Water from Rock

The Story of Primary Water

"In hydrogeology, just as in any other science, ideas that repudiate the traditional point of view and therefore at first seem, using Einstein's expression 'stupid', are of especial interest: the question is – are they sufficiently paradoxical to be true."
– E.V. Pinneker, *General Hydrogeology*, Cambridge University Press, 1980

Lyn Hebenstreit

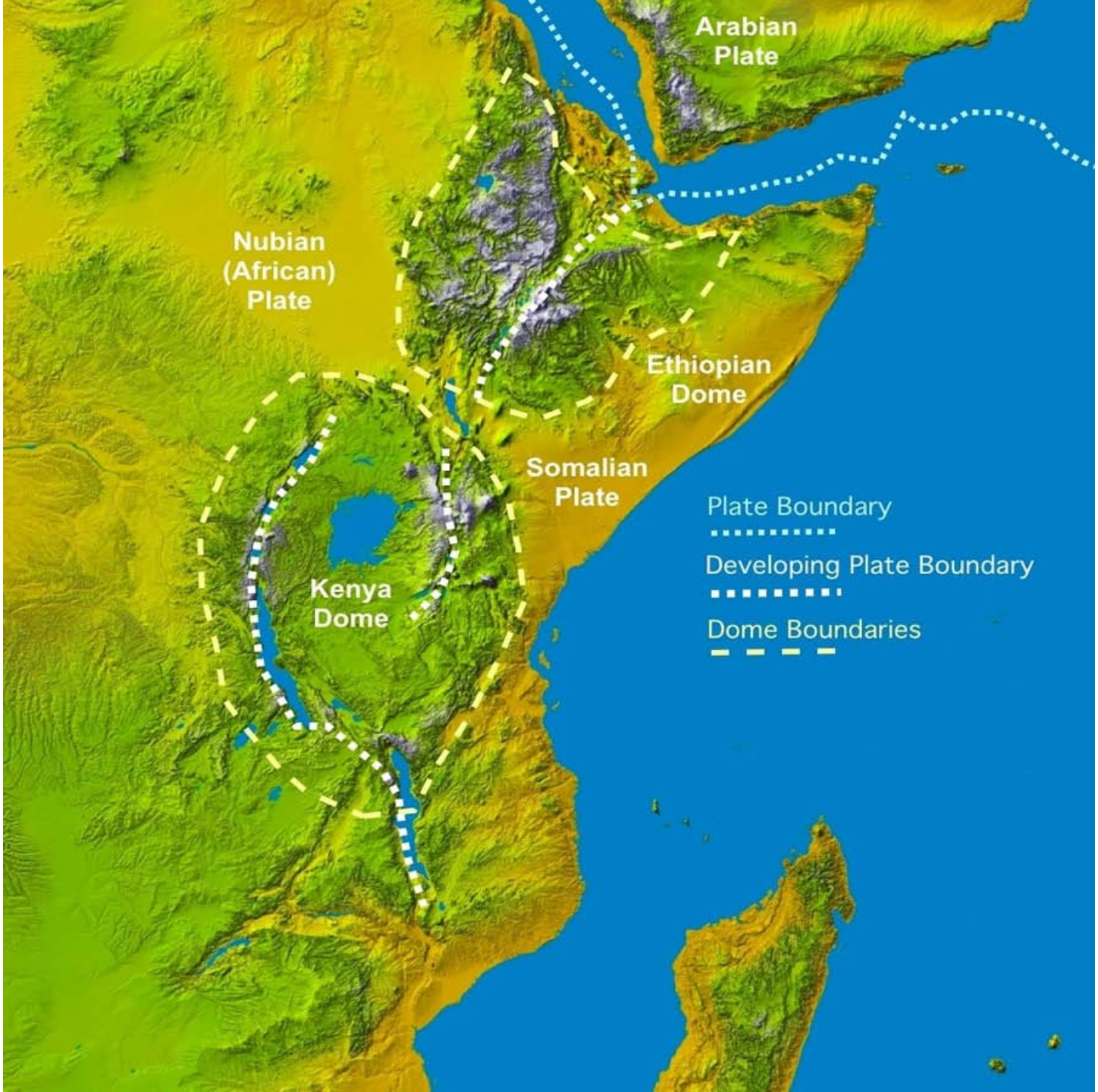
Global Resource Alliance

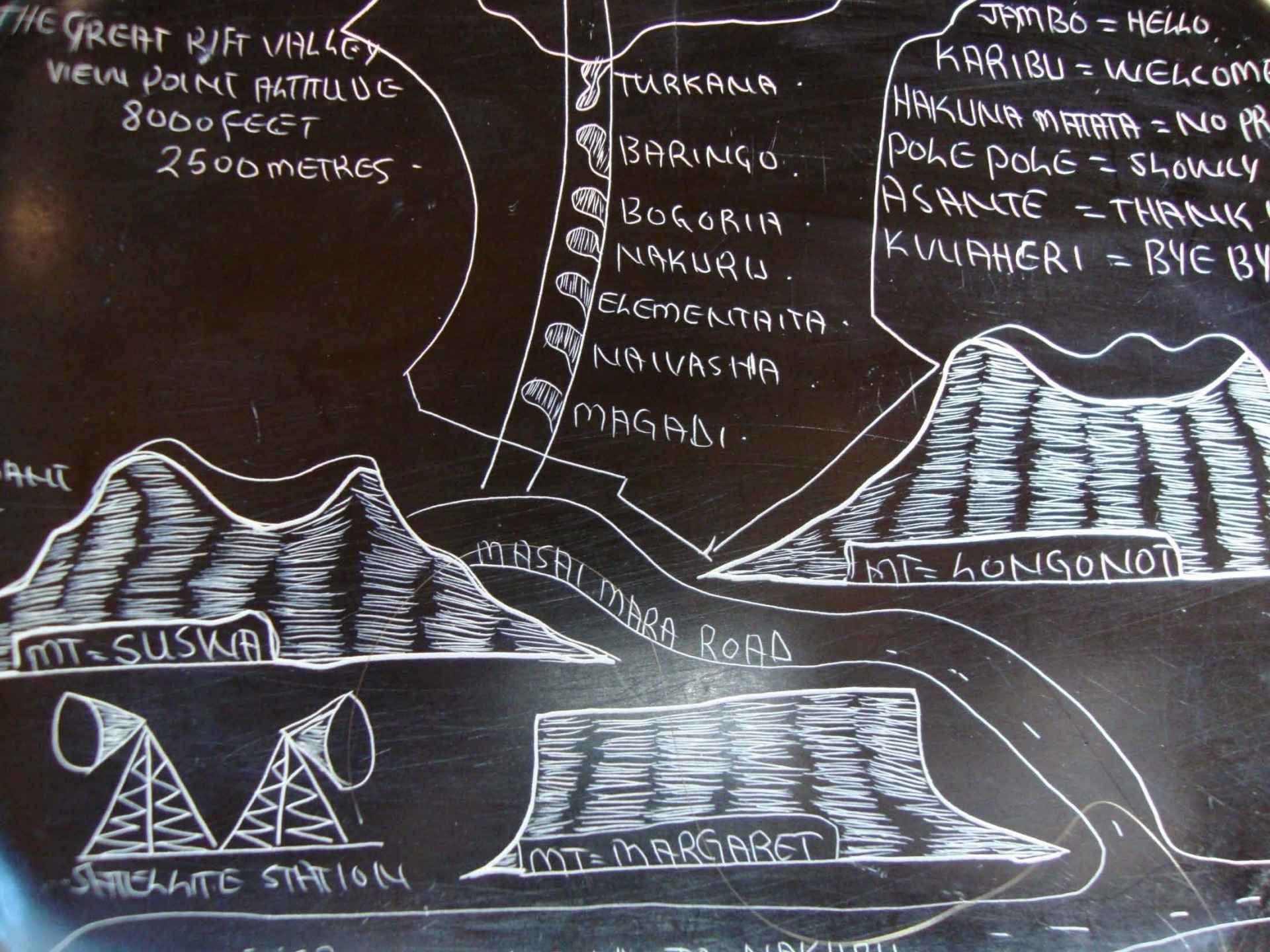
Stephan Reiss (1898-1985) – “After seeing a few of his wells spouting water from the solid granite at the rate of two or three thousand gallons a minute, and after listening to what he had to say about faults and fissures, about juvenile water and primary water, about hydrogen and oxygen coming together at high temperatures and under vast pressures in the bowels of the earth and rising, as H2O towards the surface, wherever the crust was weak, I began to understand the mystery of Nefta and Jericho; and I began at the same time to feel a little more hopeful about humanity's prospects for survival and a good life on this under-watered and soon to be overpopulated planet.” From the Foreword by Aldous Huxley, Salzman, ***New Water for a Thirsty World****,* 1945

Bill Cox dowsing for water in Japan (1996)

Cox borehole producing an artesian flow of over 100 gallons per minute

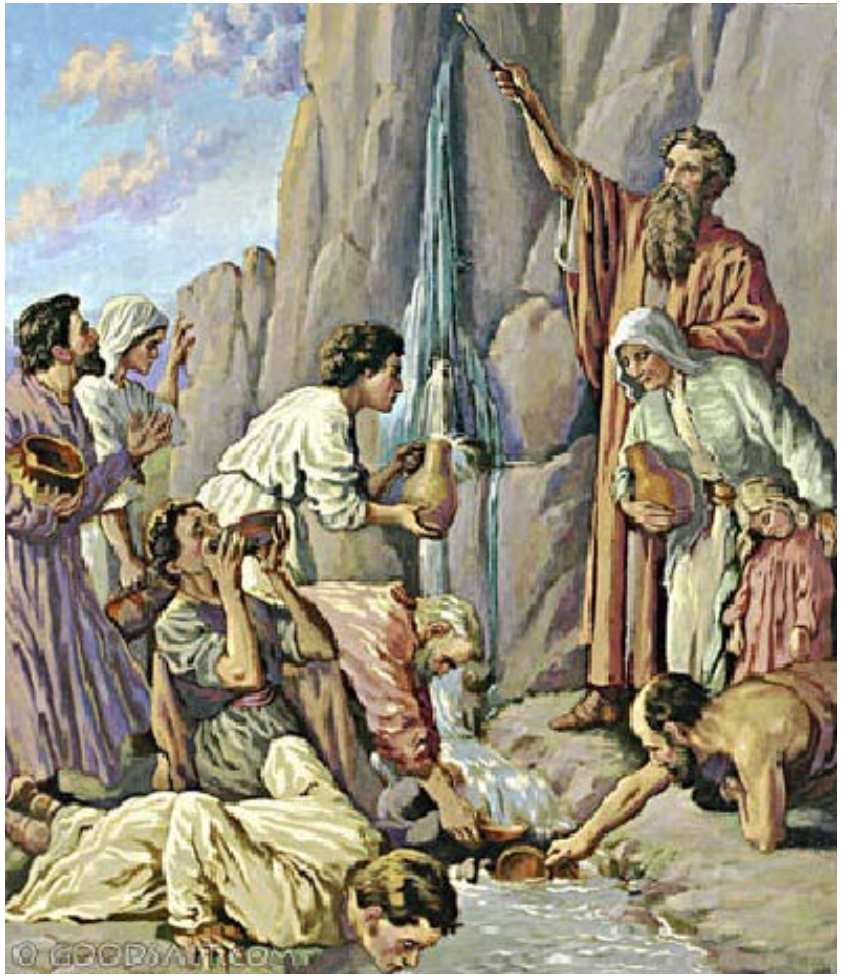
Kootenay Lake, British Columbia


Arabian Plate
Nubian (African) Plate
Ethiopian Dome
Somalian Plate
Kenya Dome
Plate Boundary
Developing Plate Boundary
Dome Boundaries


THE GREAT RIFT VALLEY
VIEW POINT ALTITUDE
8000 FEET
2500 METRES
TURKANA
BARINGO
BOGORIA
NAKURU
ELEMENTAITA
NAIVASHA
MAGADI
JAMBO = HELLO
KARIBU = WELCOME
HAKUNA MATATA = NO PR
POLE POLE = SLOWLY
ASANTE = THANK
KWAHERI = BYE BY
MT = LONGONOT
MASAI MARA ROAD
MT = SUSWA
SATELLITE STATION
MT = MARGARET

Earth vs. Sky

An ongoing debate



Moses (1391–1271 BC) - “And Moses lifted up his hand, and with his rod he smote the rock twice: and the water came out abundantly, and the congregation drank, and their beasts *also*.” *Numbers* 20:11

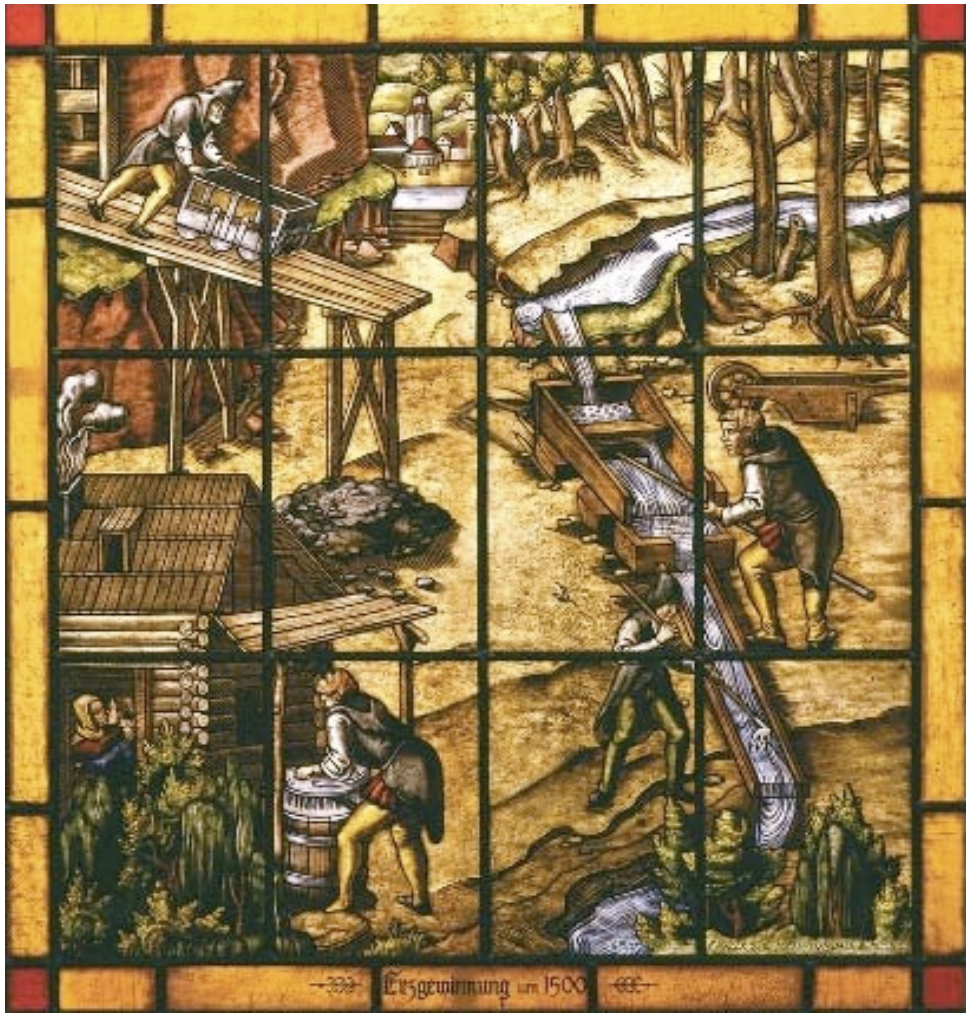
Anaxagoras (500 -428 BC) - said that oceans were created from rivers flowing into them and from what he called the “waters of the earth”

Aristotle (384-322 BC) - “The water coming from the earth unites with rain water to produce rivers. The rainfall alone is quite insufficient to supply the rivers of the world with water.” *Meterologicia*

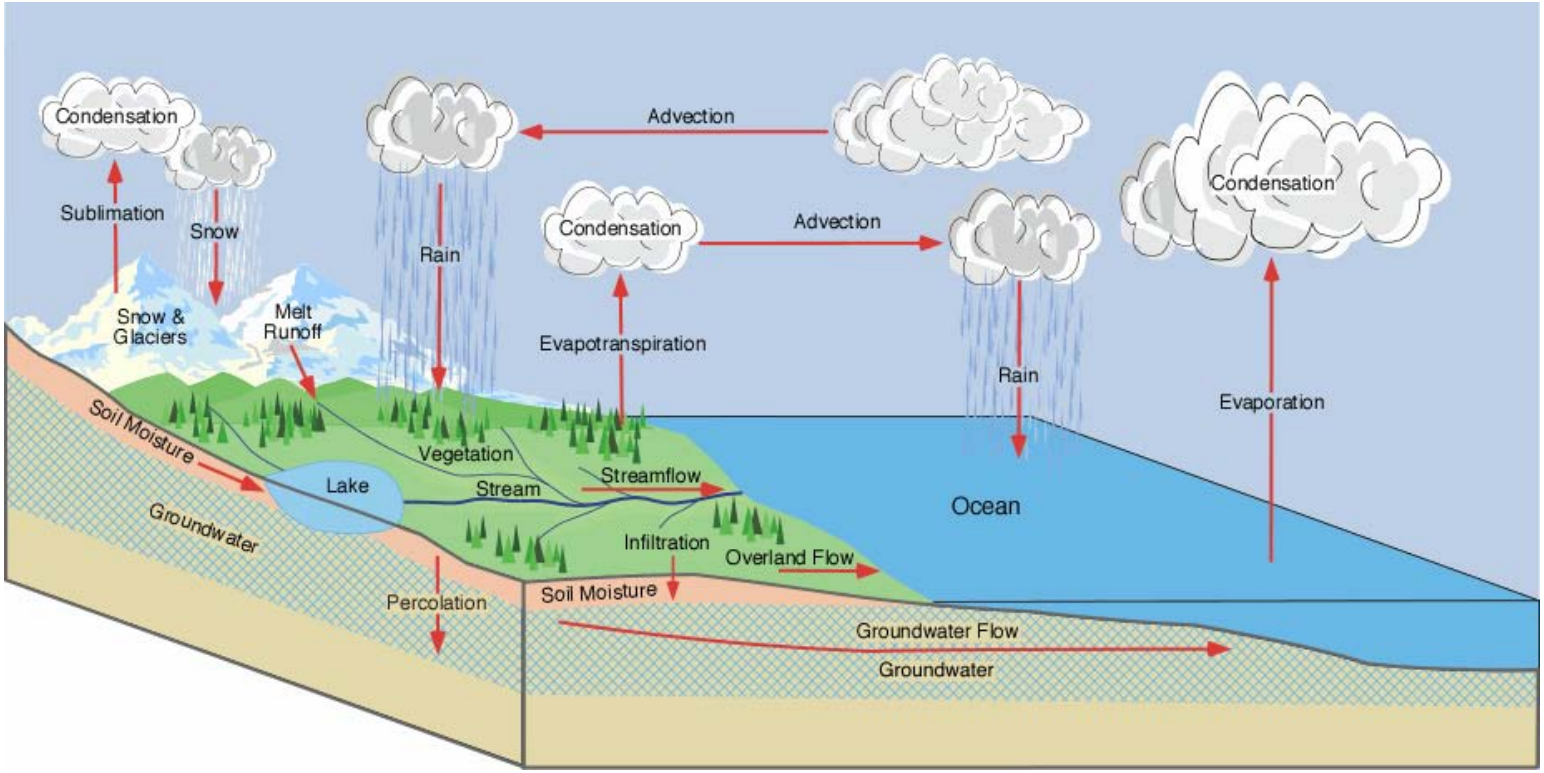
Marcus Vitruvius Pollio (75 -15 BC), described a philosophical theory of the hydrologic cycle, in which precipitation falling in the mountains infiltrated the Earth's surface and led to streams and springs in the lowlands.

Muhammad (570-632 AD) - "For among rocks there are some from which rivers gush forth; others there are which when split asunder send forth water."
Qur'an, Surah 2, Verse 74

Leonardo da Vinci (1452-1519) – "… came close to the modern definition of the hydrological cycle, recognizing that water passes through the major river systems countless times, summing up to volumes much greater than those contained in the world's oceans." ***Leonardo da Vinci's Water Theory***

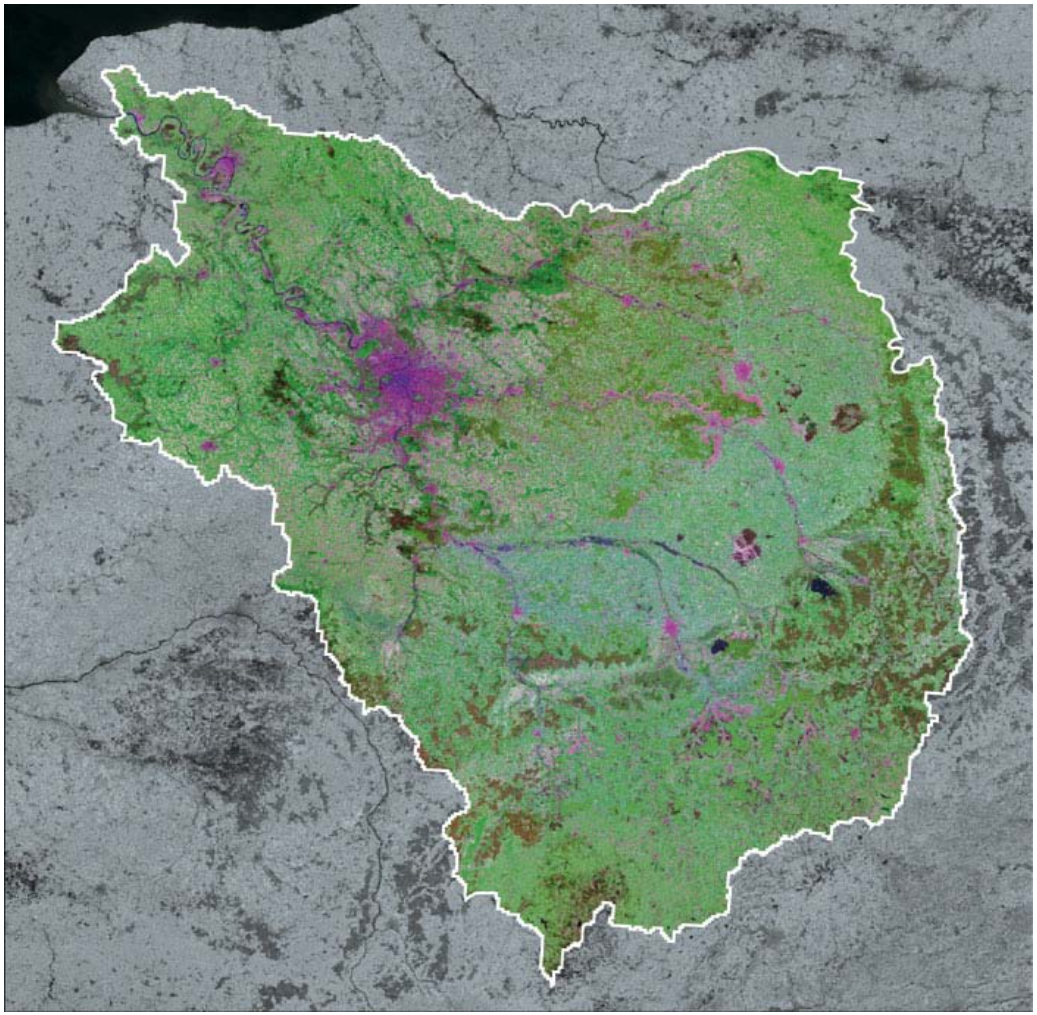


Georgius Agricola (1494-1555) – “Besides rain, there is another kind of water by which the interior of the earth is soaked, so that being heated it can continually give off *halitus,* from which arises a great and abundant force of waters.”

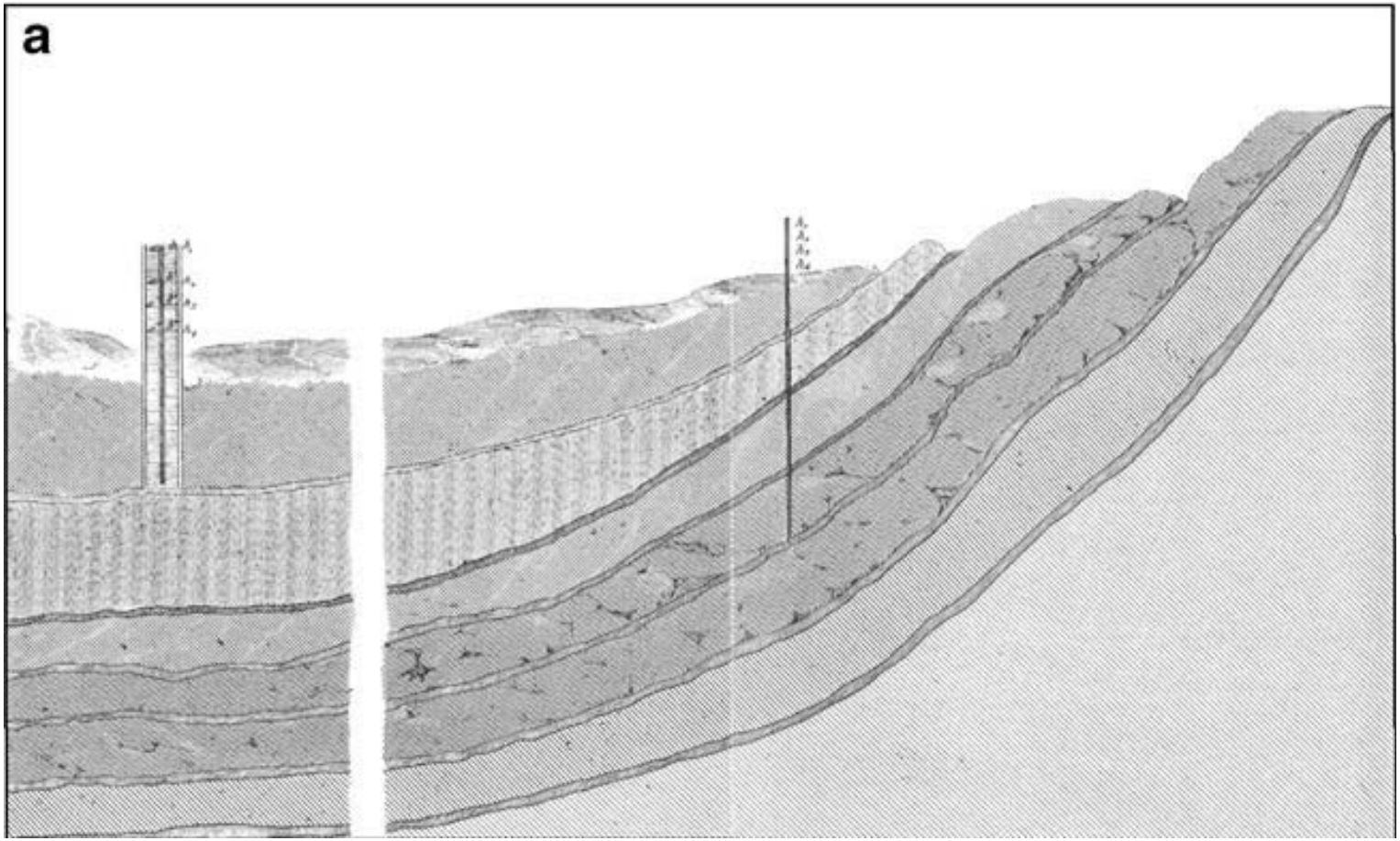


Bernard Palissy (1510 - 1590) – "And when the winds push these vapors the waters fall on all parts of the land, and when it pleases God that these clouds (which are nothing more than a mass of water) should dissolve, these vapors are turned to rain that falls on the ground.

And these waters, falling on these mountains through the ground and cracks, always descend and do not stop until they find some region blocked by stones or rock very close set and condensed. And they rest on such a bottom and having found some channel or other opening, they flow out as fountains or brooks or rivers according to the size of the opening and receptacles…"



Pierre Perrault (1608-1680) - measured the average annual rainfall over a small part of the upper Seine River basin well as the annual discharge of the river from that catchment. He found that rainfall was six times the amount that flowed in the Seine, thus proving that precipitation was more than enough to supply the water in the Seine.



Henry Darcy (1803–1858) - City engineer for Dijon France who claimed that the city's water originated as rain and snow high in the Alps – over two hundred km away – and moved through porous material underground at a rated calculated using what later became known as Darcy's Law.

Eduard Suess (1831-1914) - “grouped all natural waters into juvenile and vadose. Juvenile waters are those first emerging in deep magmatic centers; they never participated in water cycles of the upper crust, prior to their arrival there. This sets them apart from the vadose waters — comparatively shallow and participating in the numerous water cycles.

According to Suess, vadose waters originated from the juvenile, in a continuous degassing at depths. He believed that this process is now confined to rift zones, chiefly in volcanic eruptions; other substances (CO_2, H_2, etc.), likewise juvenile, arrive at the surface layers in the same way.” Pinneker, ***General Hydrogeology***, 1980

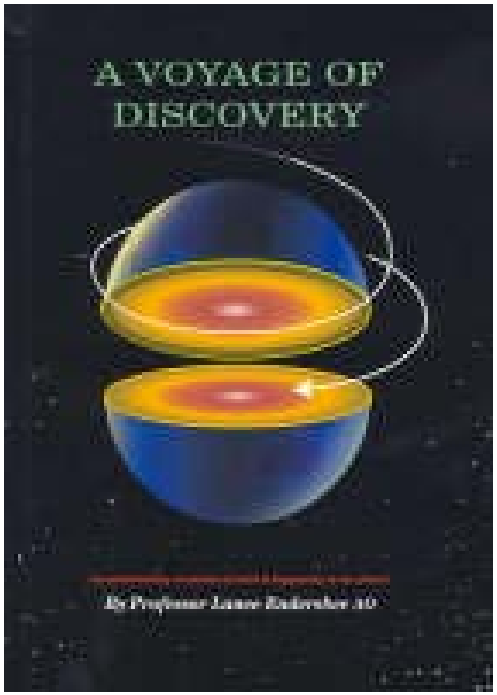
Adolph Nordenskiold (1832-1901) - “One day after I had, at quite some length, explained Riess' work to him, Dr. Linus Pauling surprised me by saying that Riess' successes reminded him of the Swedish mineralogist Nordenskiold who had been nominated for a Nobel Prize for his ability to locate fresh water in the solid rocks.” Salzman, ***New Water for a Thirsty World,*** 1945

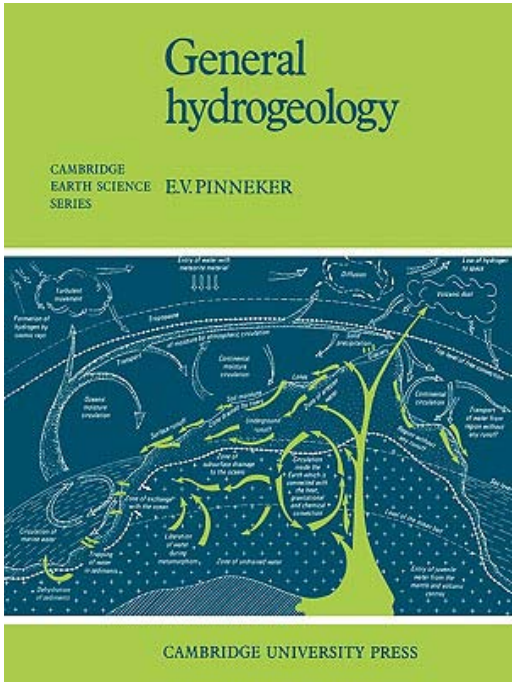
Influence of Pressure on the Solubility of Water in Molten Granite

Temp. (°C)	Atmospheres	Depth (m)	% Water
900	490	1,847	3.70
900	980	3,695	5.70
900	1,950	7,352	8.08
900	3,000	11,310	8.92
900	4,000	15,080	9.35

Geophysical Laboratory of the Carnegie Institution - Washington, DC

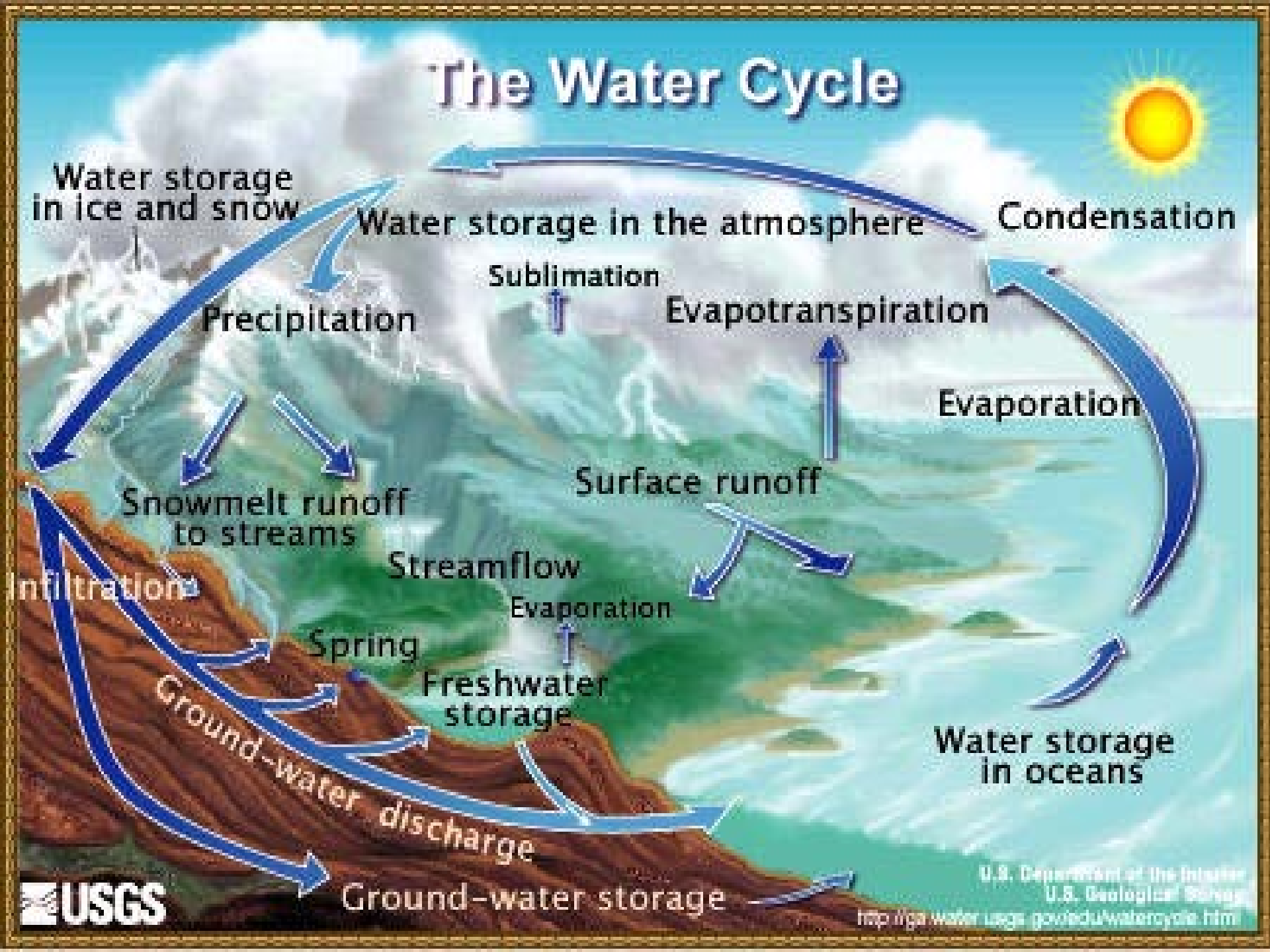
William W. Rubey (1898-1974) - concluded that both the ocean waters and the earth's atmosphere have come from the interior of the earth. According to his calculations, an igneous crust 40 km thick will release enough water to fill the present oceans.

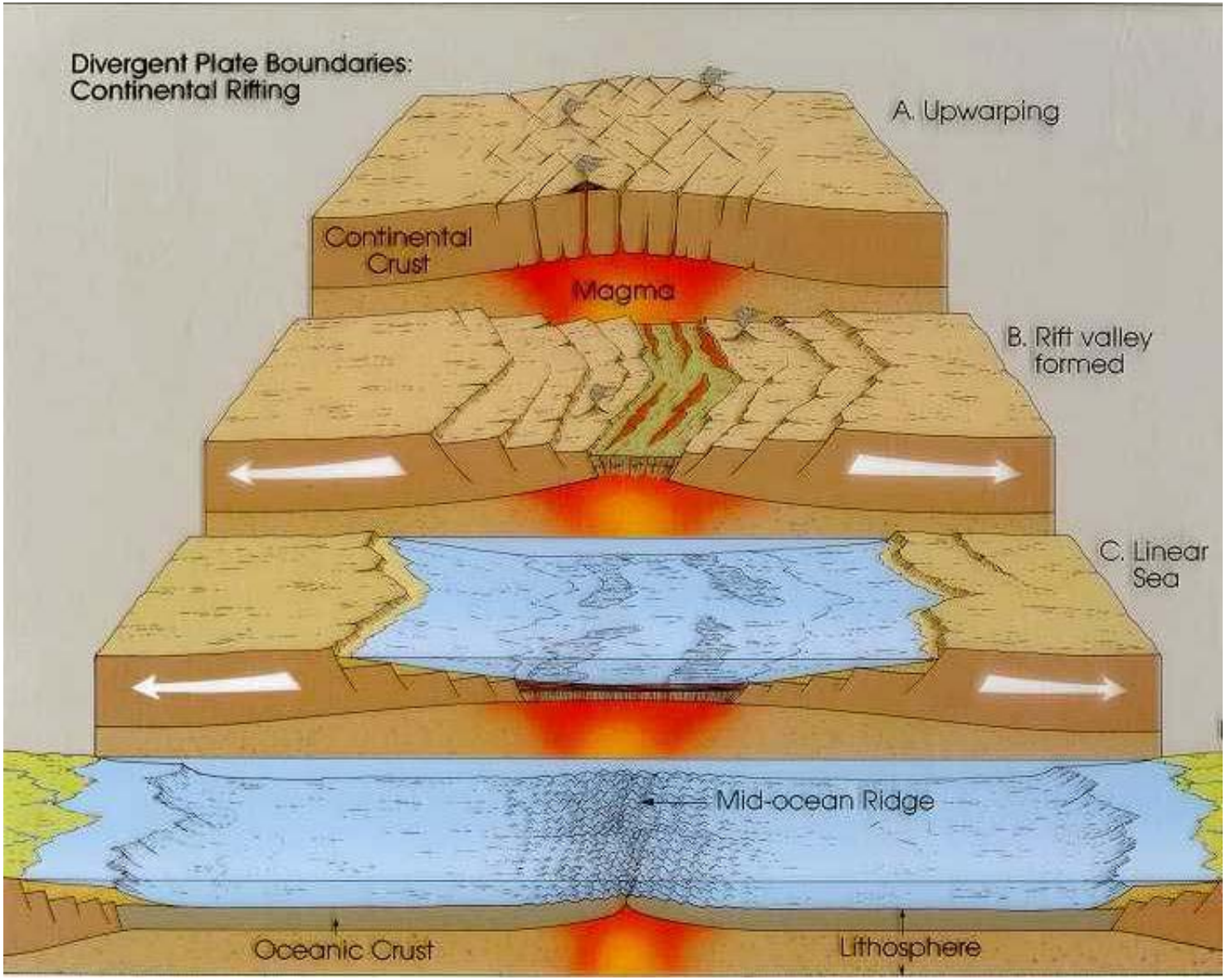




"There is a continuing release of water from the interior towards the surface of the earth, and we see that in the steam of volcanoes, and from the water gushing from deep ocean vents." Lance Endersbee, ***A Voyage of Discovery*** , 2005

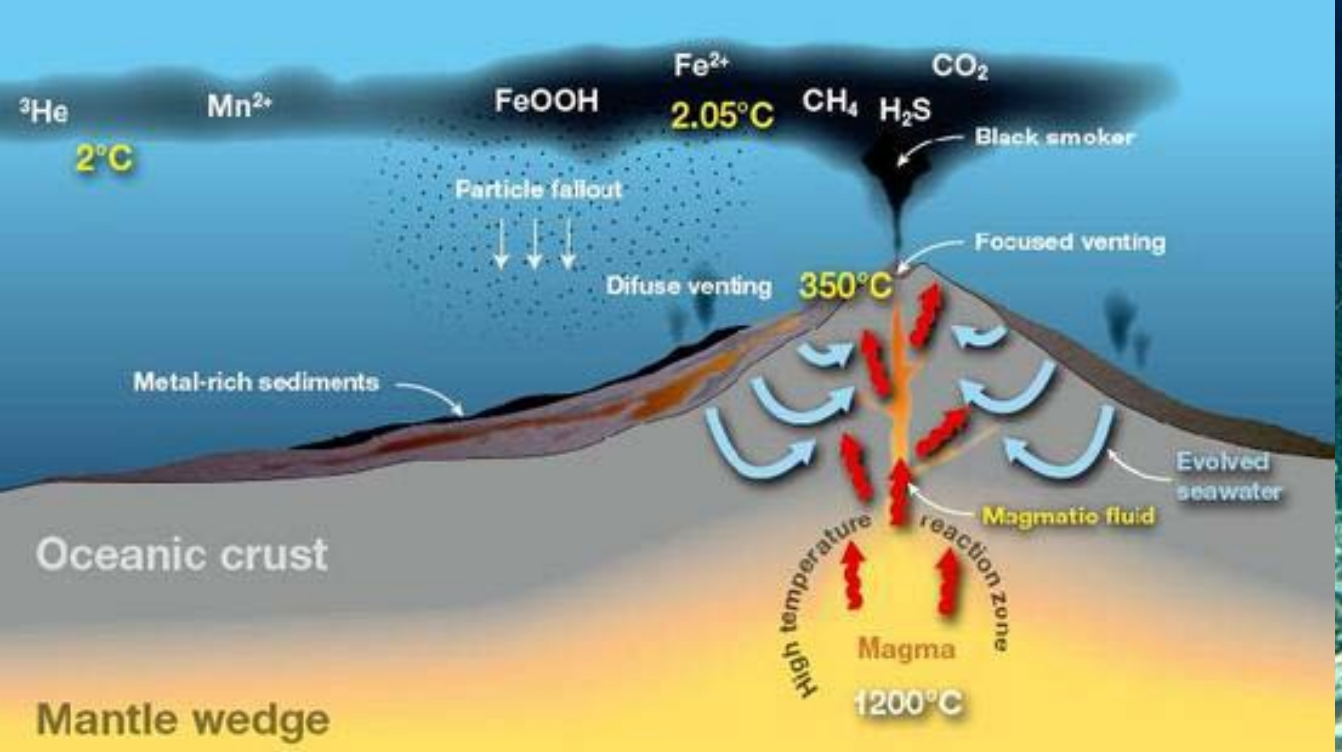
"Since Suess (1902) expressed the idea of *juvenile water* the arguments about this have never ceased. Nowadays, as we have seen, the mantle is considered to be the source of water, and the generation of water molecules is associated with the most volatile products of the degassing of the material of the mantle." E.V. Pinneker, ***General Hydrolgeology***, 1983


The Water Cycle
Water storage in ice and snow
Water storage in the atmosphere
Condensation
Sublimation
Precipitation
Evapotranspiration
Evaporation
Surface runoff
Snowmelt runoff to streams
Streamflow
Infiltration
Evaporation
Spring
Freshwater storage
Ground-water discharge
Water storage in oceans
Ground-water storage
USGS
U.S. Department of the Interior
U.S. Geological Survey
http://ga.water.usgs.gov/edu/watercycle.html



http://blue.utb.edu/paullgj/geog1303/lectures/plate_tectonics.html

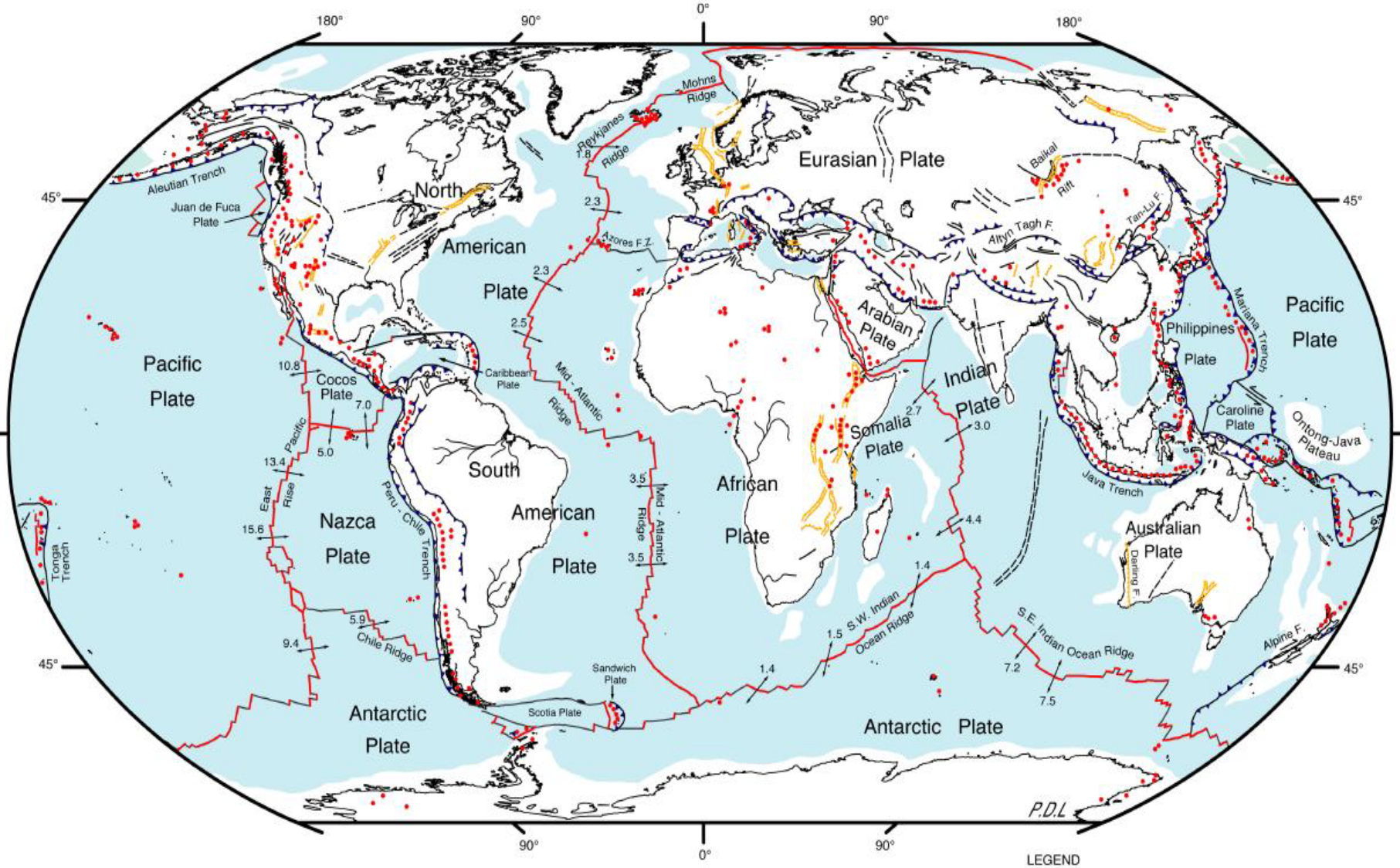
“Now, scientists from several countries have confirmed that the volcanic processes at work beneath the Ethiopian rift are nearly identical to those at the bottom of the world's oceans, and that the rift is indeed likely the beginning of a new sea.” ***ScienceDaily*** (Nov. 3, 2009)



http://www.gns.cri.nz/Home/Learning/Science-Topics/Ocean-Floor/Undersea-NewZealand/Hydrothermal-Vents

Hydrothermal activity plays an important part in moving dissolved minerals and other substances through the Earth's crust and into the ocean, says Andrew T Fisher, a hydro-geologist at the University of California at Santa Cruz. There's enough water flowing through such seafloor vent systems to recycle the ocean's volume every 500,000 to 1 million years, he notes.

http://www.thefreelibrary.com/New+type+of+hydrothermal+vent+looms+large.-a077049888



DIGITAL TECTONIC ACTIVITY MAP OF THE EARTH

Tectonism and Volcanism of the Last One Million Years

DTAM

NASA/Goddard Space Flight Center
Greenbelt, Maryland 20771

Robinson Projection

Mainly oceanic crust

October 1998

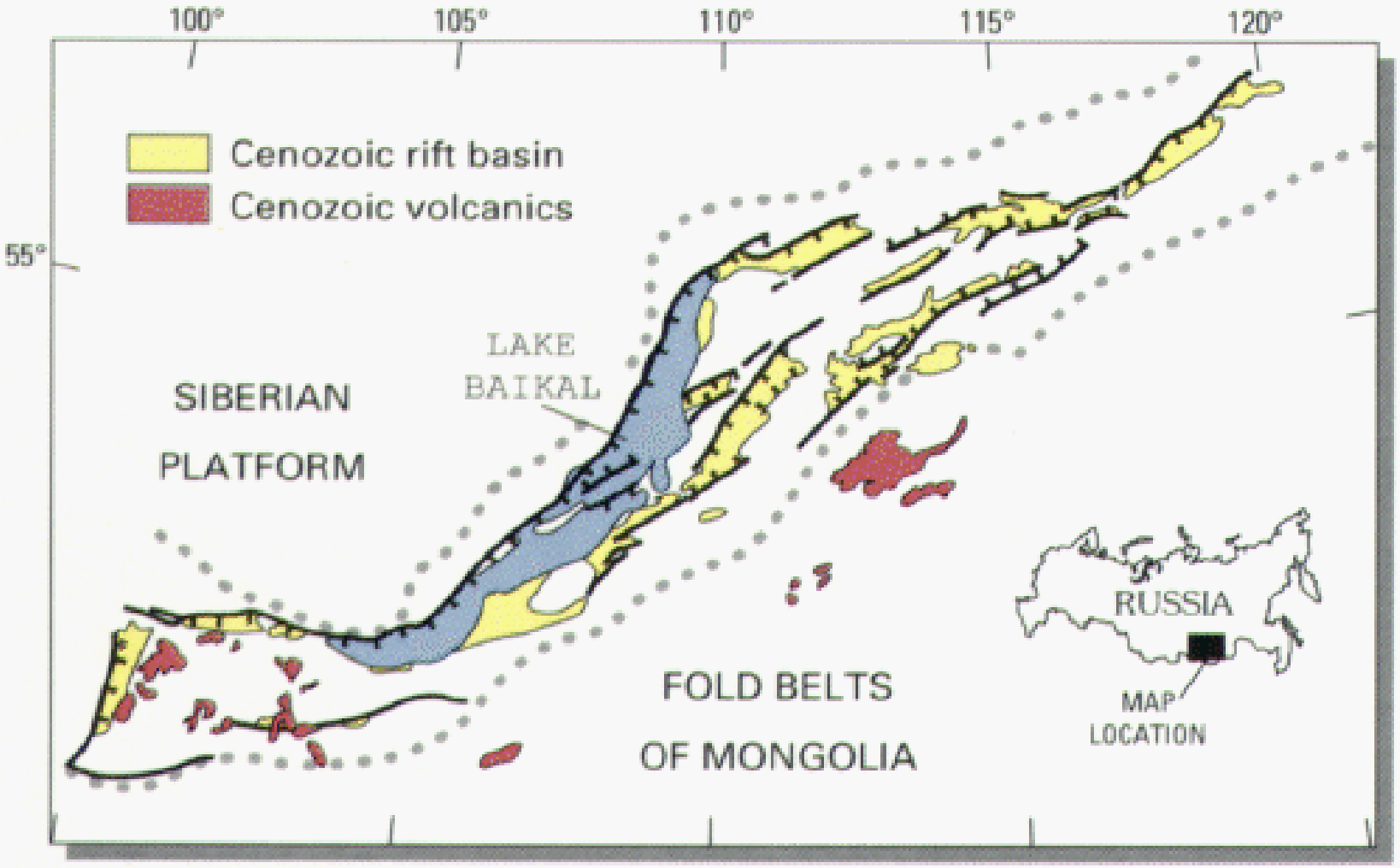
LEGEND

- Actively-spreading ridges and transform faults
- Total spreading rate, cm/year, NUVEL-1 model (DeMets et al., Geophys. J. International, 101, 425, 1990)
- Major active fault or fault zone; dashed where nature, location, or activity uncertain
- Normal fault or rift; hachures on downthrown side
- Reverse fault (overthrust, subduction zones); generalized; barbs on upthrown side
- Volcanic centers active within the last one million years; generalized. Minor basaltic centers and seamounts omitted.

G221.001

World's 10 Largest Lakes

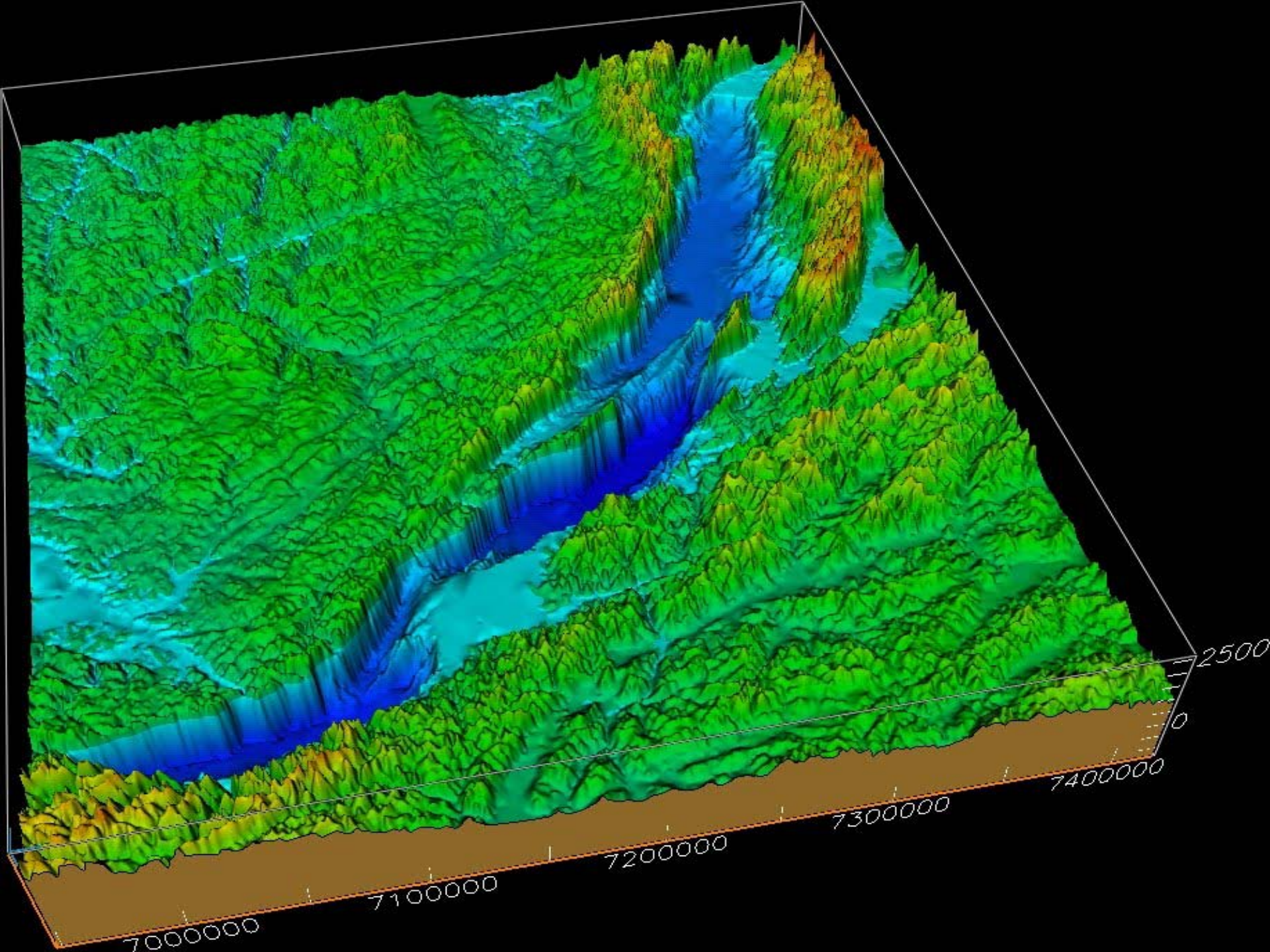
	Name	Country	Water volume
1.	Baikal	Russia	23,600 km^3
2.	Tanganyika	Tanzania, DR Congo, Burundi, Zambia	18,900 km^3
3.	Superior	Canada, United States	11,600 km^3
4.	Michigan-Huron	Canada, United States	8,260 km^3
5.	Malawi	Malawi, Mozambique, Tanzania	7,725 km^3
6.	Vostok	Antarctica	5,400±1,600 km^3
7.	Victoria	Tanzania, Uganda, Kenya	2,700 km^3
8.	Great Bear Lake	Canada	2,236 km^3
9.	Issyk-Kul	Kyrgyzstan	1,730 km^3
10.	Ontario	Canada, United States	1,710 km^3



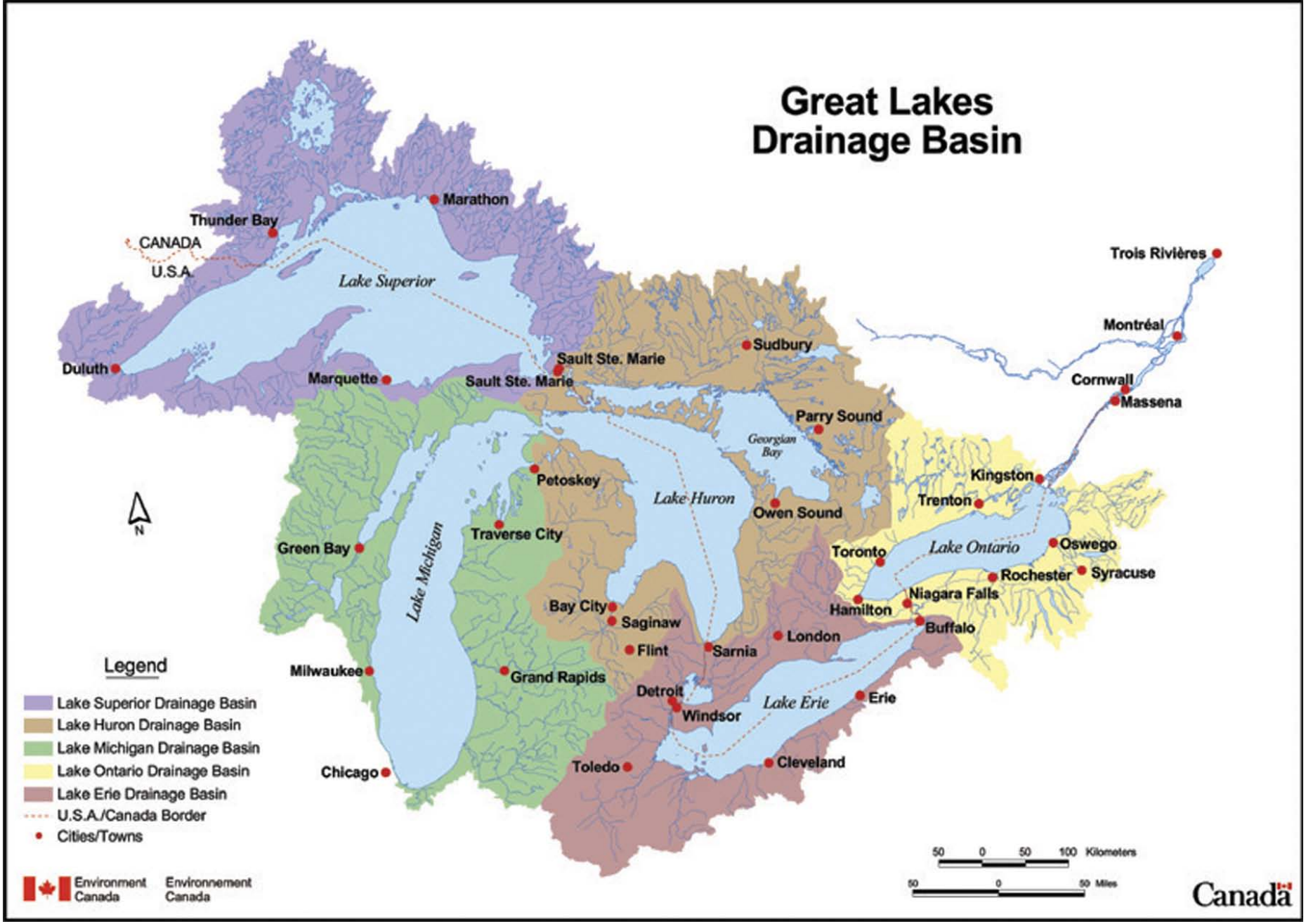
Map showing location of Lake Baikal and associated rift basins.

#1 - Lake Baikal

“A joint U.S.-Soviet research team has discovered an oasis of life around springs of heated water along the floor of Siberia's Lake Baikal, the oldest and deepest lake on Earth. Many similar "hydrothermal vent communities" thrive in the oceans, but until now scientists had never seen an example in fresh water. “ *Science News*, August 18, 1990

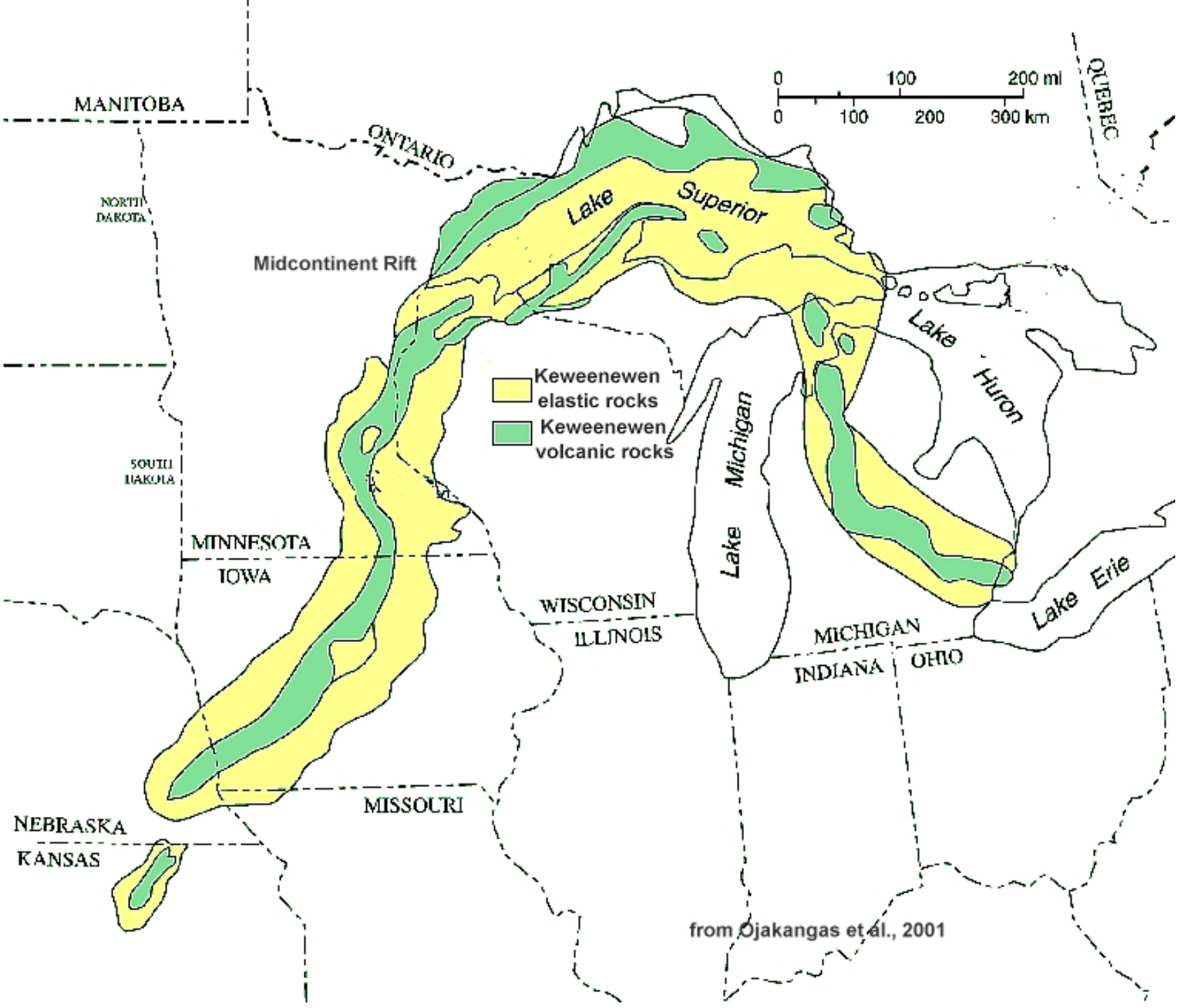

2500
0
7000000
7100000
7200000
7300000
7400000


#2 – Lake Tanganyika

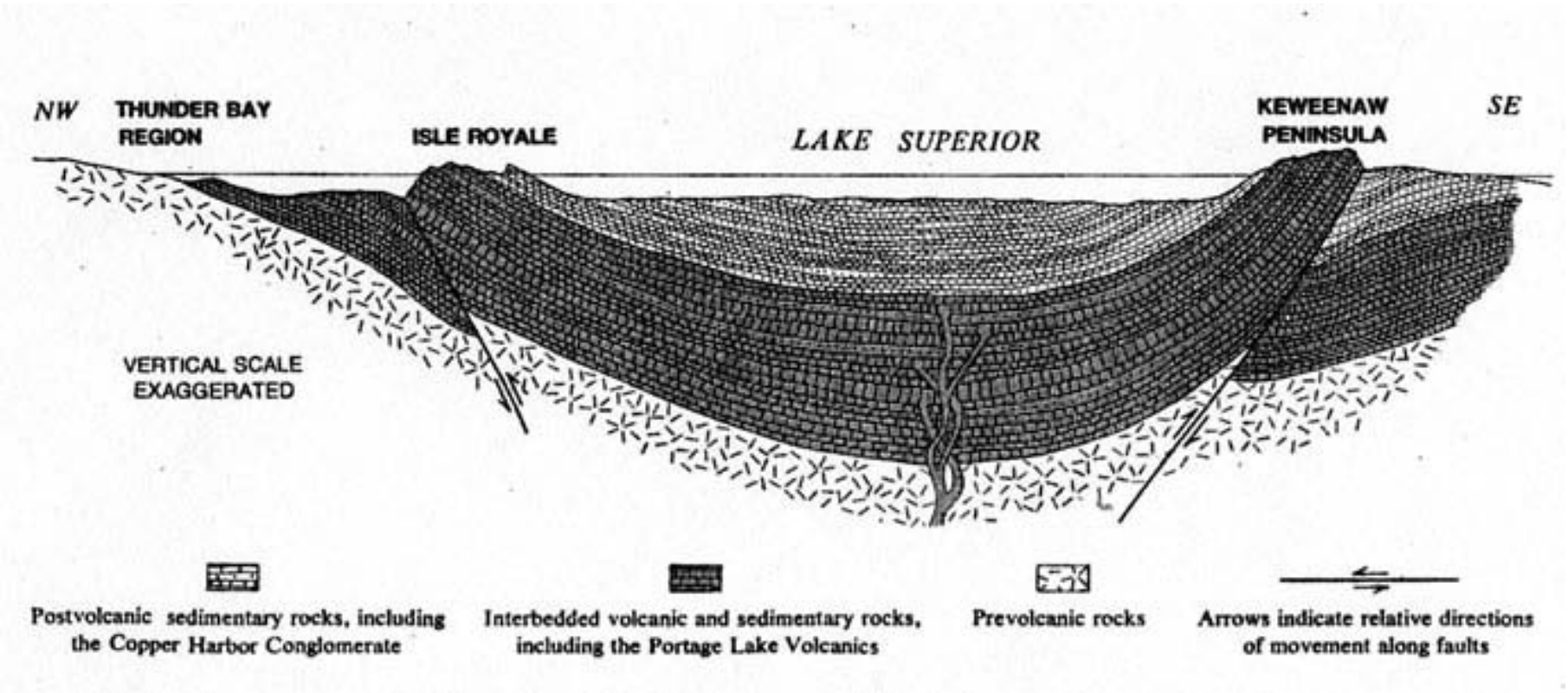


#3 – Lake Superior

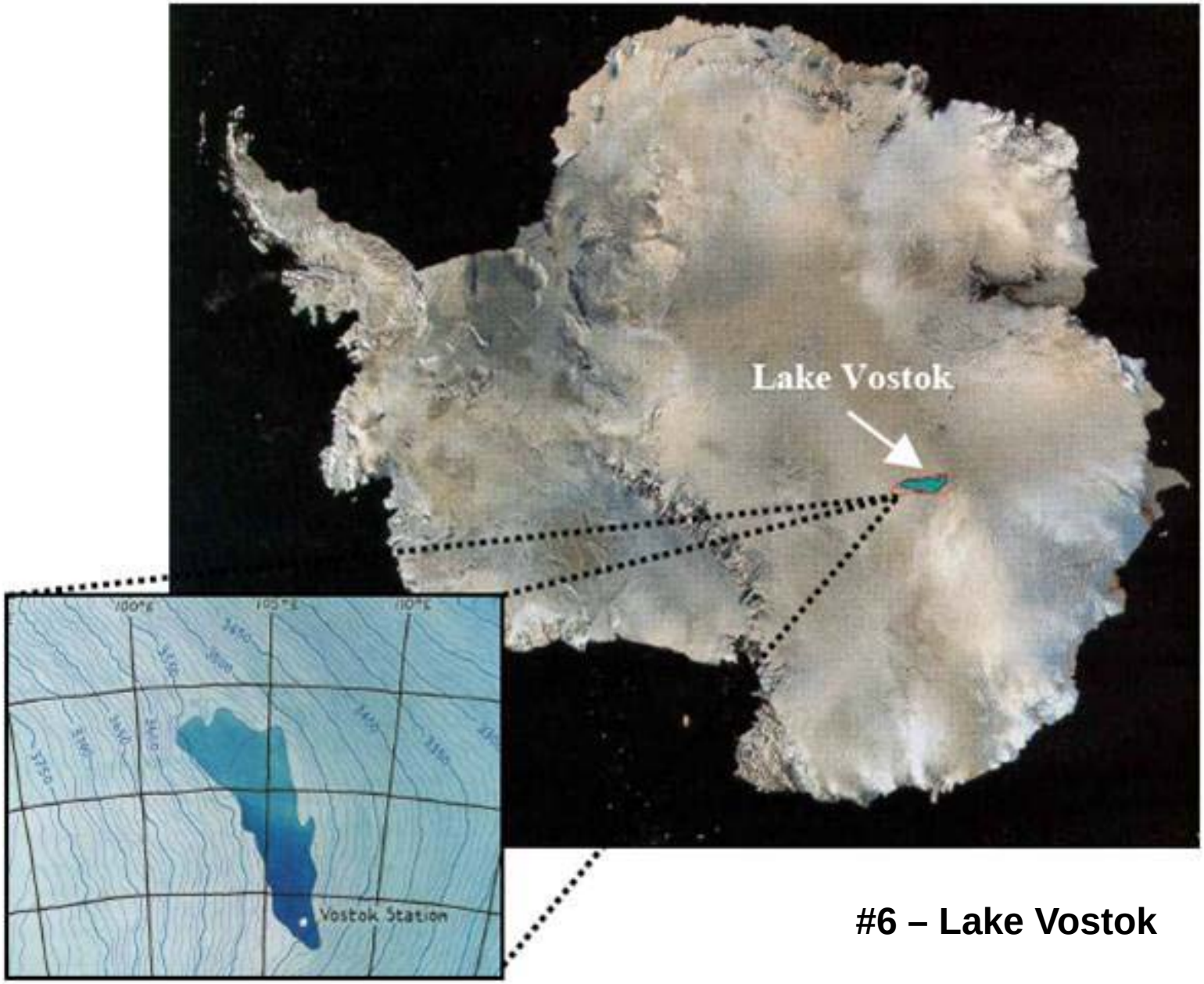
#4 Lake Michigan/Huron


MANITOBA
ONTARIO
QUEBEC
NORTH DAKOTA
SOUTH DAKOTA
MINNESOTA
IOWA
WISCONSIN
ILLINOIS
MICHIGAN
INDIANA
OHIO
MISSOURI
NEBRASKA
KANSAS
Lake Superior
Lake Michigan
Lake Huron
Lake Erie
Midcontinent Rift
Keweenewen elastic rocks
Keweenewen volcanic rocks
0 100 200 mi
0 100 200 300 km
from Ojakangas et al., 2001

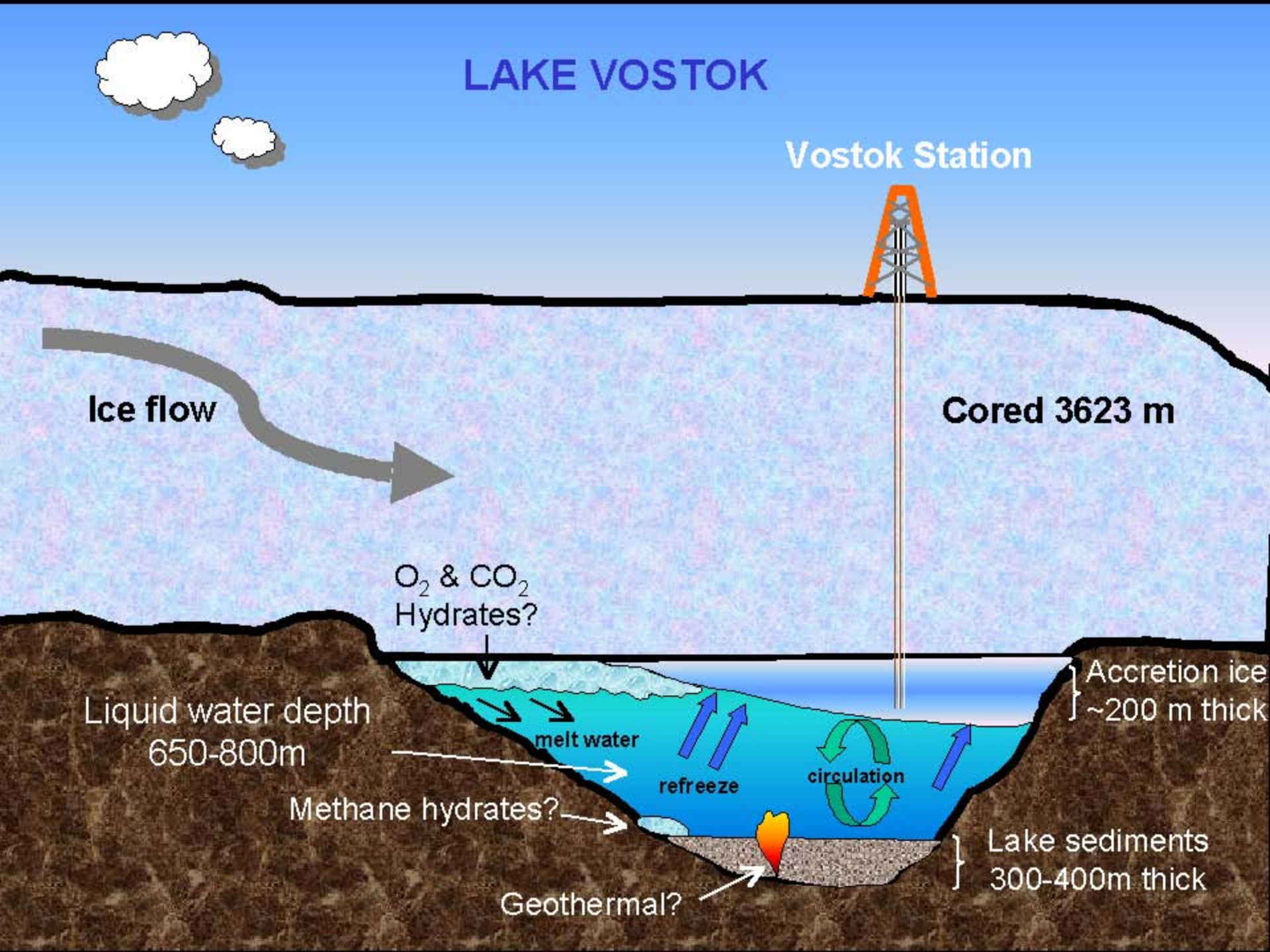
US Geological Survey Bulletin #1309



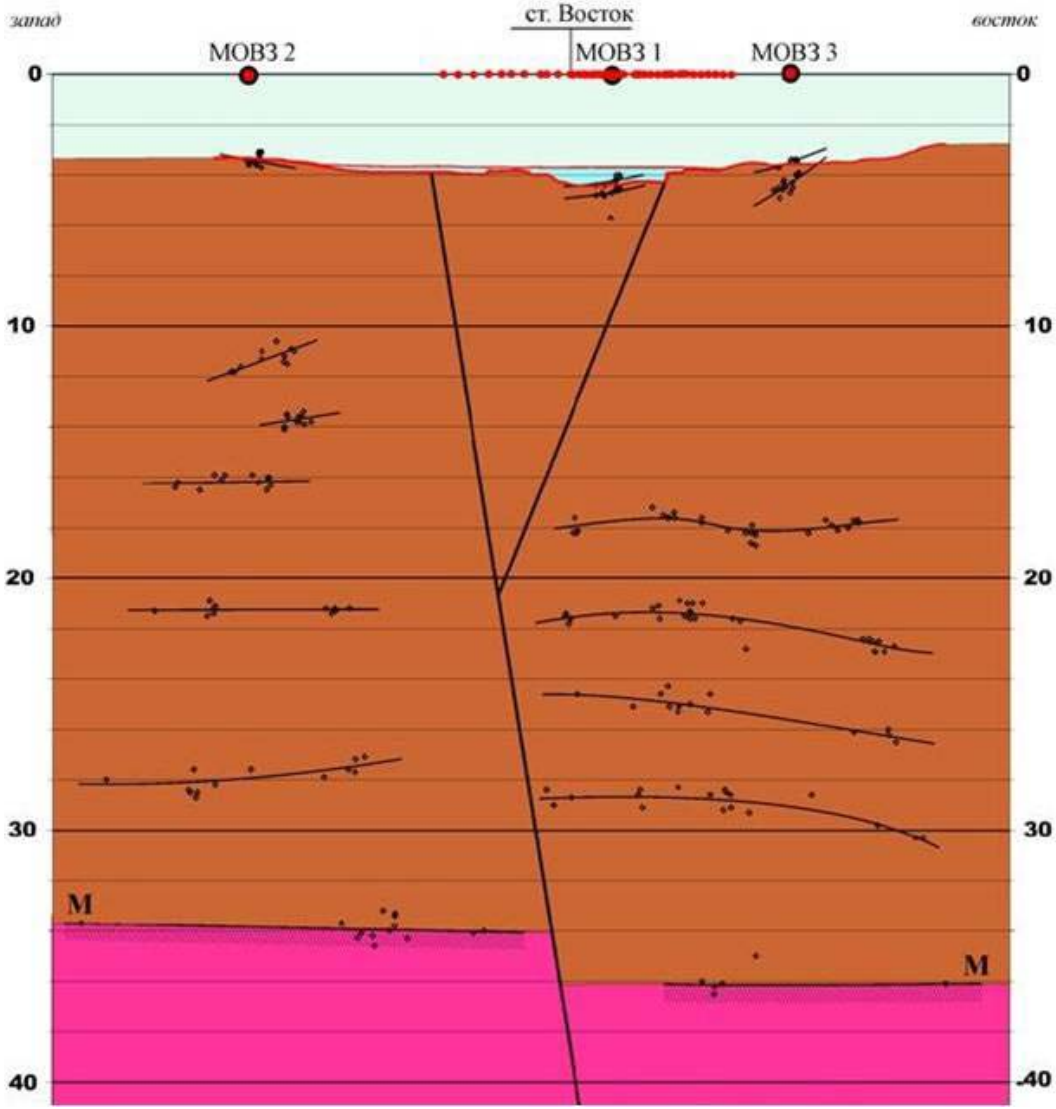
#5 – Lake Malawi



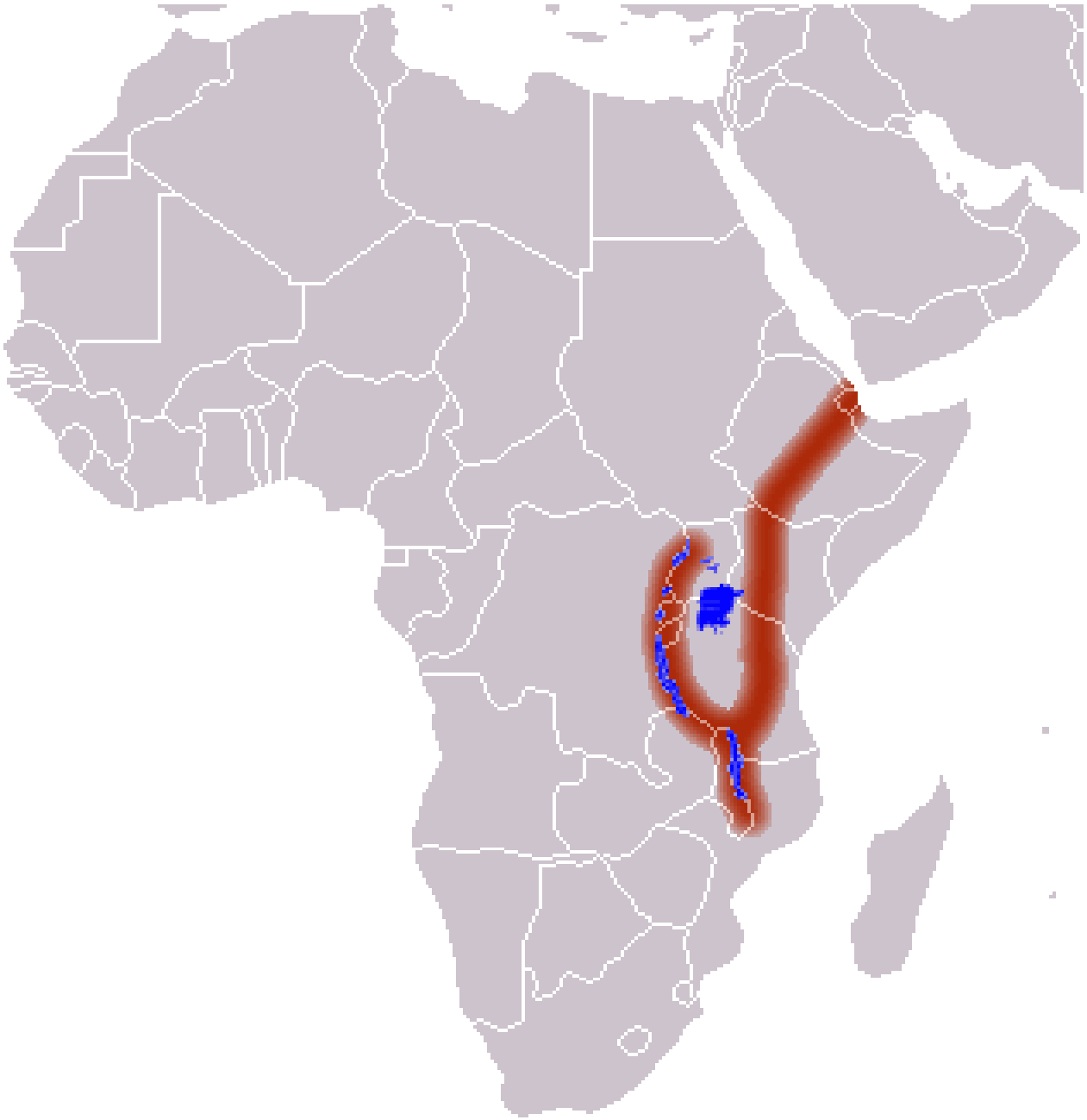
#6 – Lake Vostok

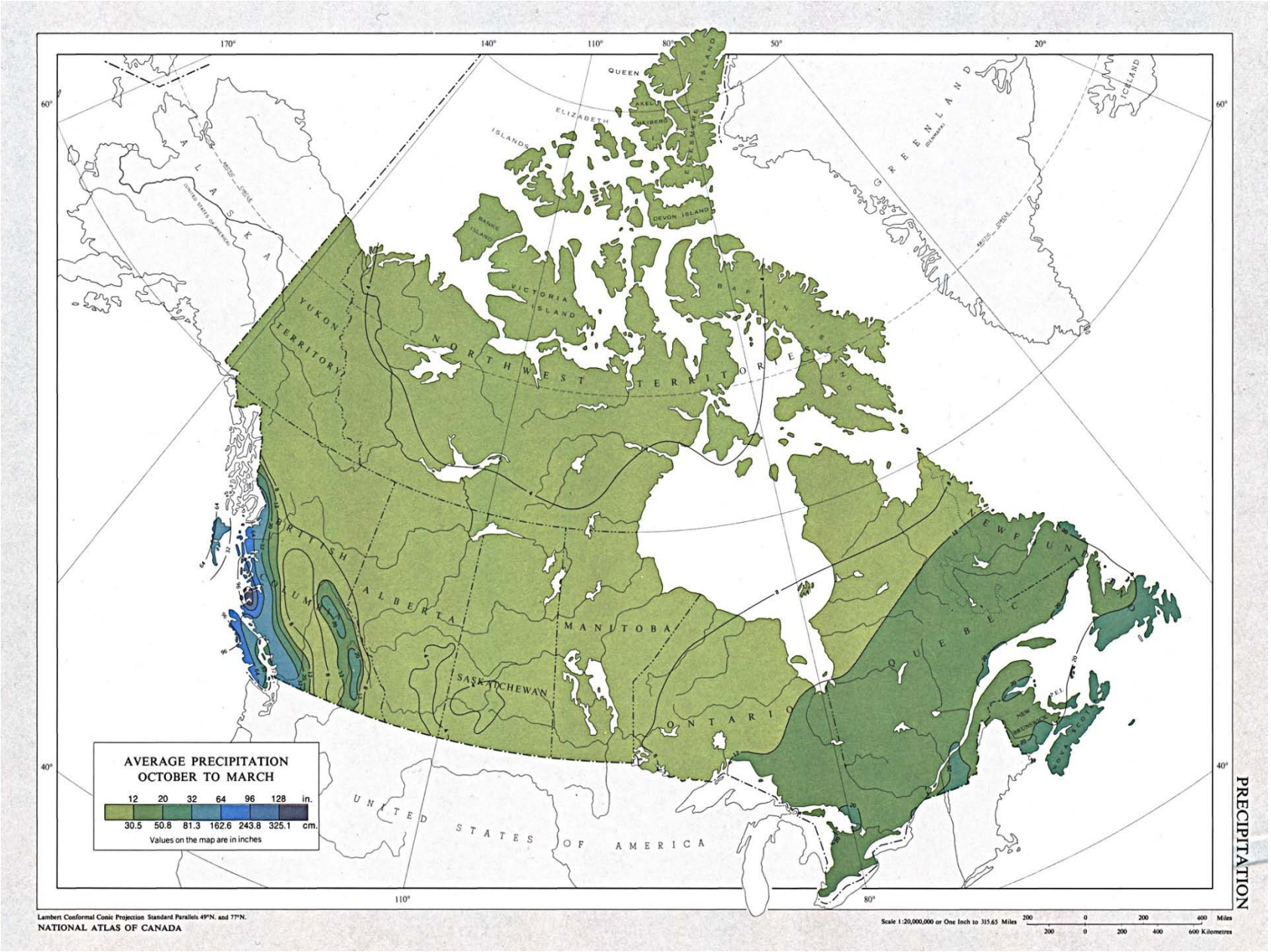

LAKE VOSTOK
Vostok Station
Ice flow
Cored 3623 m
O_2 & CO_2
Hydrates?
Liquid water depth
650-800m
melt water
refreeze
circulation
Accretion ice
~200 m thick
Methane hydrates?
Lake sediments
300-400m thick
Geothermal?

Lake Vostok Fault

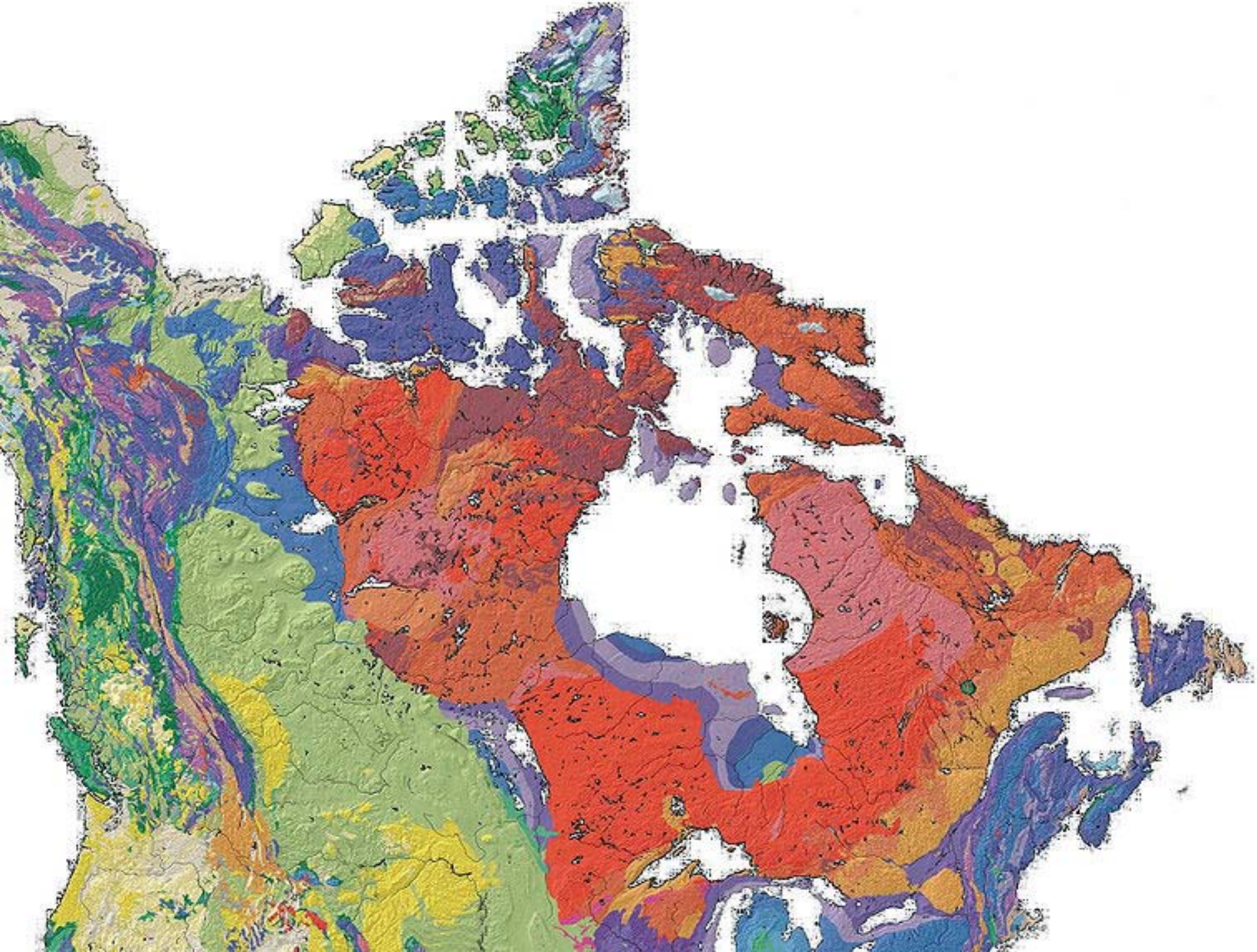


#7 – Lake Victoria

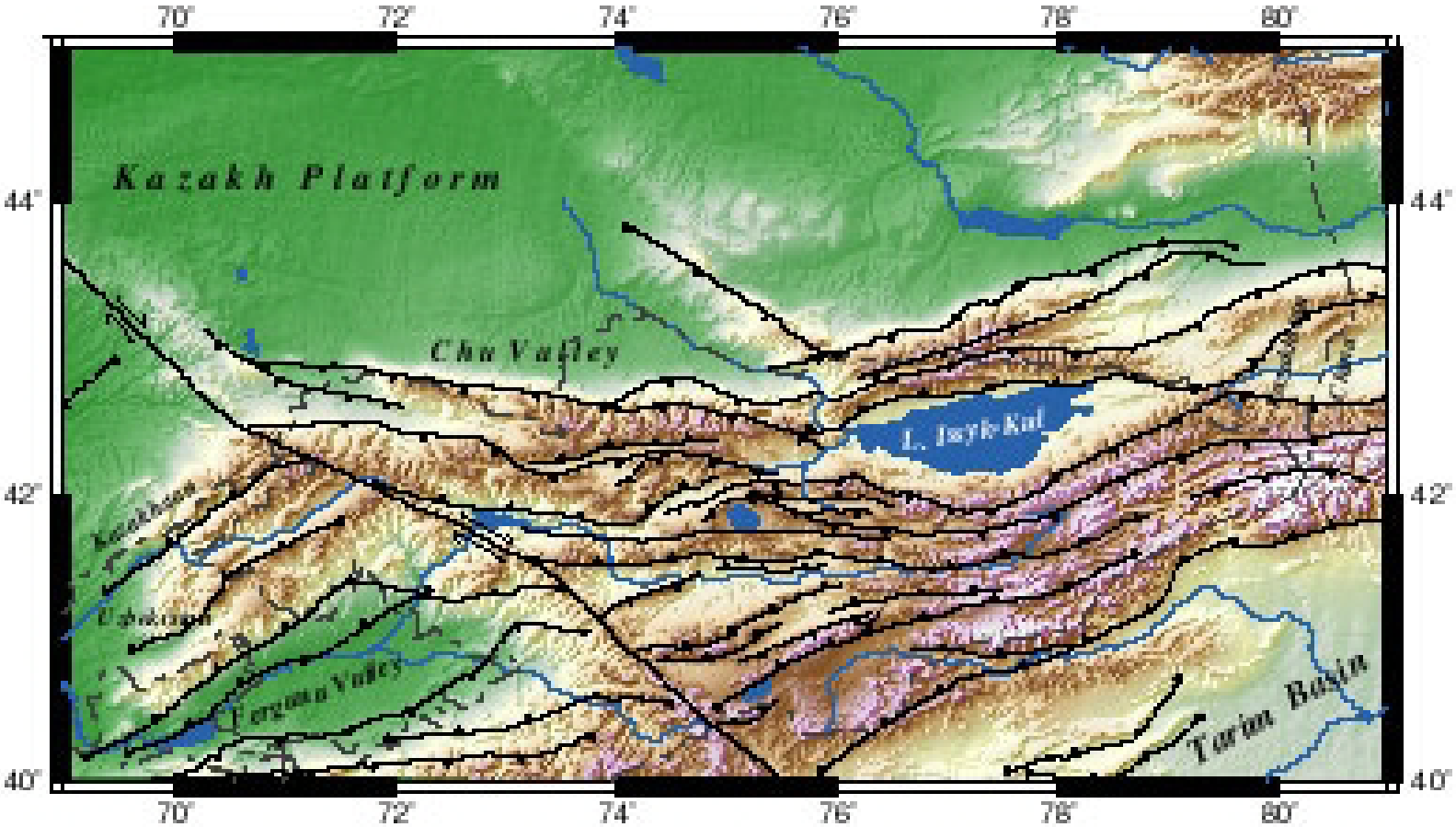




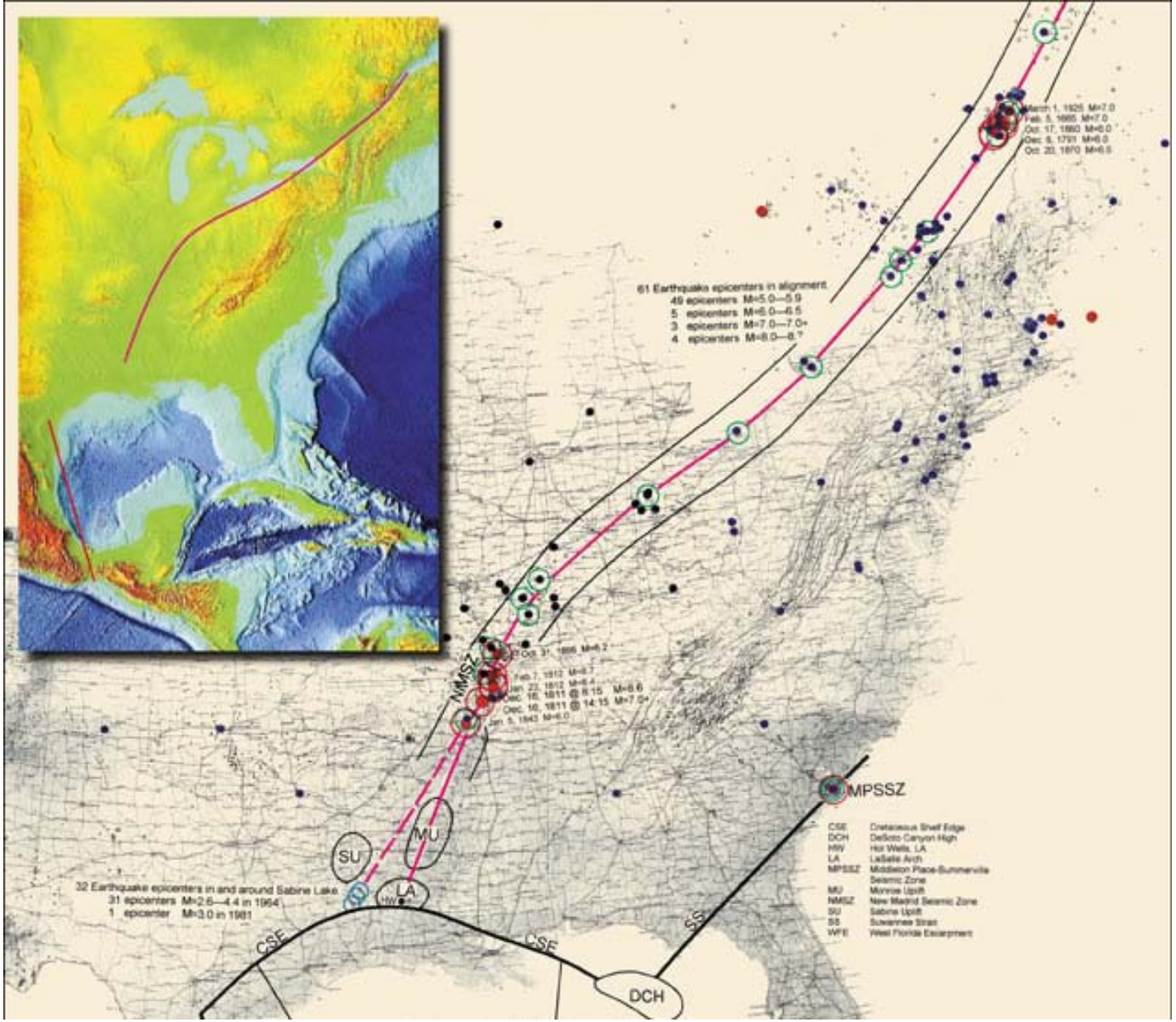
#8 – Great Bear Lake



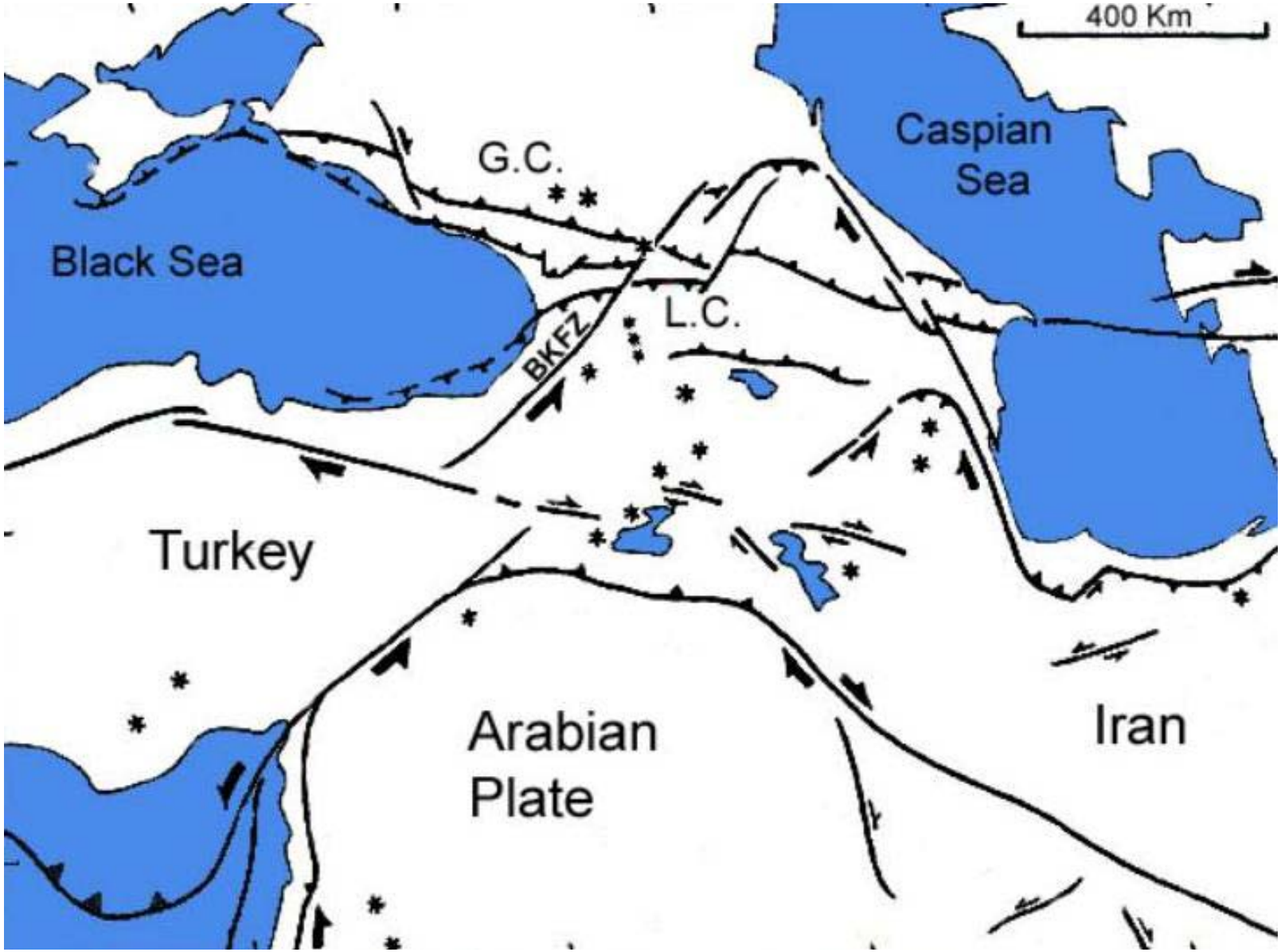
#9 – Lake Issyk Kul, Kyrgyzstan



Central Tien Shan mountains of Kyrgyzstan and China, showing major faults.

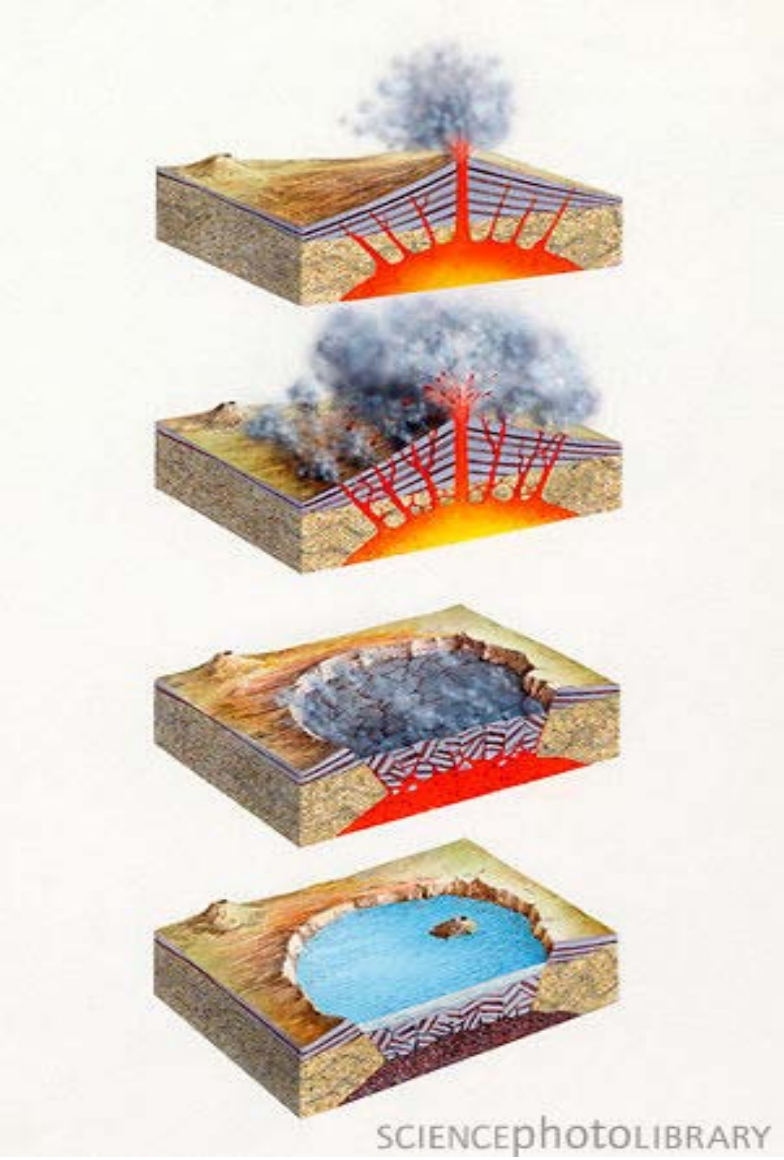


#10 – Lake Ontario



Caucasus Seismic Information Network

Volcanic Lakes




2003 © M. GIULI

Lake Chala, Tanzania, Kenya

Lake Billy Mitchell, Papua New Guinea

Heaven Lake, China, North Korea

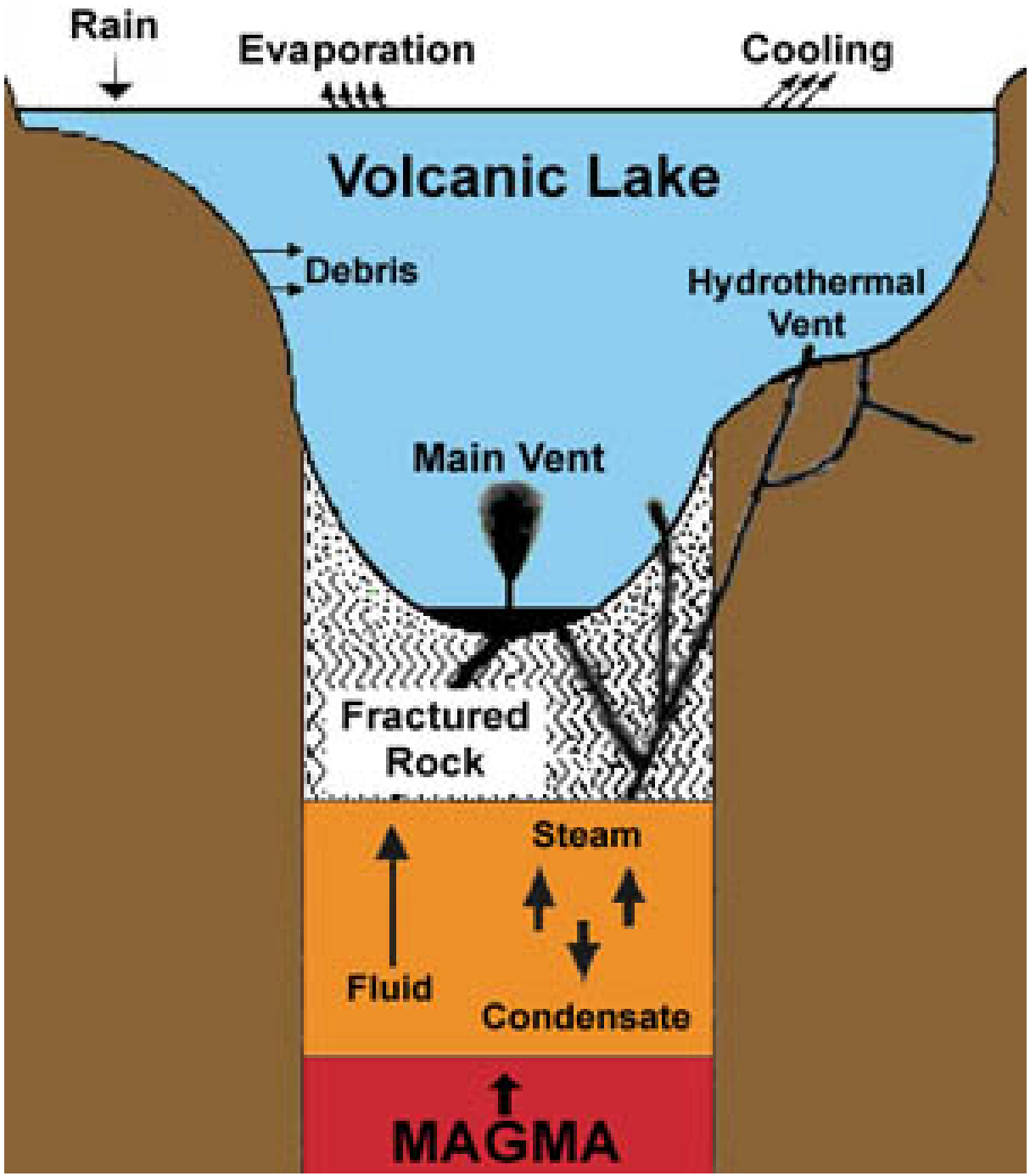
Quilotoa, Ecuador

Lake Taal, Phillipines

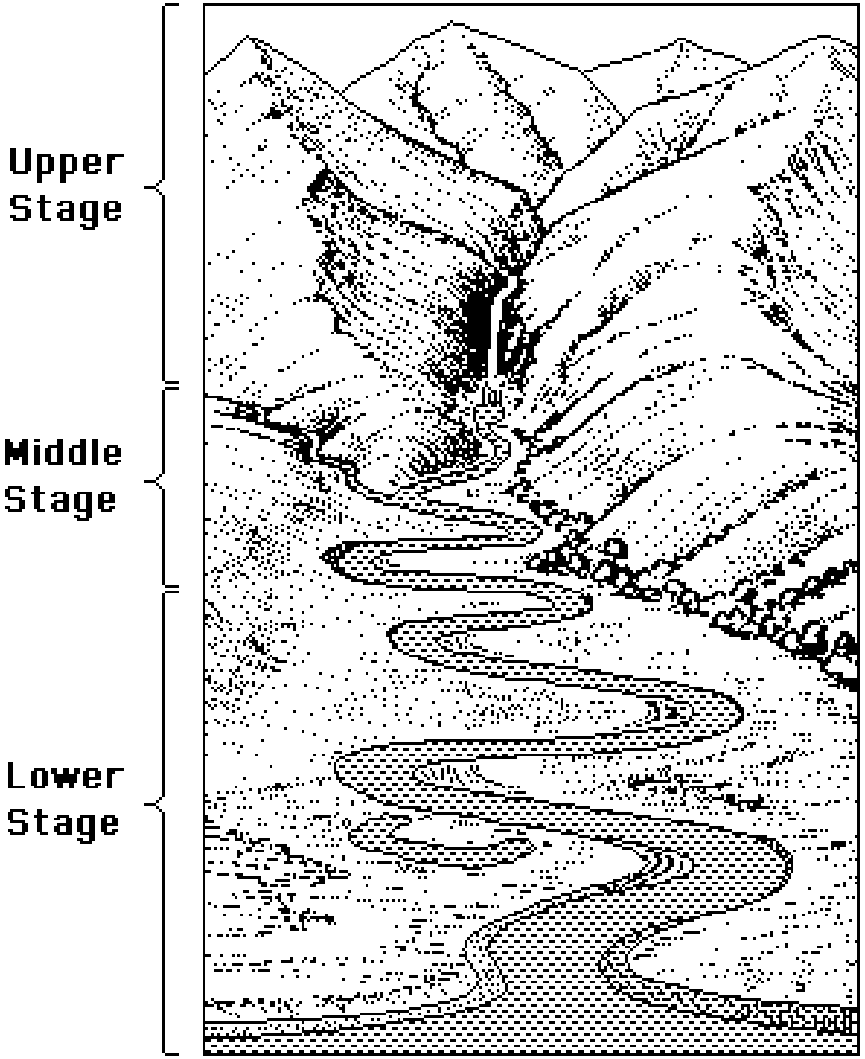
Waw an Namus, Libya

Deriba Caldera, South Sudan

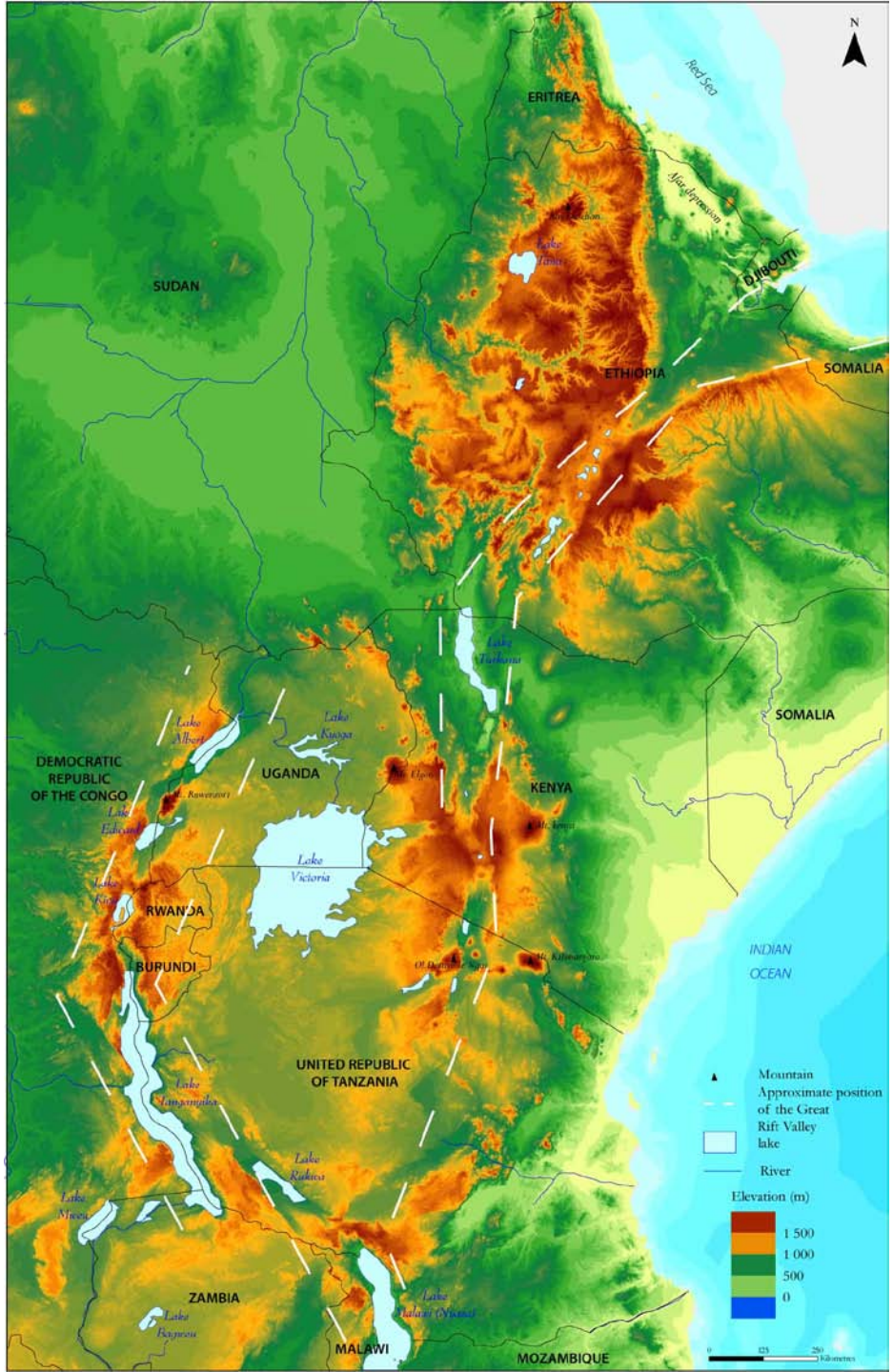
Pingualuit Lake, Canada

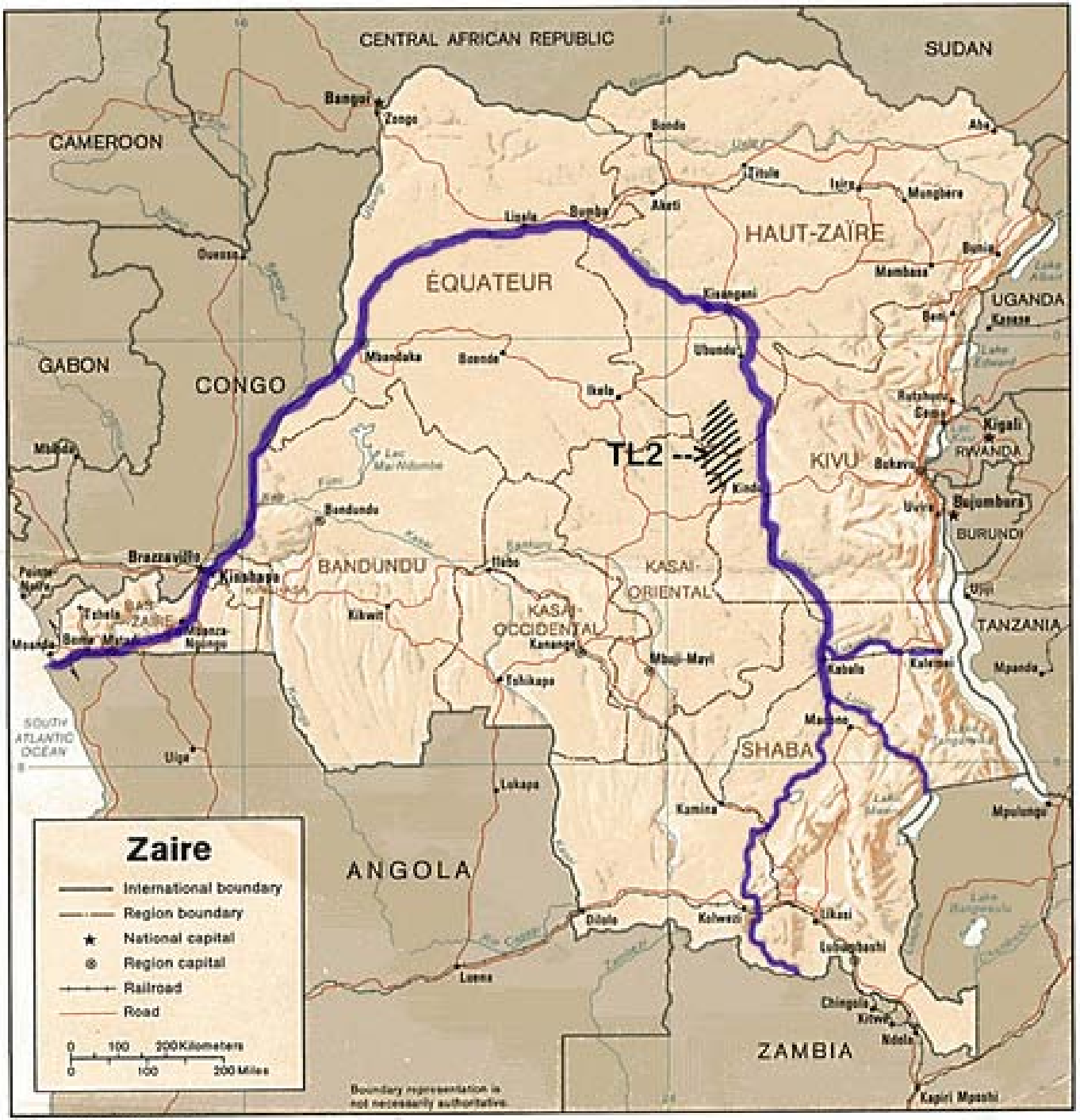

Rain
Evaporation
Cooling
Volcanic Lake
Debris
Hydrothermal Vent
Main Vent
Fractured Rock
Steam
Fluid
Condensate
MAGMA

Rivers

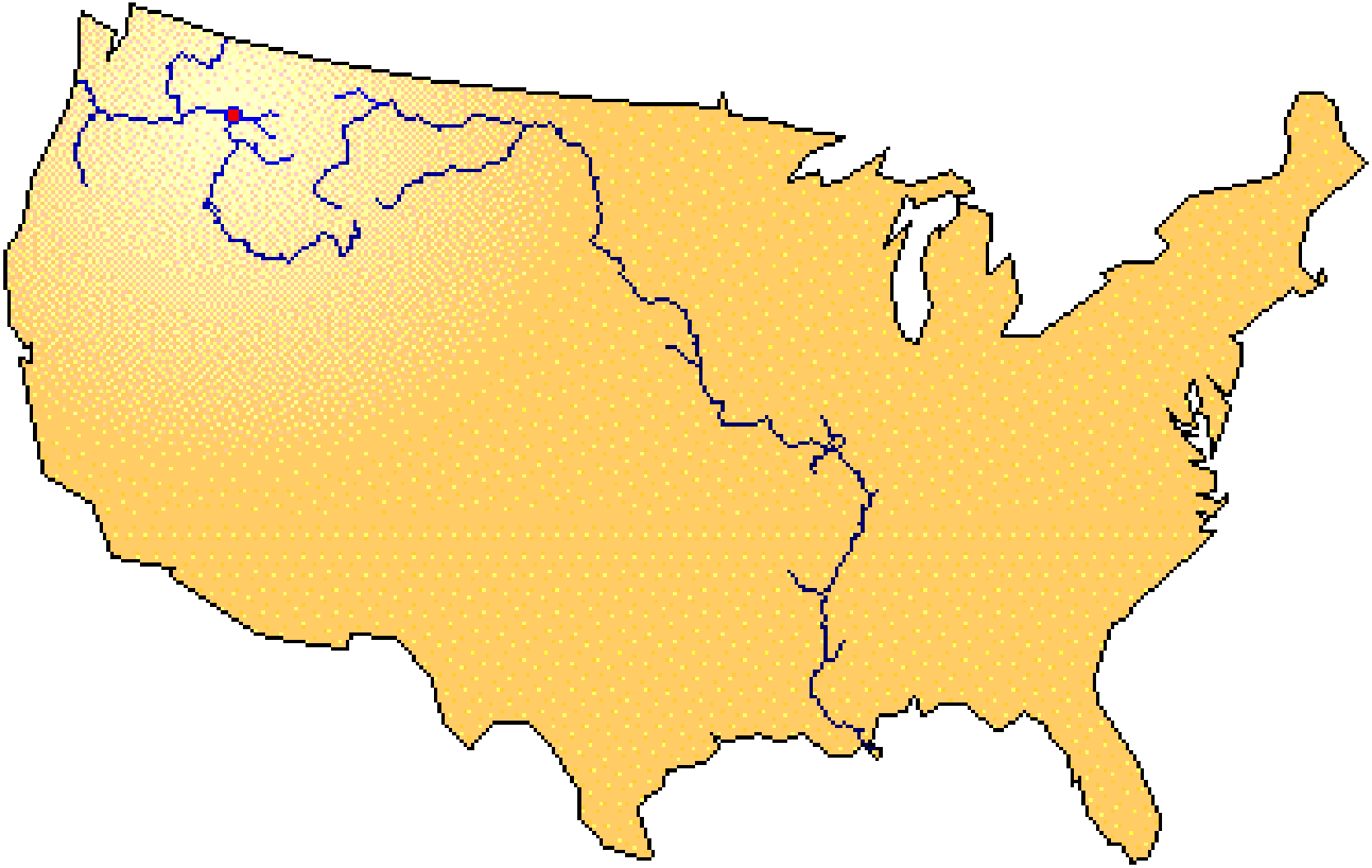



Mediterranean Sea
Red Sea
Nile
Nile
White Nile
Blue Nile
Lake Nasser
Lake Victoria
LIBYA
EGYPT
CHAD
SUDAN
ERITREA
DJIBOUTI
ETHIOPIA
SOMALIA
CENTRAL AFRICAN REPUBLIC
DEMOCRATIC REPUBLIC OF THE CONGO
UGANDA
KENYA
RWANDA
BURUNDI
TANZANIA
INDIAN OCEAN
20°
30°
40°
50°
30°
20°
10°
0°

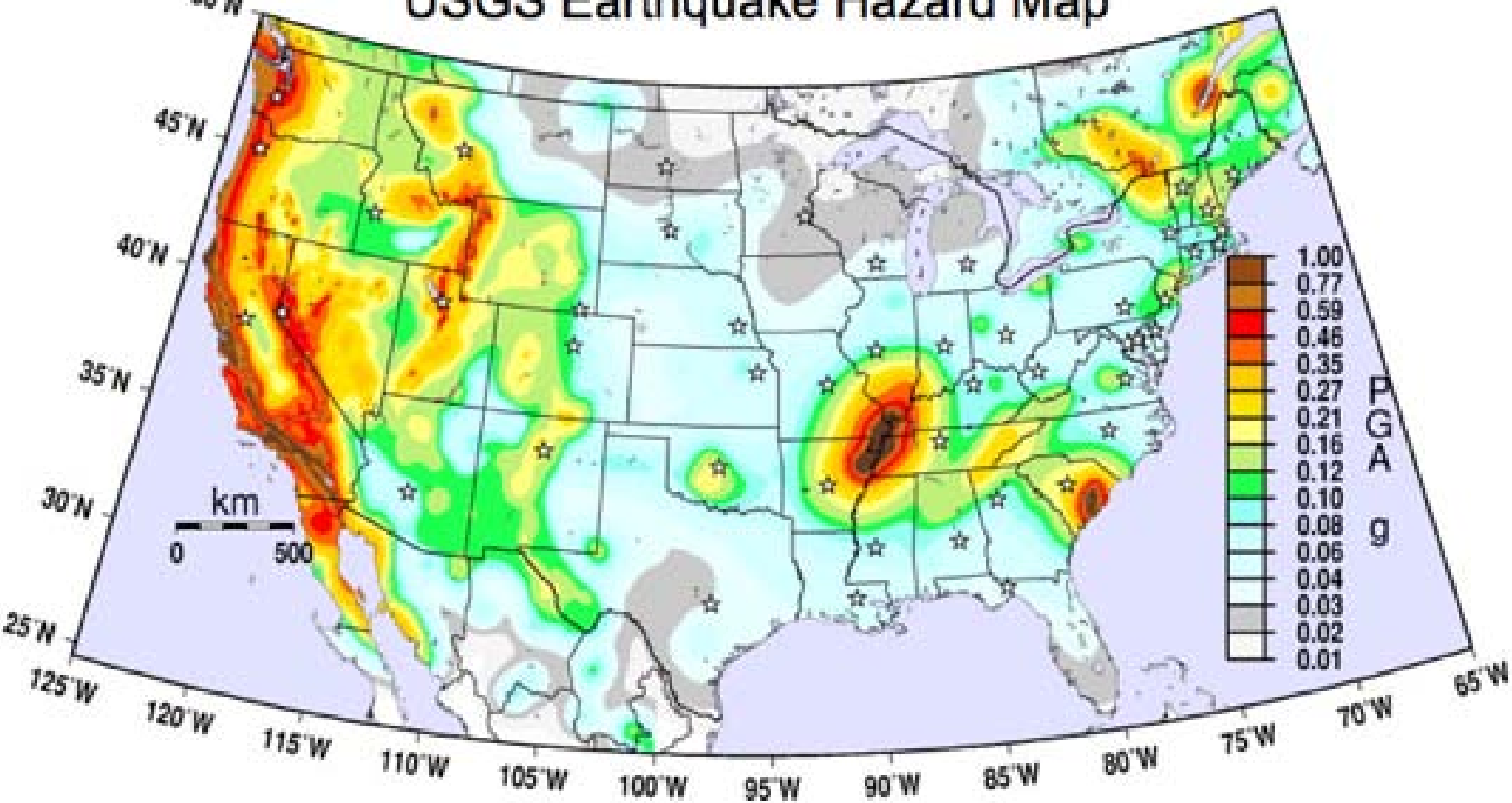

N
Red Sea
ERITREA
Lake Tana
SUDAN
DJIBOUTI
ETHIOPIA
SOMALIA
Lake Turkana
SOMALIA
Lake Albert
Lake Kyoga
DEMOCRATIC REPUBLIC OF THE CONGO
UGANDA
KENYA
Lake Edward
Lake Victoria
Lake Kivu
RWANDA
BURUNDI
INDIAN OCEAN
UNITED REPUBLIC OF TANZANIA
Lake Tanganyika
Lake Rukwa
Lake Nyasa
ZAMBIA
Lake Bangweulu
Lake Malawi (Nyasa)
MALAWI
MOZAMBIQUE
Mountain
Approximate position of the Great Rift Valley lake
River
Elevation (m)
1 500
1 000
500
0
0
125
250
Kilometres

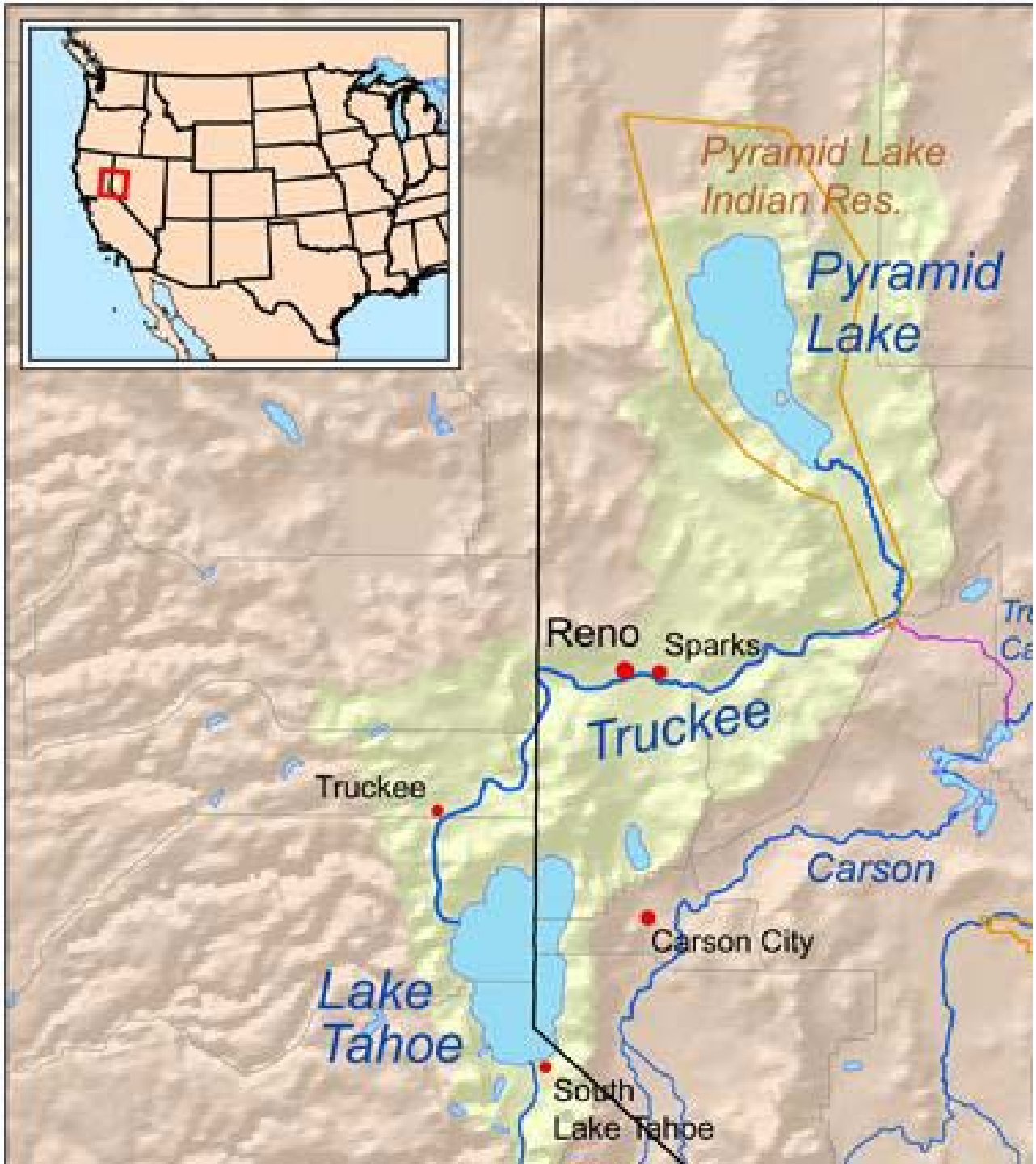


Base 505276 (A00620) 1-83

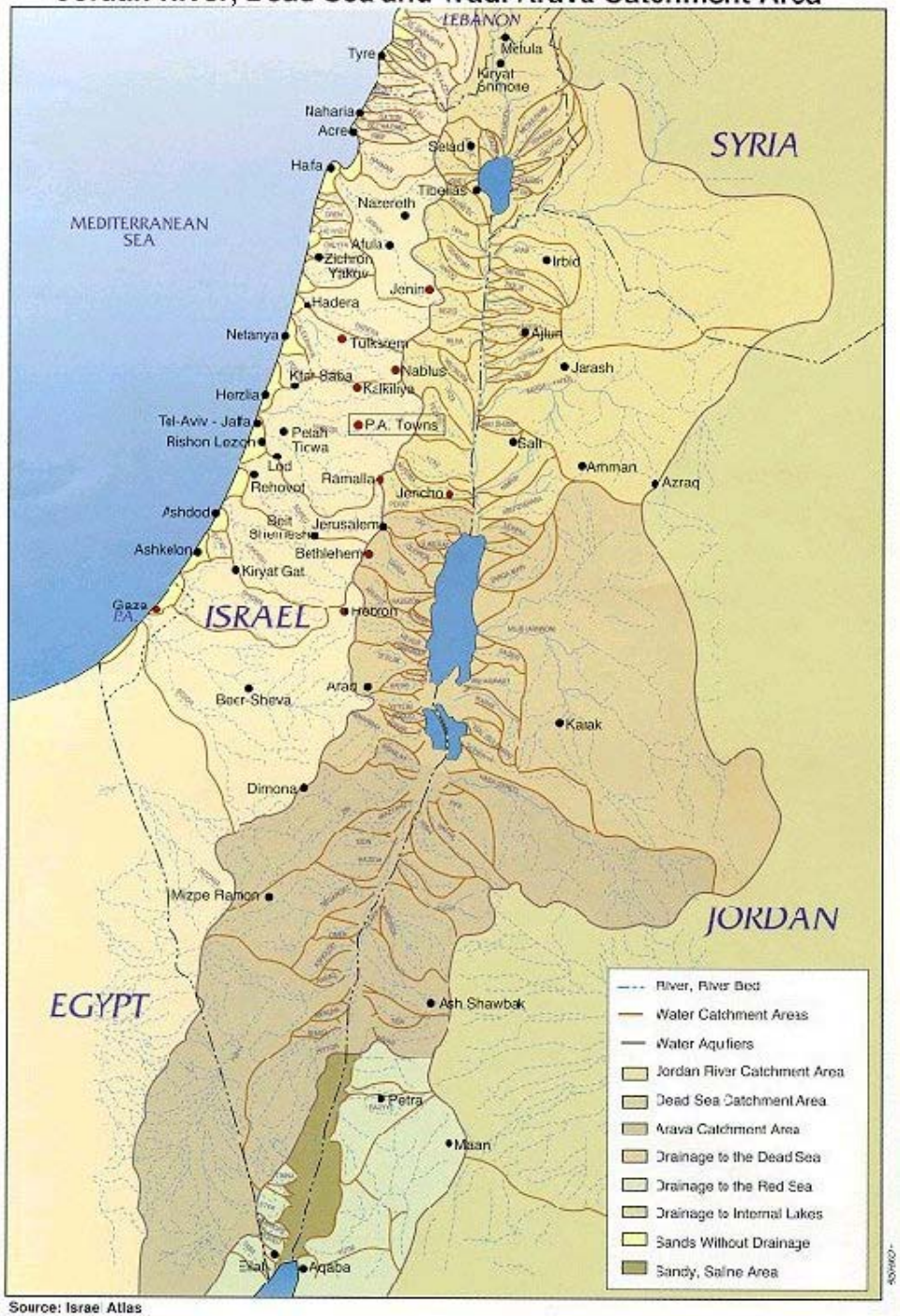


USGS Earthquake Hazard Map

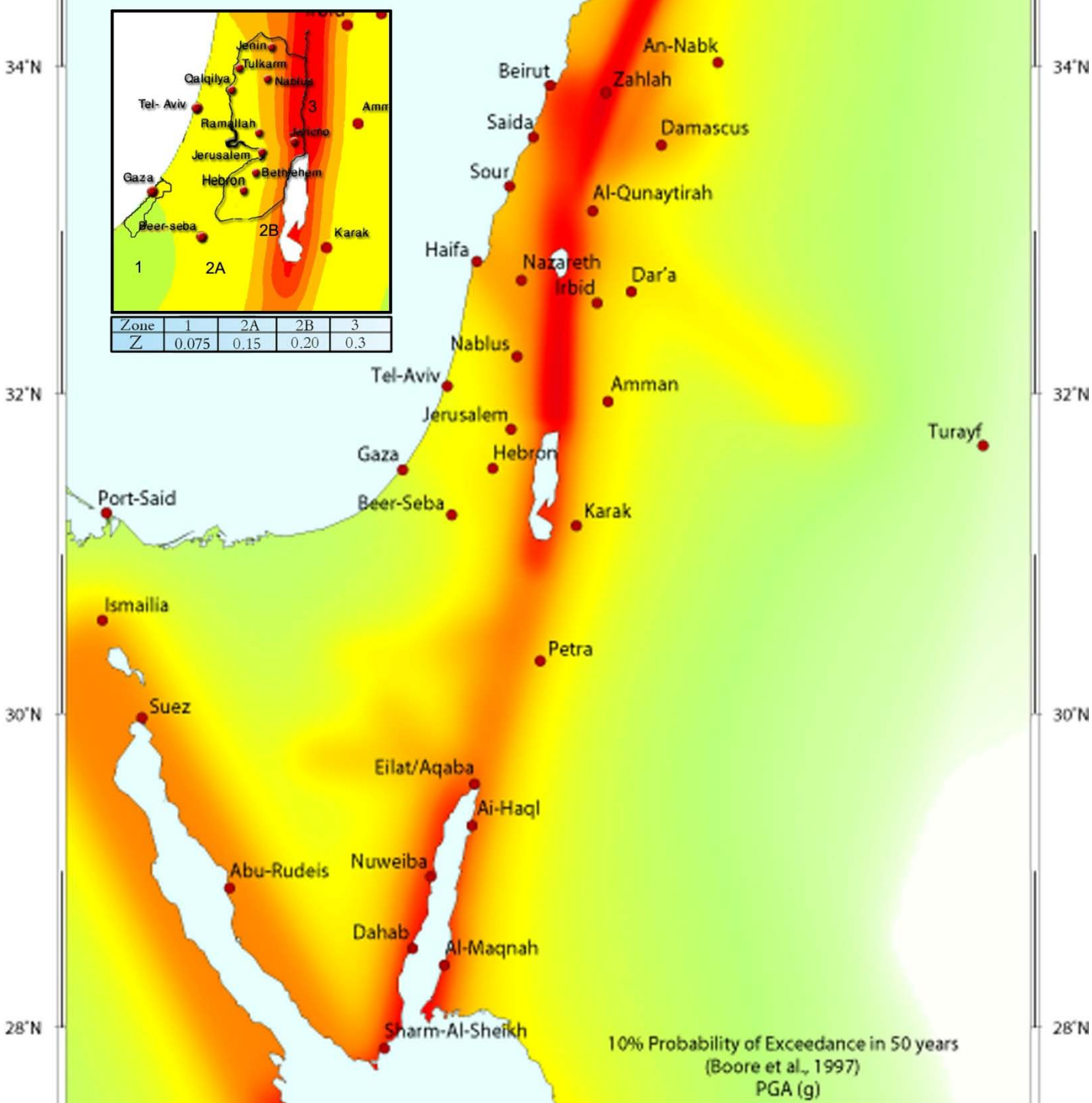



Pyramid Lake
Indian Res.
Pyramid
Lake
Reno
Sparks
Truckee
Truckee
Carson
Carson City
Lake
Tahoe
South
Lake Tahoe

Jordan River, Dead Sea and Wadi Arava Catchment Area



Source: Israel Atlas



Zone	1	2A	2B	3
Z	0.075	0.15	0.20	0.3

Springs

Figeh Spring, Damascus

Mzima Springs, Kenya


Makutano
Chyulu Hills
National Park
Ngwata
Darajani
Kathekani
Utu Village
Ngai
Nationa
Mtito Andei
Lake
Amboseli
Amboseli
National Park
Ol Tukai
Kimana
Ol Molog
Kuku
Endoinet
Oloitokitok
Rongai
Laset
Mzima
Kilimanjaro
National Park
Tarakea
Ngulia
Mandara
Mata
Mt.Kilimanjaro
National Park
Kirongo
Barangata
Mkuu
Machame
Liwati
Umbwe
Kibosho
Uswaa
Namro
Marangu
Mwika
A 23
Komakya
Boma
Ng'ombe
Kikafu
Moshi
Chala
Chala
Two Kinja village
©2011 Google - Map data ©2011

Montezuma Well, Arizona

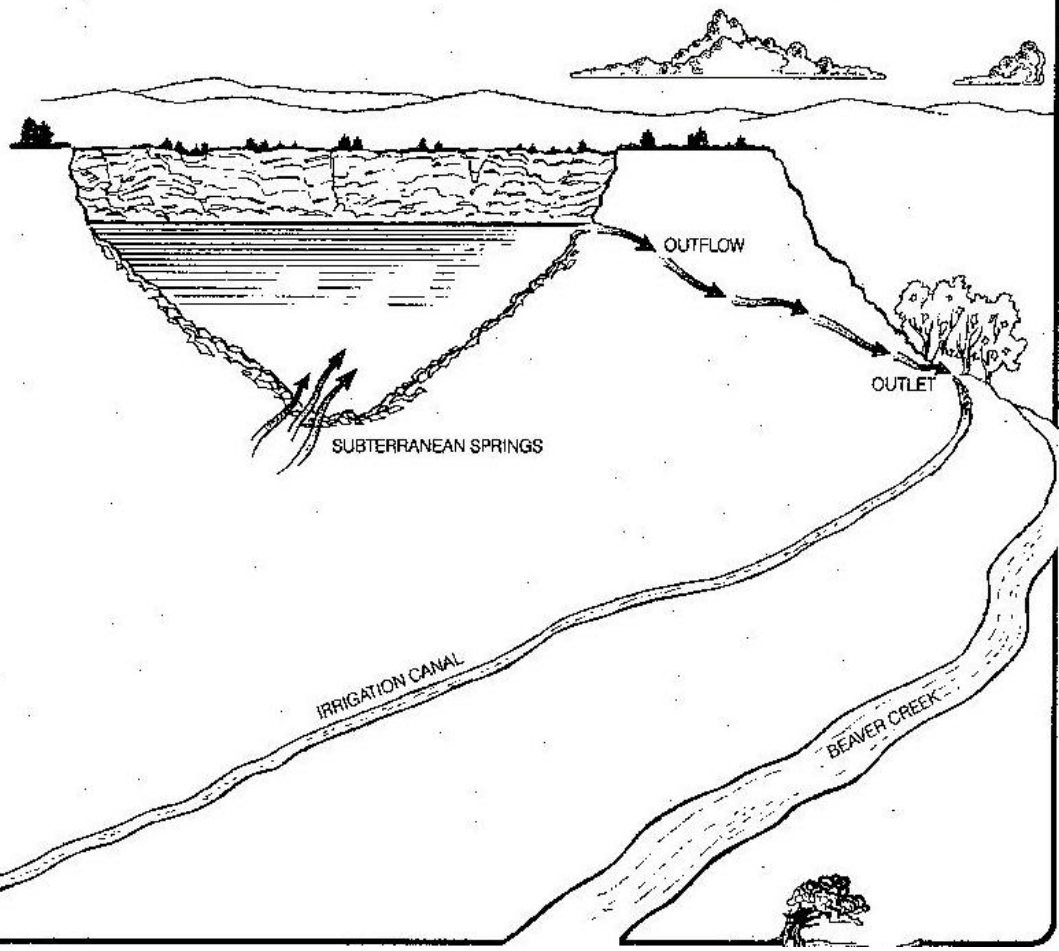
Montezuma Well

A funnel-shaped, limestone sink containing a pool of water 55 feet deep and 368 feet across, Montezuma Well is all that remains of an ancient cavern.

Subterranean springs of warm water replenish the well with over a million and a half gallons of water a day: an amount unvarying, apparently, since prehistoric times. The water maintains an even temperature of 76° (25 C°) year around.

Water from the well flows out through a side cave in the limestone cliffs to your right.

We do not know what the first settlers called this place, but early soldiers attributed the deep pool of water in the desert to the Aztec emperor who lived 2,000 miles south and several hundred years earlier.



Al Ain (The Spring) – Abu Dhabi, UAE

Boreholes

Great Artesian Basin, Australia

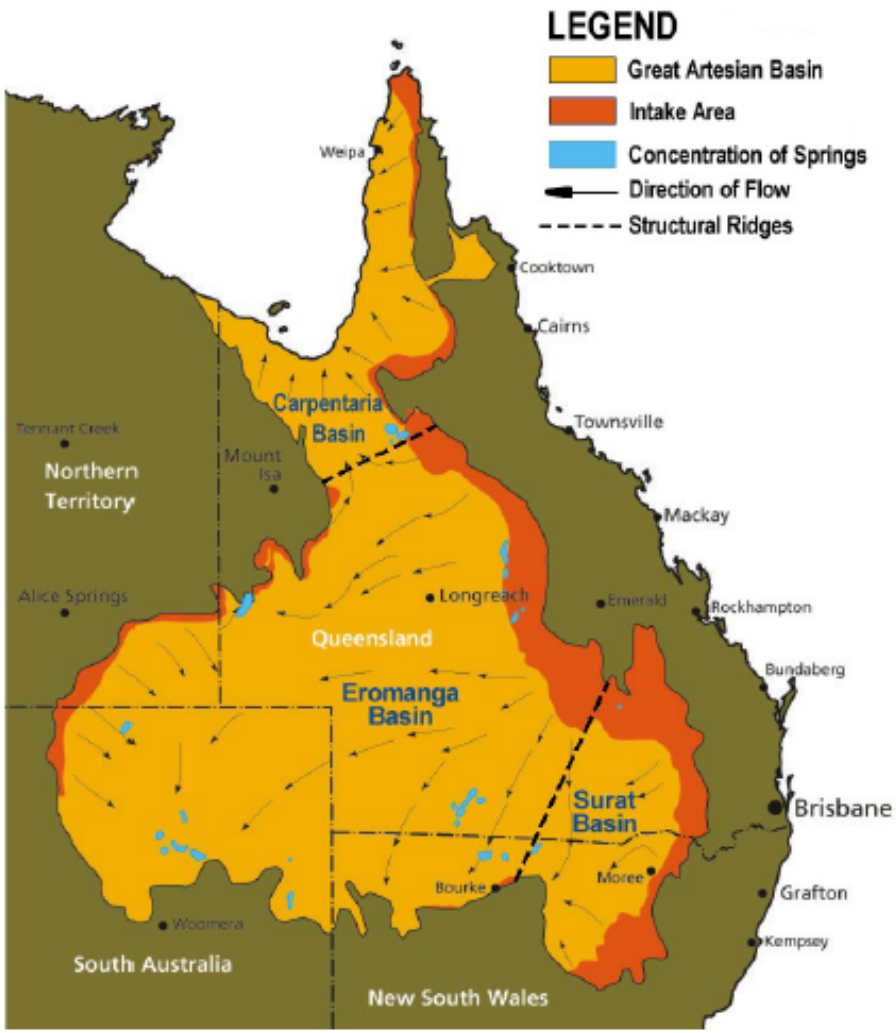


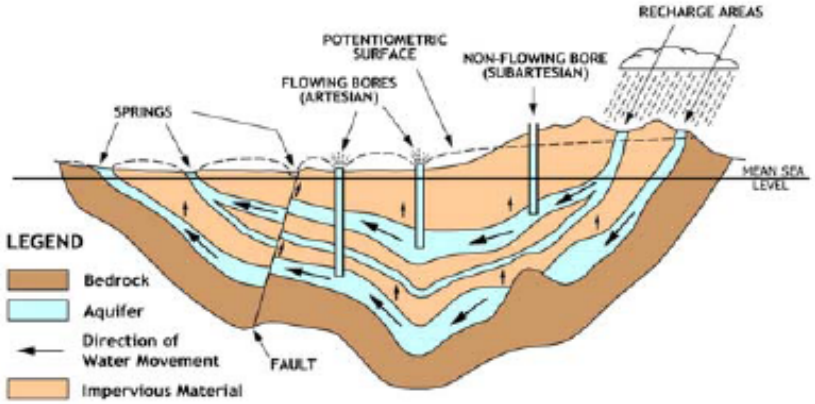
Figure 1—The Great Artesian Basin

How the basin was formed

sediments became the impermeable layers. Thickness of the combined layers varies from less than 100 metres on the basin extremities to over 3000 metres in the deeper parts. (See Figure 2).

During the Cretaceous period (about 100 million years ago), down warping and high sea levels created a shallow sea over much of inland Australia. This sea deposited mainly muddy sediments, which later consolidated, forming the rolling downs that can be seen today.

As the Cretaceous period ended, about 65 million years ago, uplift ended sedimentation in the region of the GAB. Further uplifting and erosion resulted in the exposure of the permeable sandstones in the marginal areas of the Basin. This occurred mainly along the western edge of the present day Great Dividing Range. Rainfall began to infiltrate into the sandstones that led to the accumulation of the vast groundwater reserve.



http://www.derm.qld.gov.au/factsheets/pdf/water/w68.pdf


Tunisia
Tripoli
Mar Mediterráneo
Túnez
Llanura de Jefara
Sirt
Bengazi
Dema
Tubruq
Area de perforación de Gadames
Area de perforación de Jebel Hasuna
Al Jaghbub
Libya
Area de perforación de Sarir
Egipto
Egypt
Sabha
Kufra
Area de perforación de Tazirbo
Argelia
Niger
Chad
Sahara Desert
Libyan Desert
Depósitos
Conductos ya terminados
Conductos de futura construcción
Sudán
© 2011 Europa Technologies
US Dept of State Geographer
© 2011 Google
©2010 Google


AVEDA
THE ART AND SCIENCE OF PURE FLOWER AND PLANT ESSENCES