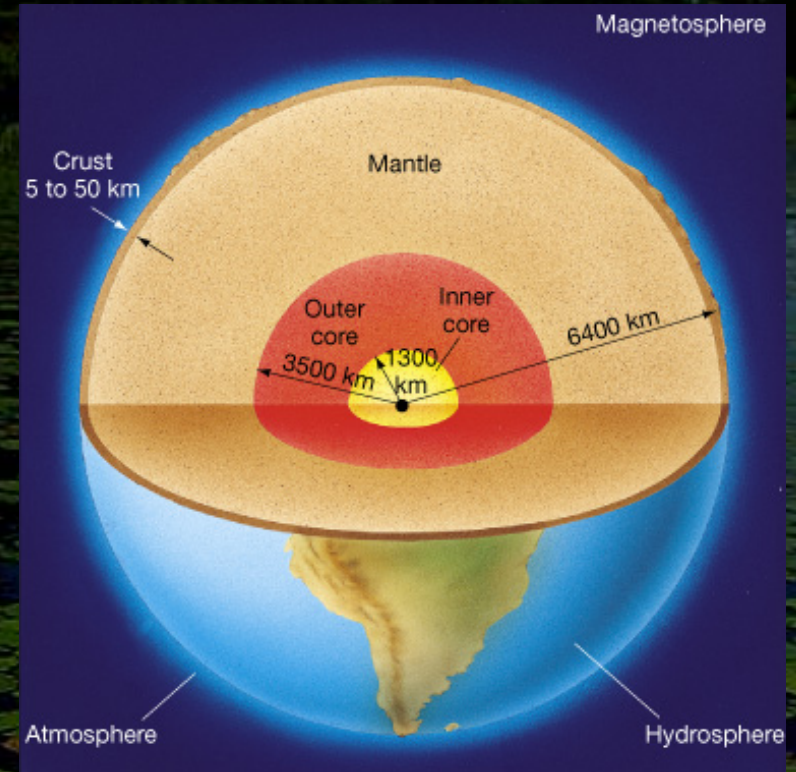
› Molten inner core

☞ creates magnetic field
required for land life!

› Plastic mantle

☞ drives plate tectonics

☞ powers volcanoes



› Crust

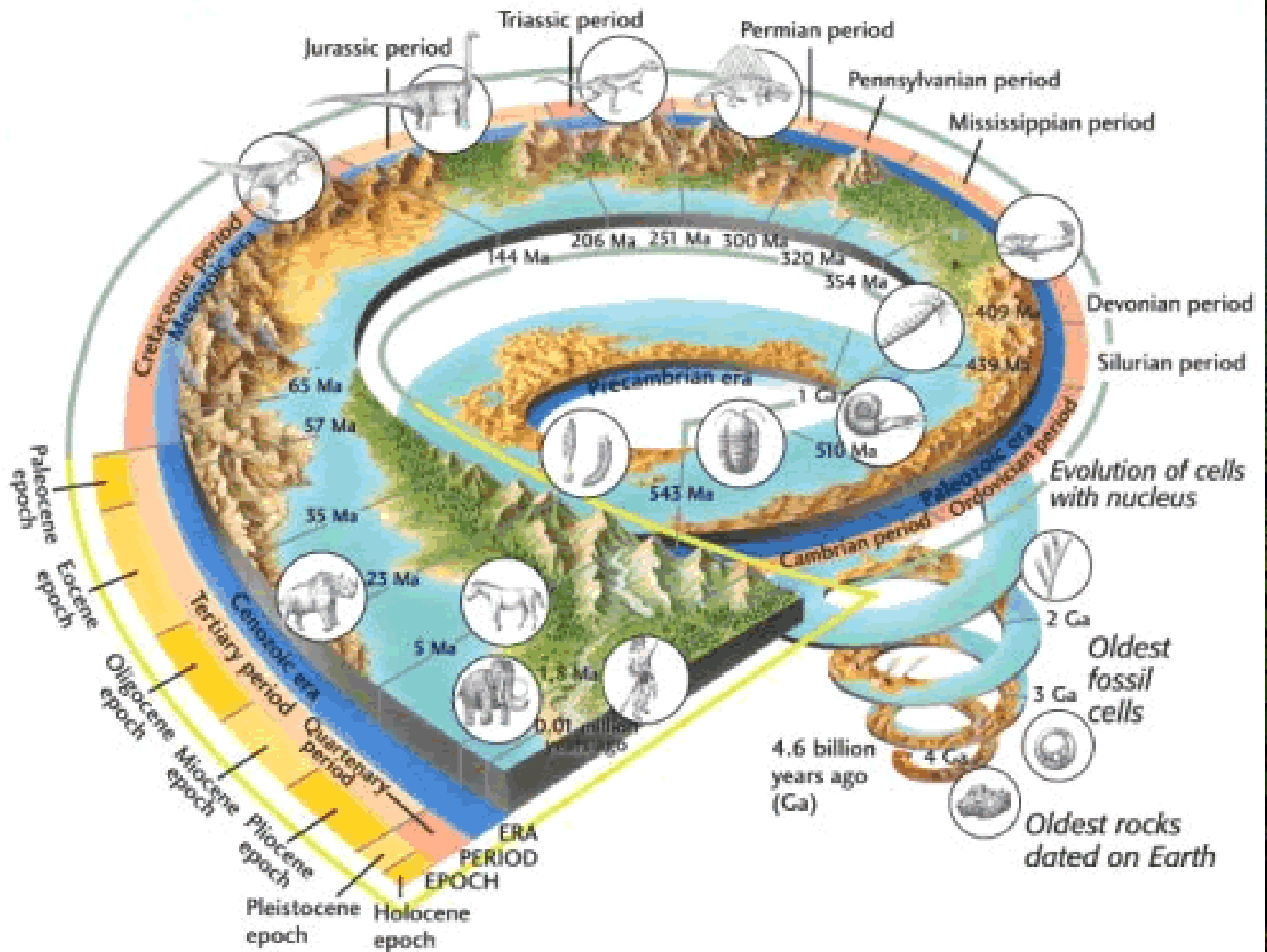
☞ Constantly evolving

› Biosphere

☞ Hydrosphere

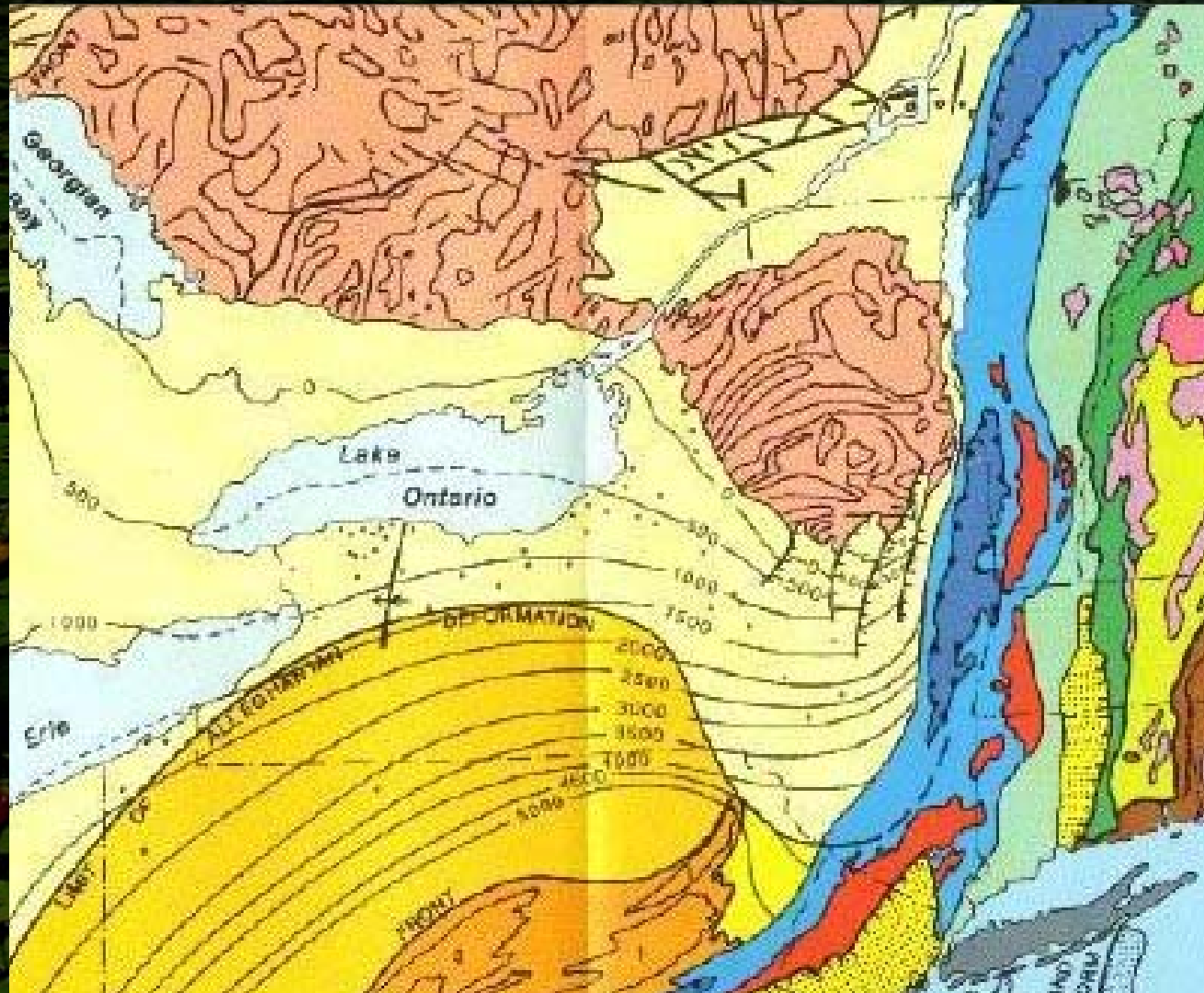
☞ Atmosphere

Earth's History



New York's History

☆ Tectonic map shows history



New York's History

☆ Oldest rocks: Canada & the Adirondacks

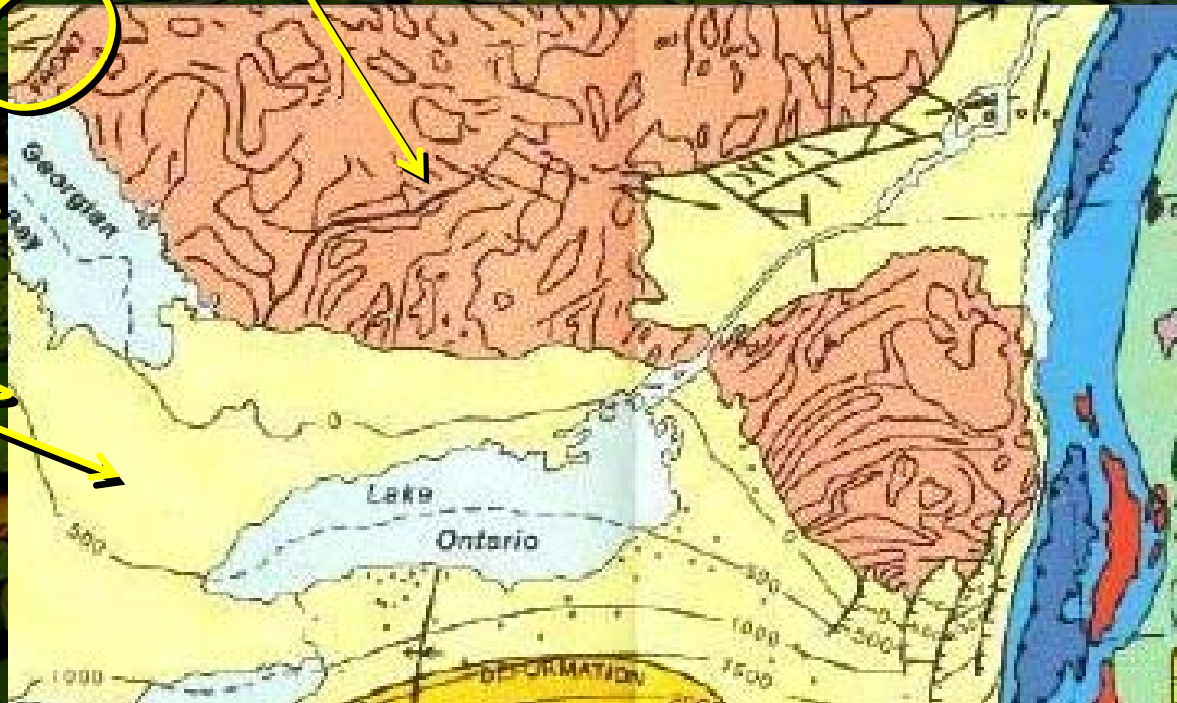
☆ Canadian Shield: Superior

- 🌐 Volcanic & Granitic rocks from 2.7 - 3.5 by ago
- 🌐 Metamorphosed ~ 2.7 by ago

☆ Canadian Shield: Grenville

- 🌐 Outwash from original N. American Continent > 1 BY ago
- 🌐 Metamorphosed ~ 1 By ago in Grenville Orogeny

☆ Sedimentary outwash from Canadian shield, tectonically passive

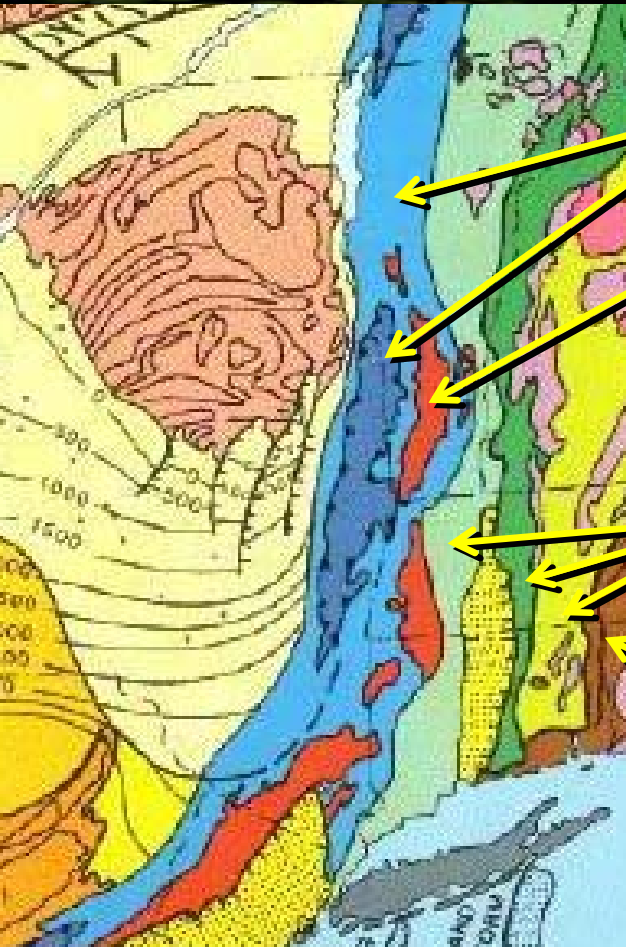


New York's History

☆ Compressed rocks: Taconic Orogeny

🌐 Closing of Iapetus Ocean

🌐 Collision with Baltica & Avalonia (Island)



☆ Marine Sediment from Iapetus Ocean

☆ Taconic Mountain roots

🌐 metamorphosed Grenville rocks

🌐 Taconic Mts. \approx Himalayas

☆ Gander Terrain

🌐 Pieces of N. Europe (Baltica) added during collision

☆ Avalonia Terrain

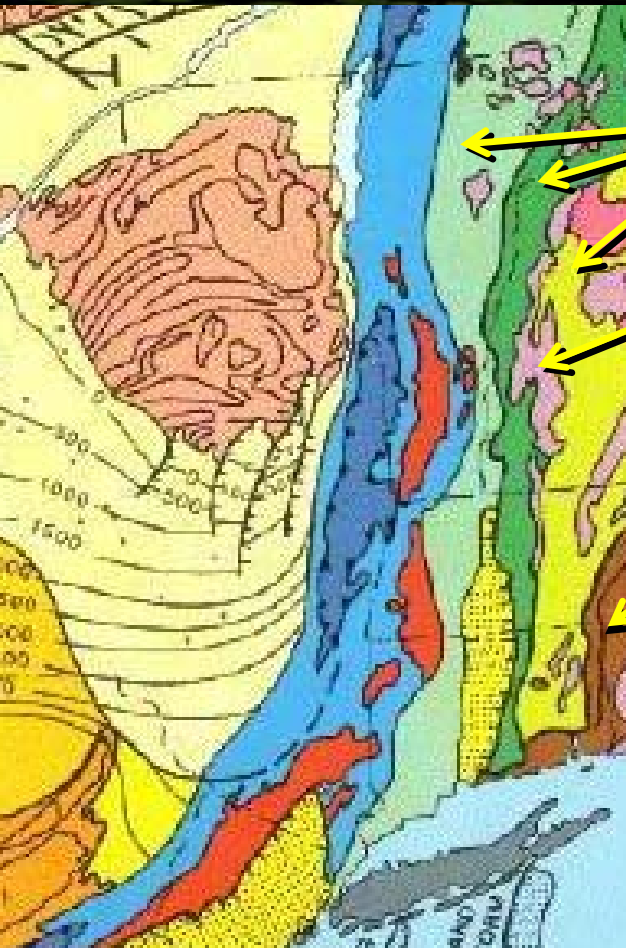
🌐 Island added during collision

New York's History

☆ Compressed rocks: Acadian Orogeny

🌐 Asia collides with Siberia creating Urals

🌐 Siberia collides with Baltica & N. America



☆ Gander Terrain

🌐 Further deformation

☆ Intrusions

🌐 Igneous & Metamorphosed granites

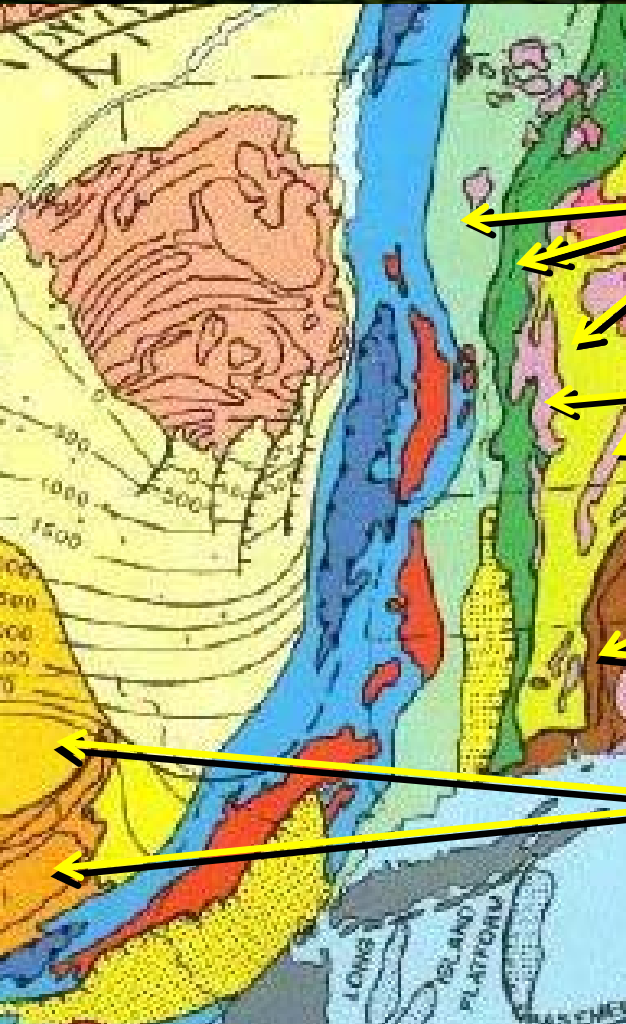
☆ Avalonia Terrain

🌐 Further deformation

New York's History

☆ Compressed rocks: Alleghanian Orogeny

🌐 Africa & S. America collide with Am.



☆ Gander Terrain

🌐 Further deformation

☆ Intrusions

🌐 Igneous & Metamorphosed granites

☆ Avalonia Terrain

🌐 Further deformation

☆ Appalachian Mountains

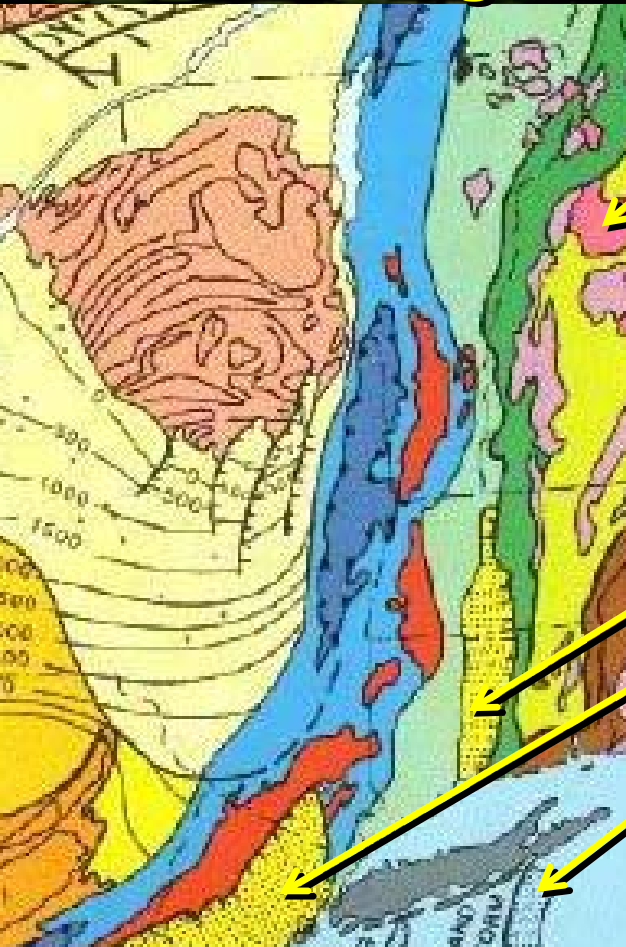
🌐 Due to collision with Africa

New York's History

☆ Stretched rocks: Birth of Atlantic

🌐 Breakup of Pangea

🌐 Rifting of NE N. Am. From Europe



☆ Plutons

🌐 Upwelling of molten rock from mantle during rifting

🌐 eg. White Mountains of NH

☆ Rift Basins open

🌐 Connecticut River Valley

🌐 Newark Basin

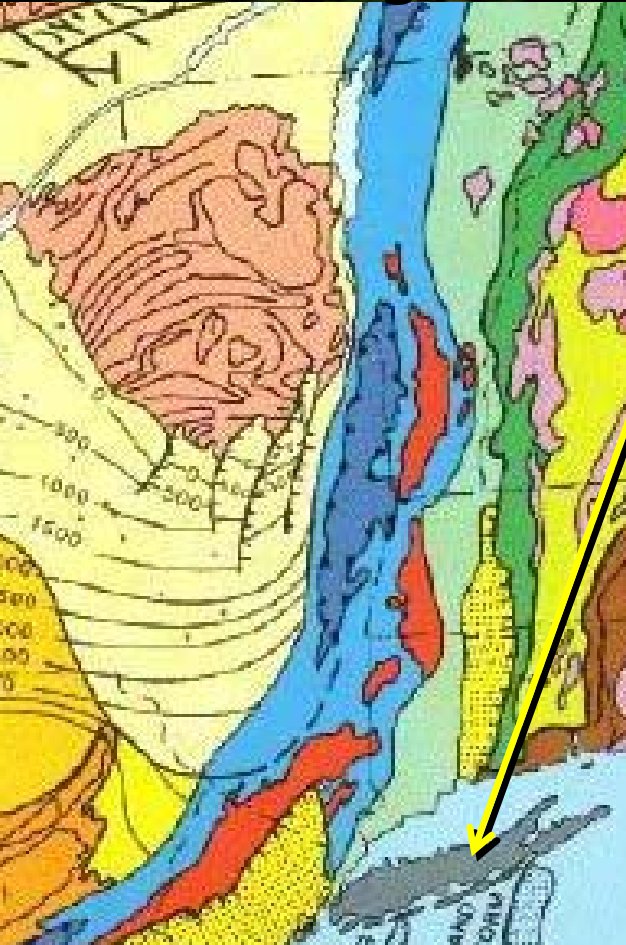
🌐 Undersea Basins

New York's History

☆ Gouged & Piled rocks: Glaciation

🌐 Mohawk & Hudson Valleys Carved out

🌐 Long Island created from glacial till



☆ Terminal Moraine

🌐 Farthest extent of glaciation

🌐 Jumbled sediments

› Not sorted by size

☆ Canton/Potsdam area

🌐 Under glaciers

🌐 Under Lake Iroquois

› Ice dam blocked St. Lawrence outlet

🌐 Under Champlain Sea

› Sea intruded after ice broke

› Receded as continent rebounded

New York's History

☆ Current landscape a snapshot

🌐 Taconic Mountains

› were higher than Himalayan mountains

✎ same origin: colliding continents

› have eroded completely

✎ Taughannock Falls cutting Taconic sediments!



Earth's History

☆ 4.6 Billion Years

🌍 Oldest Material 4.0 – 4.2 Billion years old

➤ Zircon crystals in W. Australia

🌍 Oldest Rocks 3.7 – 3.8 by

➤ Iron Mountain, Greenland

🌍 Oldest Fossils

➤ Microscopic: 3.5 by

🌀 Stromatolites (bacterial colonies)

➤ Macroscopic: 650 my

🌀 soft-bodied organisms



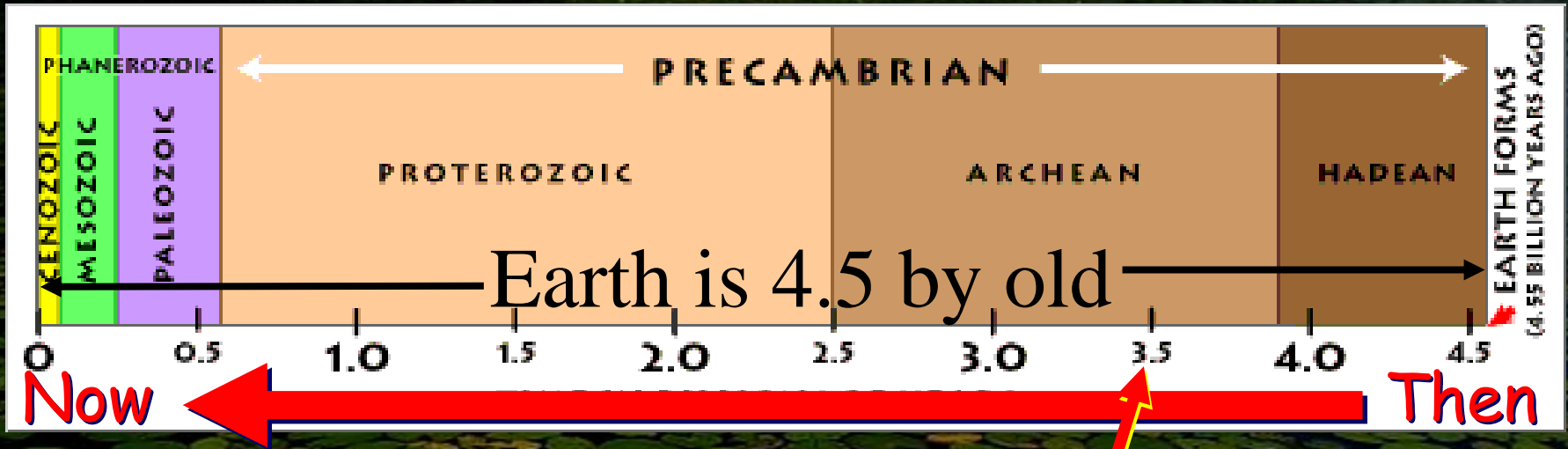
Mass on the World

"... Over every living thing which is to
spring up, to grow to flower, to ripen
during this day say again the words:

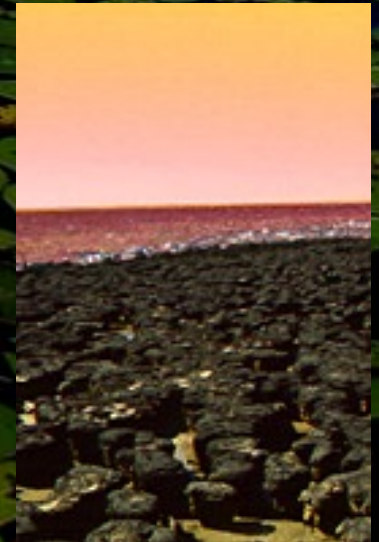
This is my Body.

Teilhard de Chardin

Life's History



Earliest life
3.5 by ago:
stromatolites
(cyanobacteria)



Life At High Temperature

Hot Springs in Yellowstone National Park



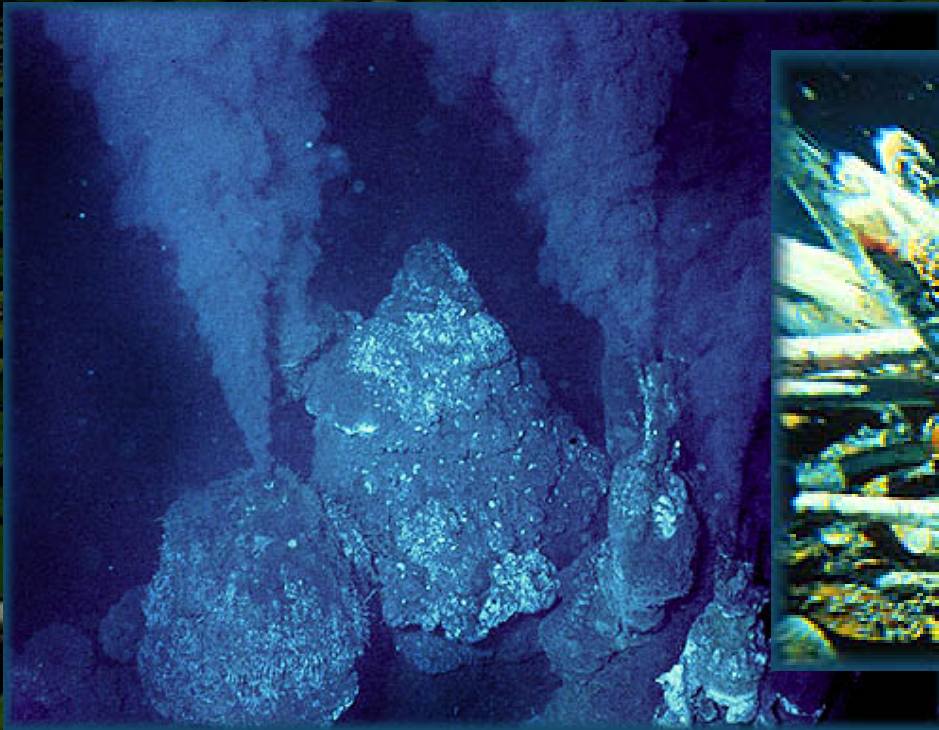
Cyanobacteria ...
the most ancient
life on Earth



Life In The Dark

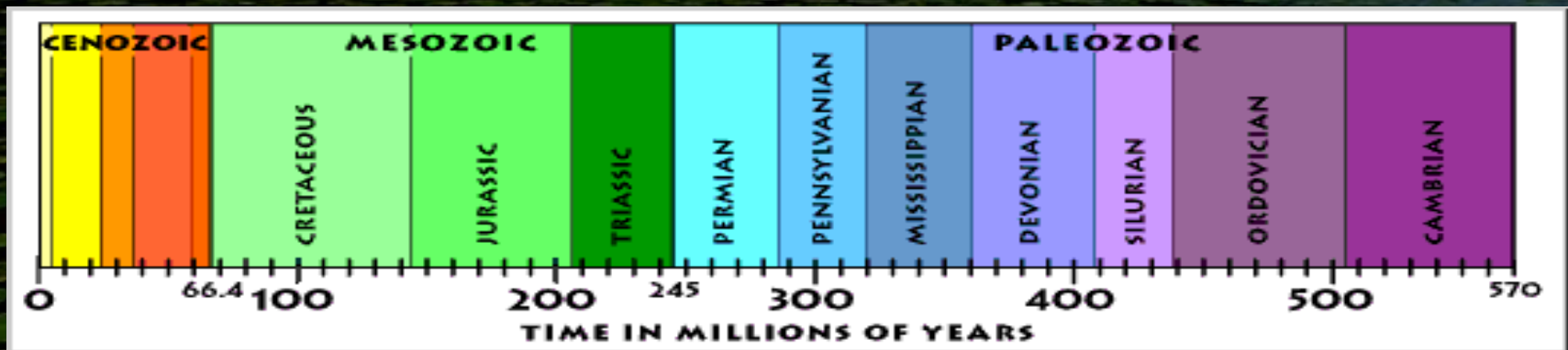
The Deep Sea Vents

Life utilizes minerals from Earth's interior



Life's History

Evolution of complex life only in last 650 million years!

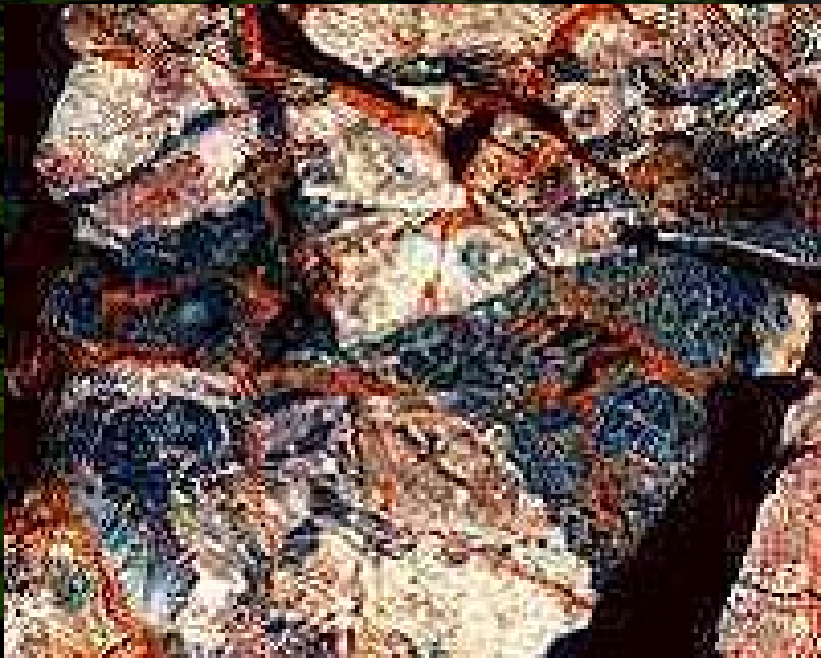


Most evolution has taken place **ONLY**
in last 14% of the age of Earth!

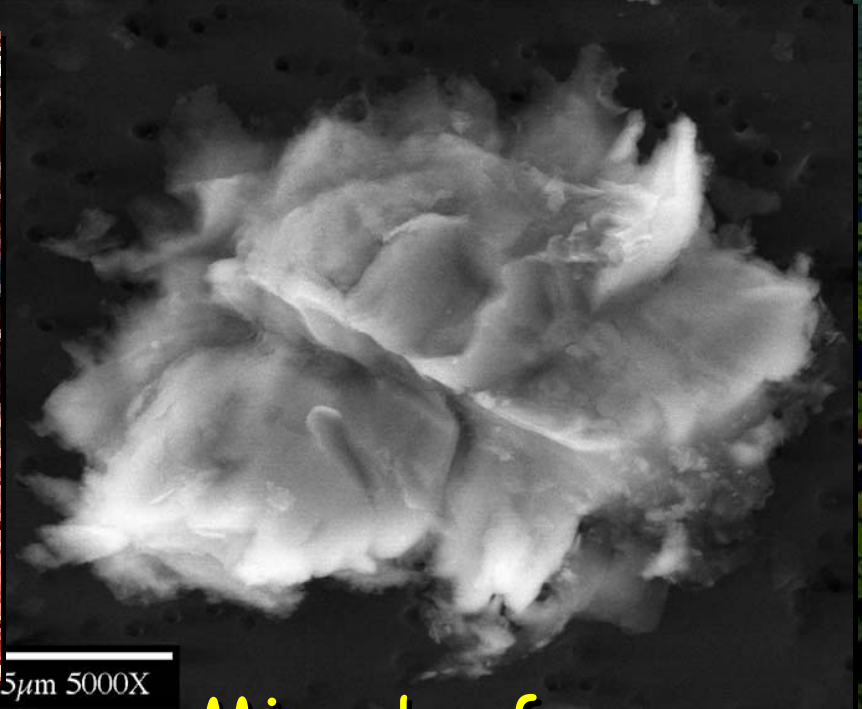
Most evolution has taken place **ONLY**
in last 5% of the age of the universe!

Abundance Of Life

☆ Life survives in every ecosystem on Earth ... even within ice and rocks!



Sulfide-digesting
bacteria on rocks

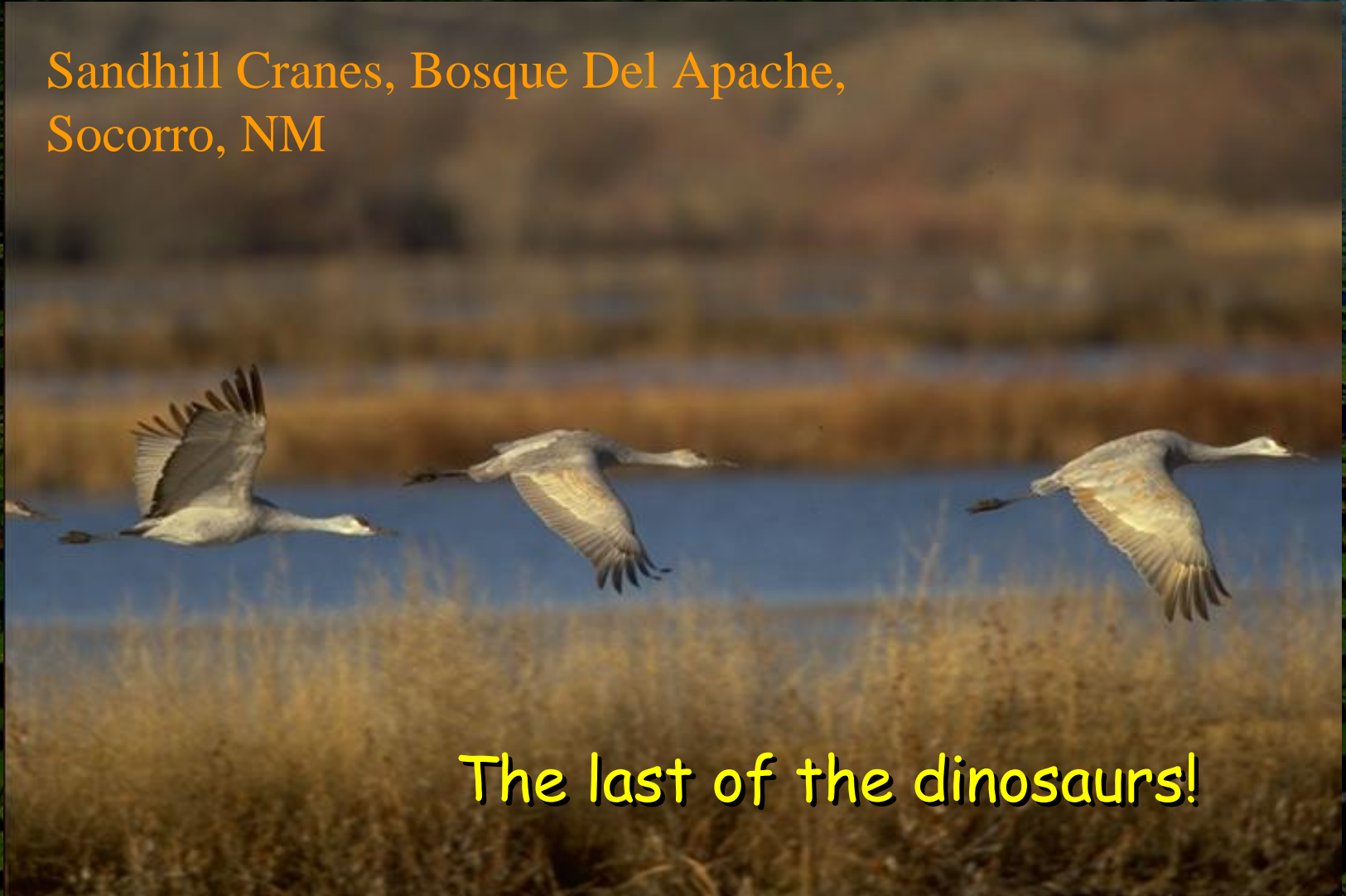


Microbe from
Antarctic Ice

Abundance of Life

Life fills the air

Sandhill Cranes, Bosque Del Apache,
Socorro, NM



The last of the dinosaurs!



Life
Everywhere
On Land



Life From The Rocks

**Shrub on the
desert pavement**



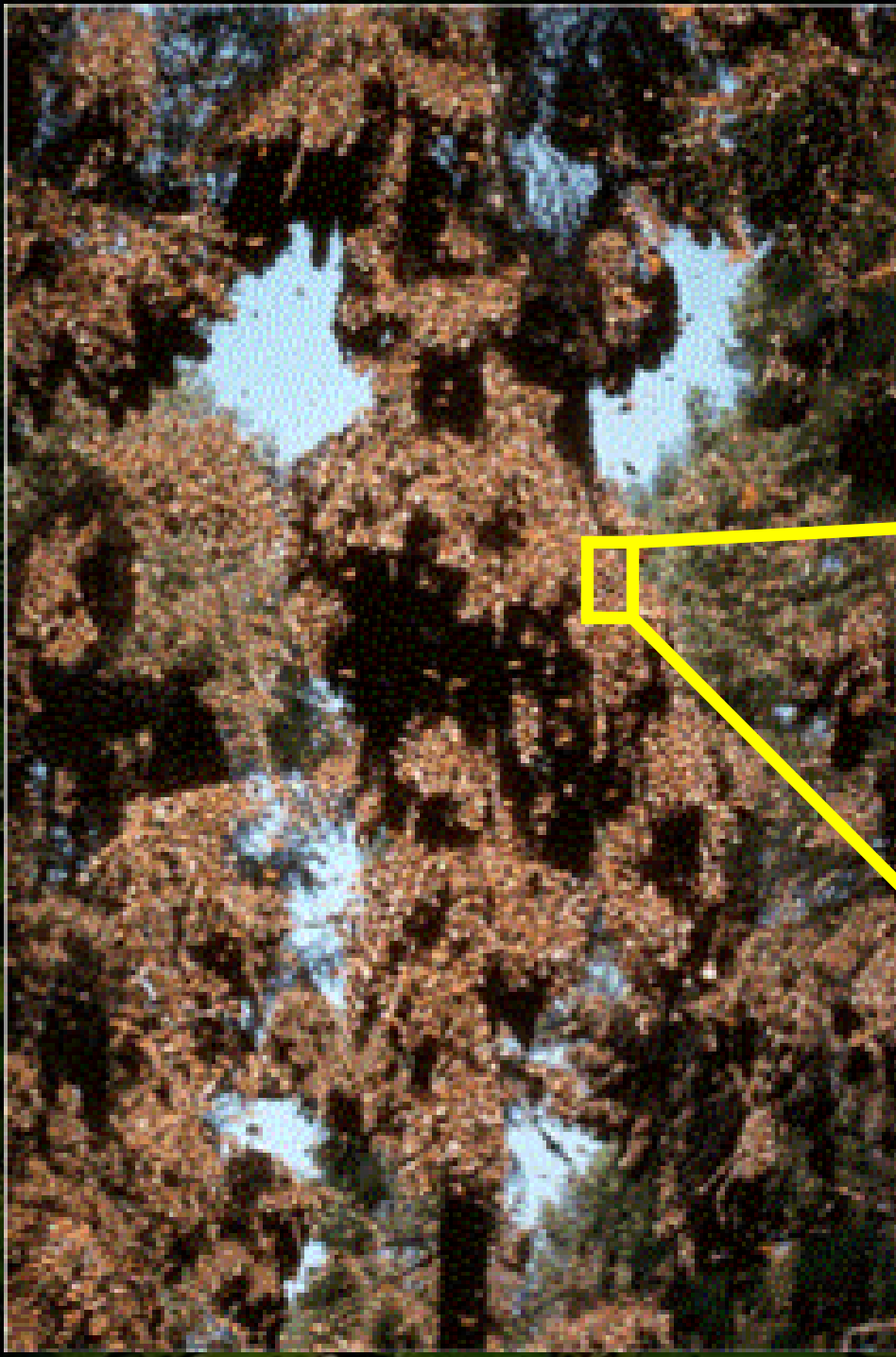
**Lichens:
symbiotic
associations of
algae and fungi**



Trees From The Rocks



Life On The Trees



Given Hydrogen, Gravity & 15 Billion Years The Universe Made



Kiva



Pace

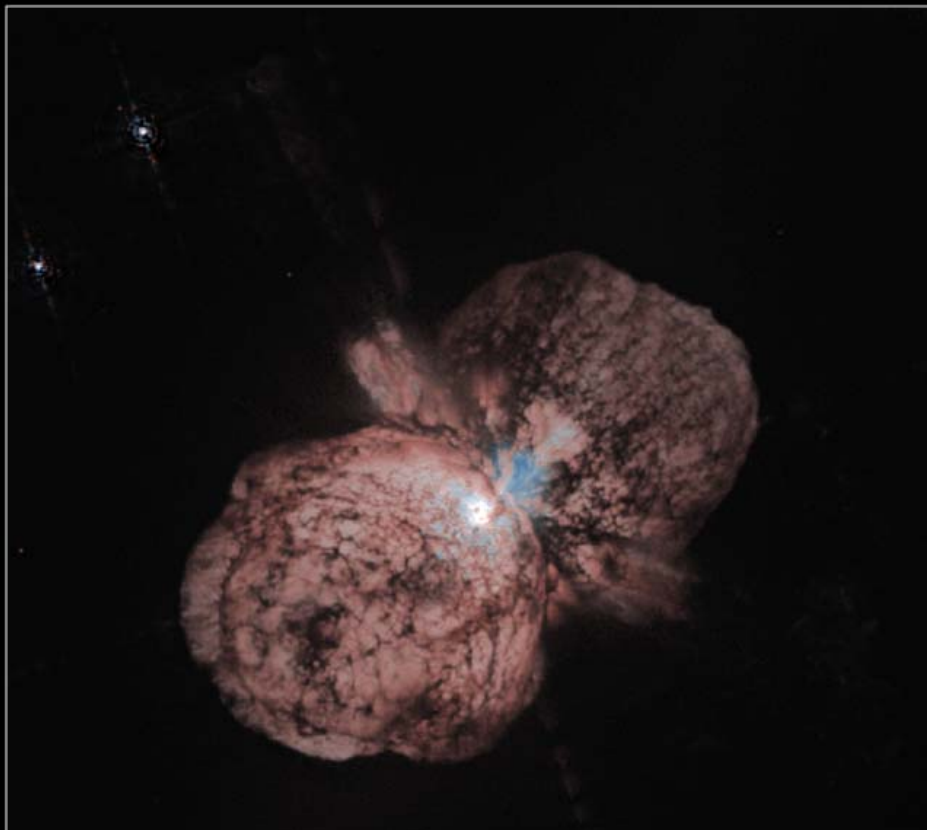
Puppies!

Touching Earth

Whenever your feet touch Earth
you know they are touching
Where something has died
or been born.

Antler
Earth Prayers

And All Is From The Stars!

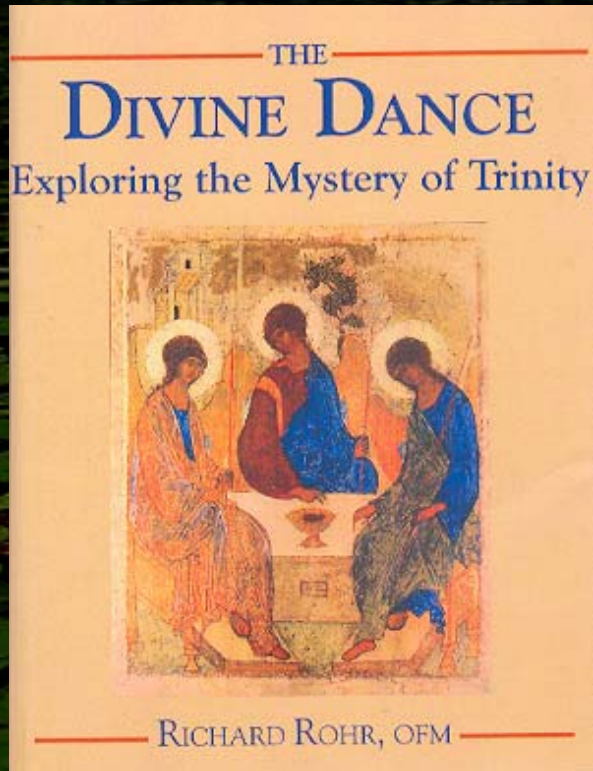


Planetary Nebula NGC 6751



Except the hydrogen which is from the first millisecond after the Big bang!

The Divine Dance



"There are only two ways that people really have *new* experience. Most things we call experiences are things that are just repetitions and we imprison them inside experience we already have ... so most people stop growing after 17 or 18.

Wonder as the Spiritual Path

"There are two ways we can break through and have new experience ...

Awe or Wonder where your logic breaks down. At that point you can have new experience. Otherwise you will just fit everything into your old experience and it will just be repetition.

Wonder as the Spiritual Path

"Awe and wonder are co-relative terms with mystery ...

When you have to remain in the humility of wonder and awe before mystery,

that's when God can break in with new experience.

And you can never say "I know" or "I've got it in a package."

Fr. Richard Rohr, OFM

A photograph of a pond with many green lily pads floating on the water. In the background, there is a line of trees under a dark sky. The text is overlaid on the image in a yellow, bold, sans-serif font.

But Wait! Don't Order Yet ...

Meteors have wiped out up to 90%
of life on Earth ...

A nearby supernova would destroy
life on Earth with radiation ...

☆ The sun becoming a red giant will destroy
life on Earth ...

The Very Wonders Kill

☆ The universe is not always gentle

🌍 meteors kill

🌍 volcanoes kill

🌍 solar radiation kills

🌍 animals must kill to live

Genesis

"God saw everything he had made,
and indeed, it was very good.
And there was evening and there
was morning, the sixth day."

But what about roadkill?

A photograph of a pond covered in green lily pads. In the background, there is a dense forest of tall trees. The text "Even Roadkill Is Star Stuff!" is overlaid on the image in a large, stylized font. The main text is yellow with a red-to-orange gradient and a black outline. Below it, the same text "Even Roadkill Is Star Stuff!" is repeated in a smaller, blue font with a black outline, flanked by blue wing-like graphics.

Even Roadkill Is Star Stuff!

Even Roadkill Is Star Stuff!

Roadkill: Inadvertent Death

"The Earth is full
of your creatures"

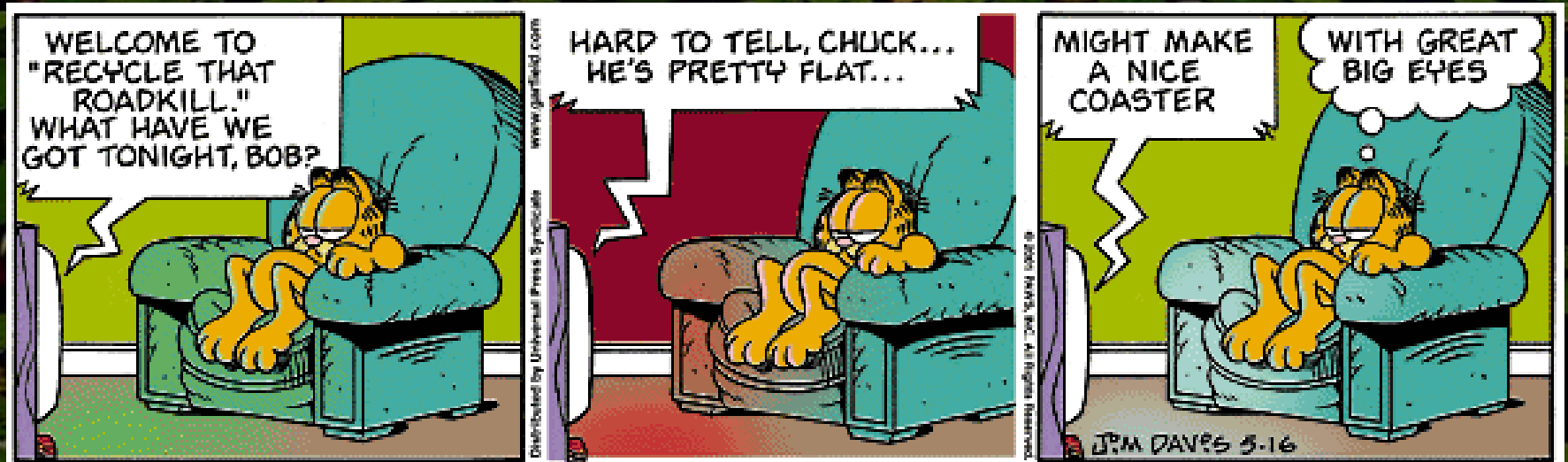


Roadkill

Life is so abundant ...

We can waste it

And make fun of it.



Is God Present in Roadkill?

☆ Inadvertent, wasteful death



☆ Caused by the gifts of metals,
☆ machines
☆ and minds.

Coping with Roadkill

☆ What can we do about roadkill?

🌐 stop driving?

🌐 drive slower?

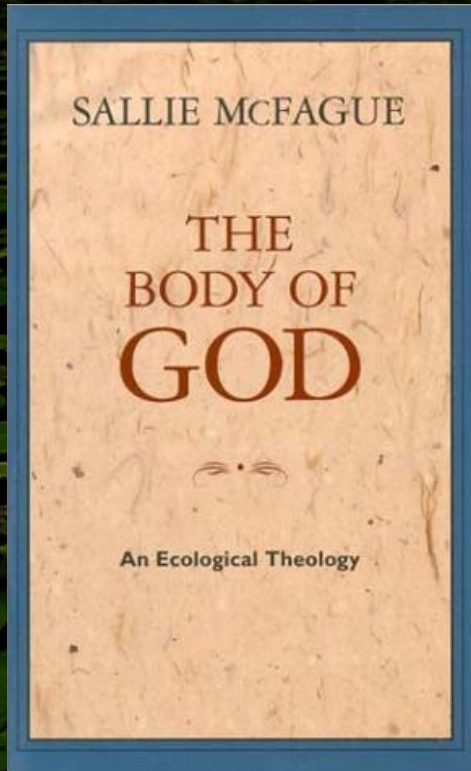
RACE AGAINST
THE MACHINE

☆ As we work to reduce & eliminate it,

☆ can we acknowledge and bless it?

☆ Can we include it in the Christic Universe?

Reducing/Eliminating Roadkill



"The concern here is with the possibility of a theology of nature, that is, using the picture of reality coming to us from postmodern science as a way to reimagine the relationship between God and the world."

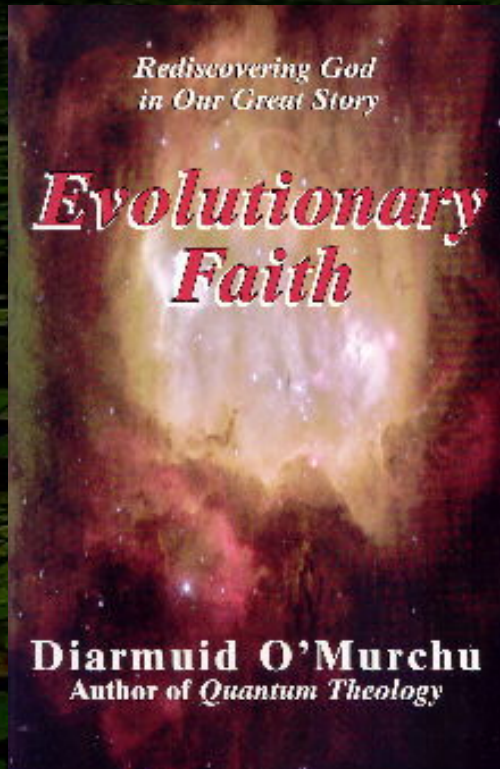
Sally McFague
The Body of God

Reducing/Eliminating Roadkill

"...to consider ourselves as inspirited bodies, profoundly interrelated with all other such bodies and yet having the distinction of shared responsibility with God for the well being of our planet."

Sally McFague
The Body of God

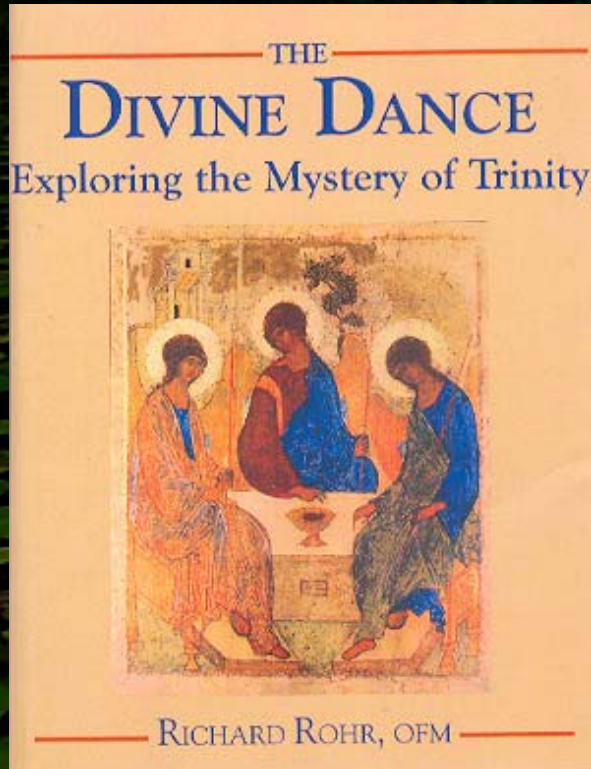
Acknowledging Roadkill



"Written into the very fabric of evolutionary E-mergence, at the cosmic, planetary, and human levels, is this paradox of creation and destruction."

Diarmuid O'Murchu
Evolutionary Faith

Suffering as the Spiritual Path



"The other forum in which we have new experience is suffering. Suffering is the only thing strong enough to break down your control systems, your explanation systems, your logic systems, your being in charge and your being in control.

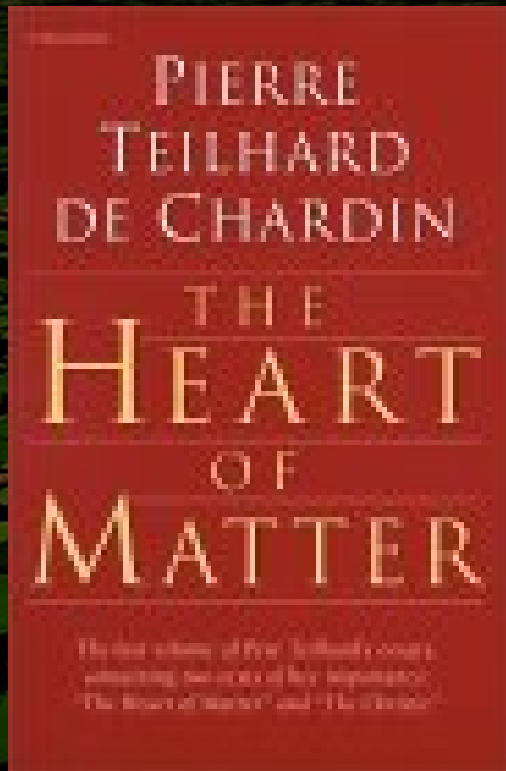
Suffering as the Spiritual Path

"God normally has to lead your mind or your intellect to the limits of its resources. Or your will where 'I cannot do it!' Your will has to fail you or intellect has to fail you, 'I can't figure it out. I can't make sense of it. I can't get through this day.'"

Fr. Richard Rohr, OFM

Blessing Roadkill

"My communion would be incomplete - would, quite simply, not be Christian - if, together with the gains which this new day brings me, I did not accept, in my own name and in the name of the world, ...



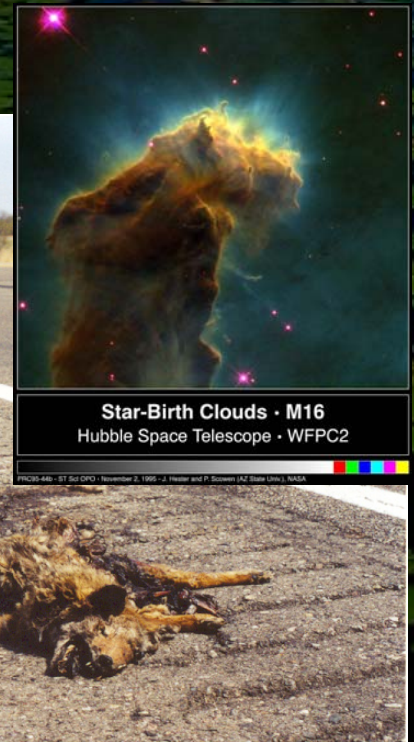
Blessing Roadkill

"... as the most immediate sharing in
your own being, those processes,
hidden or manifest,
of enfeeblement,
of aging,
of death,
which unceasingly
consume the universe."

Teilhard de Chardin
The Mass on the World

The Wonder Of Roadkill

"...yet not a single sparrow falls to the ground without your Abba God's knowledge."



Mass on the World

"... Over every living thing which is
to spring up, to grow to flower, to
ripen during this day say again the
words:

This is my Body.

Teilhard de Chardin

Finding God In Roadkill

☆ "And over every death-force which waits in readiness to corrode, to wither, to cut down, speak again your commanding words which express the supreme mystery of faith:



Loving God

"Matter and spirit: these were no longer two things, but two states of one and the same cosmic stuff."

Teilhard de Chardin

Seeking God in Einstein's Universe

"All that I have written seems to me like straw compared to what has now been revealed to me."

- Thomas Aquinas

"Anybody who knows is humble. Anybody who knows, what they largely know is that they don't know. That's the main thing you know when you're talking about God is that you don't know."

Fr. Richard Rohr, OFM



The adventure continues ...

Background photo "Water Lily Pads in the Osgood River" by Bob Lepak