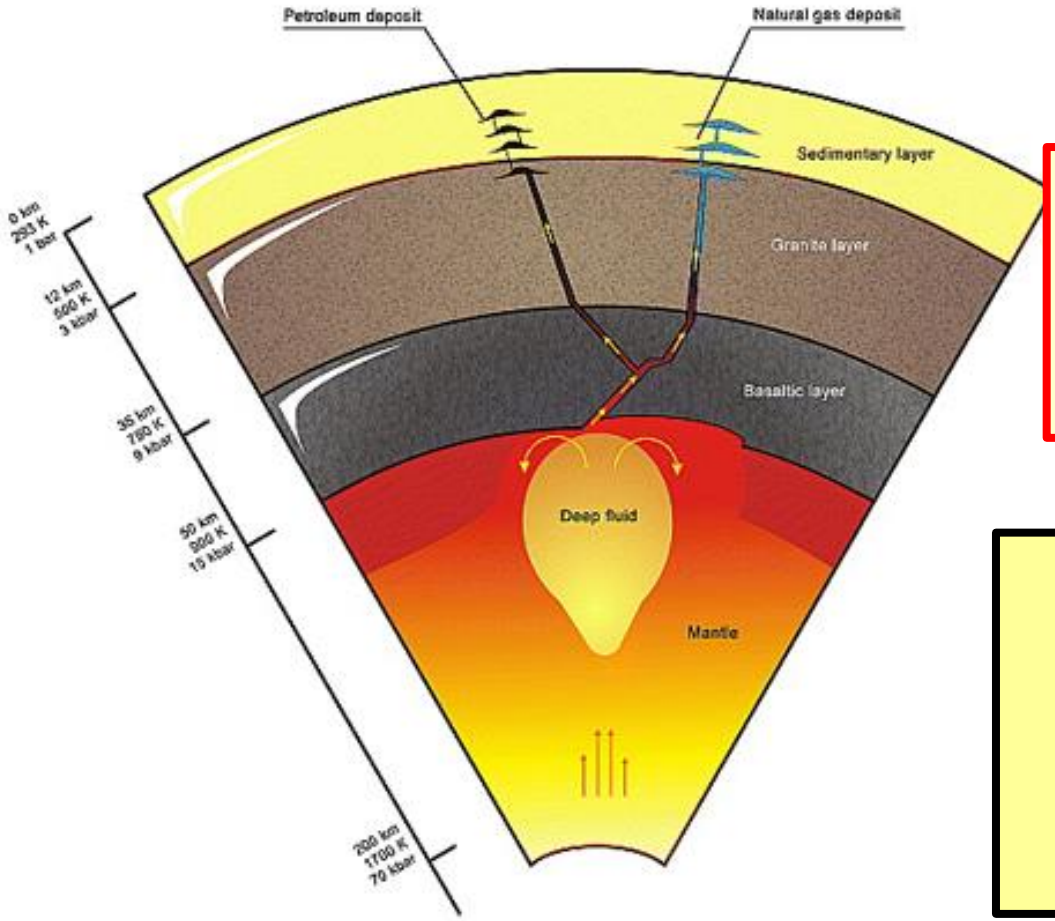
Abiogenic Oil?
Subject area of research, discussion, and strongly contrasting viewpoints



Genesis of this presentation: pondering the Alarmist view that, in the US and the world, “we are running out of oil!”

Bob Endlich
bendlich@msn.com
Cruces Atmospheric Sciences Forum
21 Feb 2026

OUTLINE

INTRODUCTION

LAYERS OF THE EARTH

VOLCANOES

KILBOURNE HOLE

FORMATION OF OIL AND GAS FIELDS IN LIGHT OF ABIOGENIC ORIGIN OF PETROLEUM

SHIELDS, AND ABIOTIC HYDROCARBONS FOUND UNDER THEM

- CANADIAN UNITED STATES (GRAND CANYON)
- BALTIC UKRANIAN
- GREENLAND AFRICA BRAZIL
- ANTARCTIC

INTRODUCTION

1991: “BLACK GOLD CAUSES STIR.”

ABIOTIC OIL?

GEOLOGIC TIME

AGU: DEEP-SEATED ABIOGENIC ORIGIN OF PETROLEUM: From geological assessment to physical theory

THE NAYSAYERS

JUPITER’S MOON TITAN

LOCAL GEOLOGY of the RIO GRANDE RIFT VALLEY

Making scientific news in 1991.

Thirty-five years ago, there was a small article in NATURE that caused some news, even consternation…

“Black Gold Causes a Stir”

PETROLEUM GEOLOGY

Black gold causes a stir

London

A SWEDISH drilling company claims to have discovered crude oil in a granite rock formation — a location that should not contain oil, according to the currently accepted theory of oil formation, which holds that oil and natural gas are formed from biological material buried in sediments.

If the new finding is confirmed, it will lend some support to a controversial theory proposed by Thomas Gold from Cornell University. Gold argues that gas and oil deposits originate from methane, released from deep within the Earth, which has seeped up into sediments near the surface. He says he has no doubt that the new find supports his theory: "The case to me is completely clear."

The challenge to orthodox petroleum geology was met with scepticism last week by geologists and geochemists alike. Many said they would want more evidence that the oil could not have originated from was that oil had simply migrated down to the granite from sedimentary rocks near the surface.

Philp has declined to analyse any further samples from Siljan, arguing that his earlier findings were "taken out of context" by Gold and Dala Djupgas to support Gold's theory. But many geochemists suspect that the team was simply recovering the diesel oil drilling fluid that they had earlier pumped down the hole.

Kenney counters that extensive chemical analyses of the earlier samples show that they contain hydrocarbons other than those in the drilling fluid. And this time Kenney has a simpler argument to tackle the sceptics: the only drilling fluid that has so far been pumped down the second hole is, he says, fresh water.

"A lot of people are interested," says Chris Clayton from British Petroleum's Sunbury Research Centre in Middlesex. But he says that the industry will remain

Djupgas shares may now increase in value during secondary trading, the company will receive no more money for each share it sells. Nevertheless, last week's news does seem to have increased interest in the Dala Djupgas share offer. "Everyone in Sweden wants to buy shares," observes company president Lars Bahlberg.

Peter Aldhous

https://www.nature.com/articles/353593a0

News
Published: 17 October 1991

"Black gold causes a stir"

Lake Siljan, Sweden

19 Dec 2025 Notes:

I was a Geology Major, graduating from Rutgers in 1962.

…maybe 10 years ago…I briefly investigated the possibility of Abiotic Oil after seeing a reference to Russians (?) drilling deeply, into basement rock, and encountering oil, perhaps at **30,000 ft** (**!**) depth…might have been in the Dnieper-Donets Basin, in Ukraine, near Russia. Unfortunately, today, I can not find this specific reference….

Maybe it was in this 2010 AGU article:

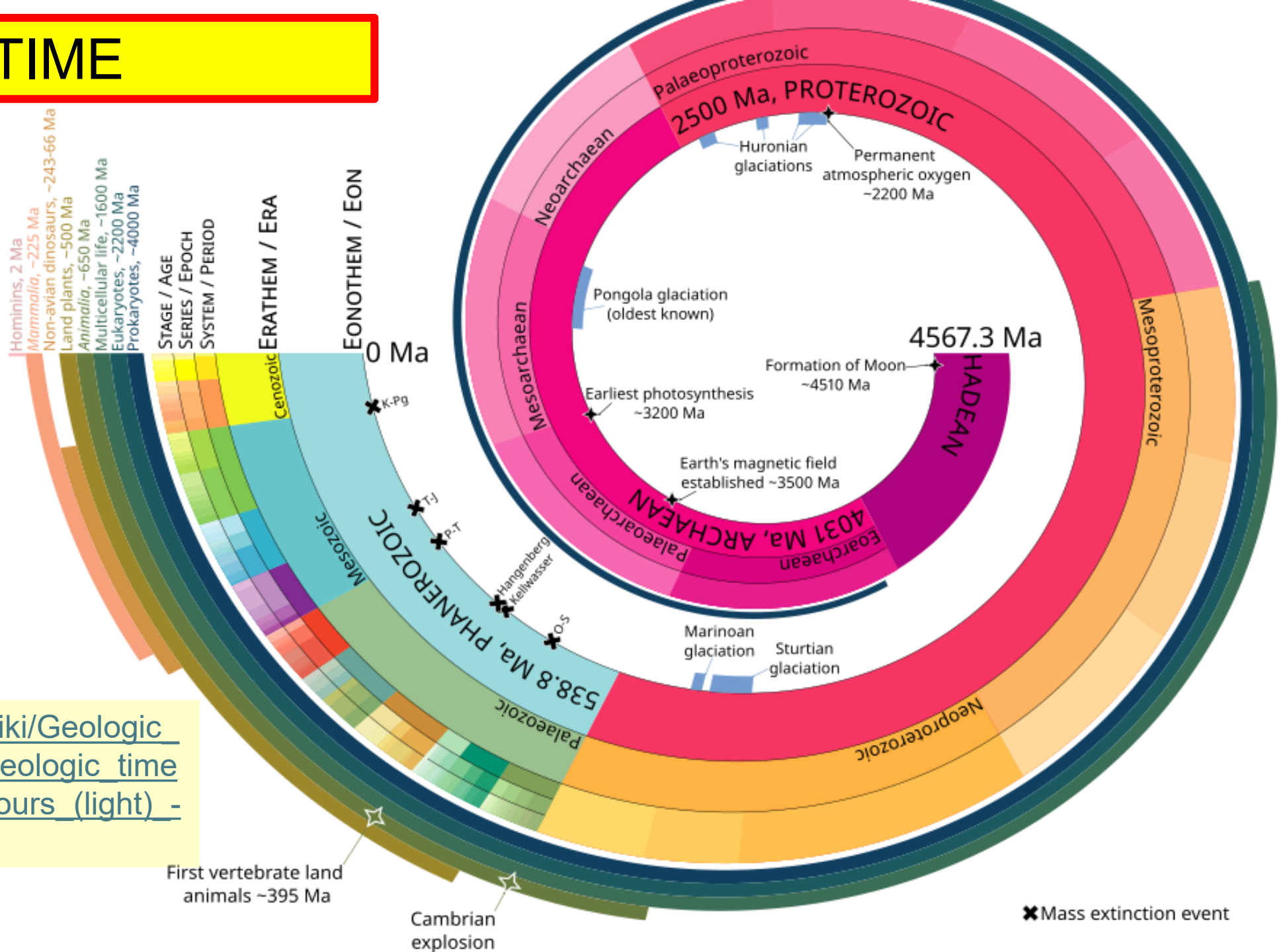
https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2008RG000270

"Deep-seated abiogenic origin of petroleum: From geological assessment to physical theory"

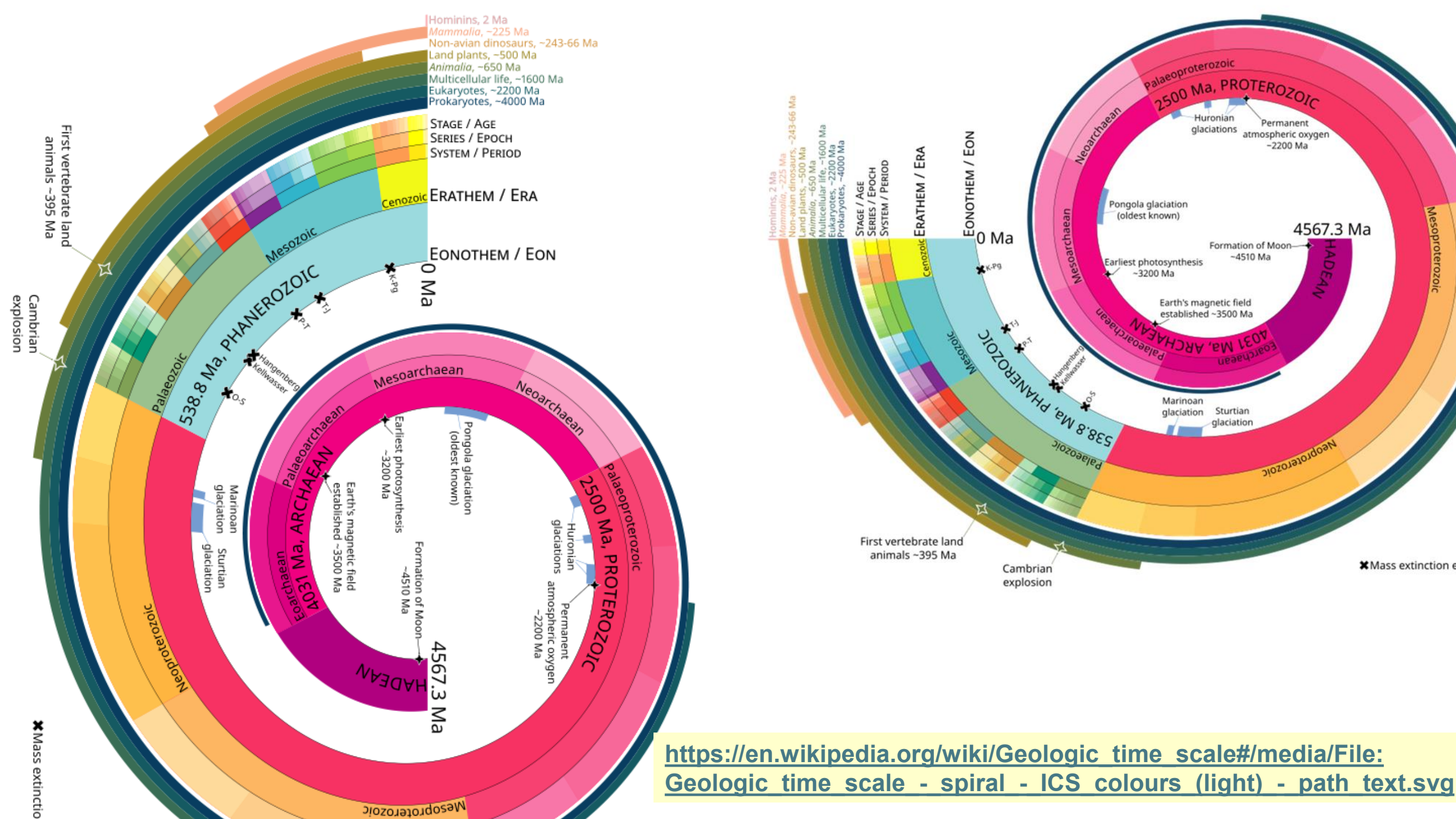
Quite similar, same authors, also 2010, from Harvard:

https://ui.adsabs.harvard.edu/abs/2010RvGeo..48.1001K/abstract

GEOLOGIC TIME

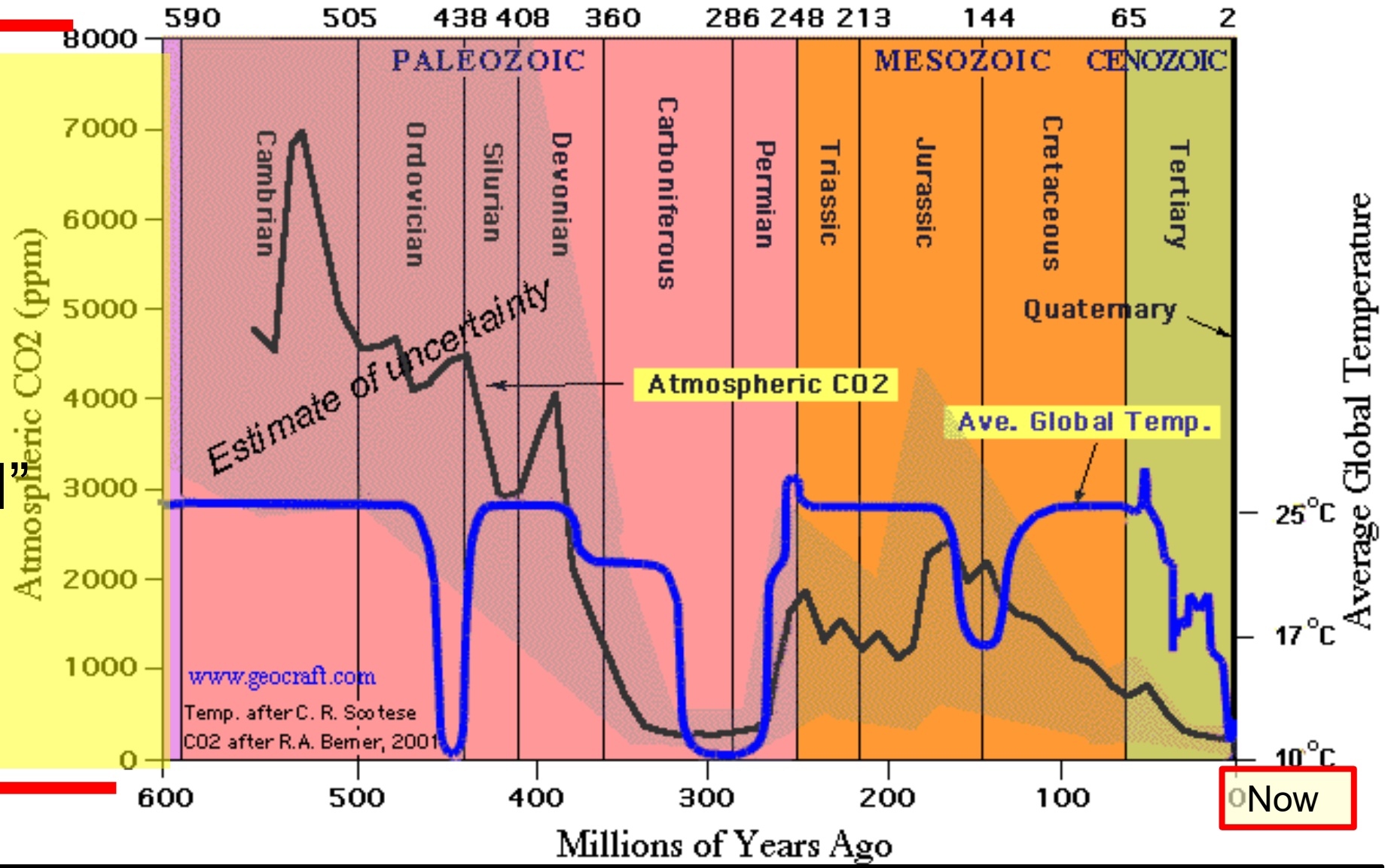


https://en.wikipedia.org/wiki/Geologic_time_scale#/media/File:Geologic_time_scale_-_spiral_-ICS_colours_(light)_-_path_text.svg



https://en.wikipedia.org/wiki/Geologic_time_scale#/media/File:Geologic_time_scale_-_spiral_-_ICS_colours_(light)_-_path_text.svg

ALL THIS TIME
IS CALLED THE
“PRE-CAMBRIAN”



X-Axis Time: Cambrian 600 Million Years ago, Left Present on Right
Y-Axis Blue Average Global Temperature, Scotese **Paleomap** Project **Climate** Tab
Y-Axis Black Atmospheric <CO2> Berner & Kothavala, Am J. Sci., 2001, p 182-204

https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2008RG000270

ADVANCING EARTH AND SPACE SCIENCES

JOURNALS TOPICS BOOKS OTHER PUBLICATIONS POLICIES

Reviews of Geophysics

Free Access

Deep-seated abiogenic origin of petroleum: From geological assessment to physical theory

Vladimir G. Kutcherov, Vladilen A. Krayushkin

First published: 12 March 2010 | https://doi.org/10.1029/2008RG000270 | VIEW METRICS

Abstract

The theory of the abyssal abiogenic origin of petroleum is a significant part of the modern scientific theories dealing with the formation of hydrocarbons. These theories include the identification of natural hydrocarbon systems, the physical processes leading to their terrestrial concentration, and the dynamic processes controlling the migration of that material into geological reservoirs of petroleum. The theory of the abyssal abiogenic origin of petroleum recognizes that natural gas and petroleum are primordial materials of deep origin which have migrated into the Earth's crust. Experimental results and geological investigations presented in this article convincingly confirm the main postulates of the theory and allow us to reexamine the structure, size, and locality distributions of the world's hydrocarbon reserves.

https://ui.adsabs.harvard.edu/abs/2010RvGeo..48.1001K/abstract

Harvard is cautious, with this label:

Preprints and early-stage research may not have been peer reviewed yet.

Deep-seated abiogenic origin of petroleum: From geological assessment to physical theory

This article's authors also,

Vladimir G. Kutcherov ✉, Vladilen A. Krayushkin

The theory of the abyssal abiogenic origin of petroleum is a significant part of the modern scientific theories dealing with the formation of hydrocarbons. These theories include the identification of natural hydrocarbon systems, the physical processes leading to their terrestrial concentration, and the dynamic processes controlling the migration of that material into geological reservoirs of petroleum. The theory of the abyssal abiogenic origin of petroleum recognizes that natural gas and petroleum are primordial materials of deep origin which have migrated into the Earth's crust. Experimental results and geological investigations presented in this article convincingly confirm the main postulates of the theory and allow us to reexamine the structure, size, and locality distributions of the world's hydrocarbon reserves.

https://www.researchgate.net/publication/386322541_The_Abiogenic_Theory_of_Hydrocarbons_Revisiting_the_Deep_Origins_of_Earth's_Energy_Resources

Youvan, Douglas. (2024). **The Abiogenic Theory of Hydrocarbons: Revisiting the Deep Origins of Earth's Energy Resources**. 10.13140/RG.2.2.30237.32484. <Edits: bolds, spacing, paragraphing>

The origin of hydrocarbons has traditionally been attributed to the decomposition of ancient organic matter, a cornerstone of the biogenic theory.

However, the abiogenic theory proposes an alternative perspective: hydrocarbons can form deep within the Earth's mantle through inorganic processes, challenging conventional beliefs.

Evidence supporting this theory spans laboratory experiments replicating mantle conditions, the discovery of hydrocarbons in igneous and metamorphic rocks, emissions in tectonic zones, and the presence of hydrocarbons on celestial bodies such as Titan and Mars. These findings suggest that abiogenic processes contribute to Earth's hydrocarbon reservoirs, potentially complementing biogenic sources. Tectonically active regions, deep faults, and mid-ocean ridges emerge as critical zones for hydrocarbon migration from mantle depths.

While the majority of commercially exploited hydrocarbons are biogenic, understanding the abiogenic contribution could revolutionize energy exploration and reshape how we view the sustainability of these resources. This article explores the evidence, mechanisms, and implications of abiogenic hydrocarbons, highlighting their role in Earth's complex hydrocarbon system.

The Naysayers

https://science.feedback.org/

https://science.feedback.org/review/dead-things-transform-into-fossil-fuels-earth-crust-over-millions-years-no-evidence-deeper-origins-renewable-source/

SCIENCE FEEDBACK

EN

GEOLOGY

Dead things transform into fossil fuels in Earth's crust over millions of years; no evidence of deeper origins or renewable source

2024-06-07

https://science.feedback.org/review/dead-things-transform-into-fossil-fuels-earth-crust-over-millions-years-no-evidence-deeper-origins-renewable-source/

KEY TAKEAWAY

Scientific evidence indicates that hydrocarbon deposits (e.g., oil and gas) found on Earth formed in sedimentary basins in Earth's crust through a process of burial and transformation of biological matter (e.g., algae, plankton, and plants). The evidence supporting this explanation includes geochemical data with biological signatures, and a consistent record of hydrocarbons being found in the same type of depositional environment (i.e., sedimentary basins). There is no scientific evidence to support claims that hydrocarbons formed in the upper mantle and rose into Earth's crust through deep faults.

COMMENT: When I looked up WHO is involved in Science Feedback, I found at least one climate alarmist from a decade or so ago, when **Marita Noon** and I were on **News New Mexico**, a syndicated radio show, and Marita's posts on **Town Hall** where she quoted me…

An immediately familiar name was **Richard Somerville**, Professor Emeritus, Scripps Institute of Oceanography, University of California, San Diego.

Made me suspicious of Science Feedback.

https://casf.me/climate-change-a-serious-threat-to-science/ by Marita Noon

Marita Noon

Due to his respected position, as climate scientist at the University of California, San Diego Institution of Oceanography, Richard C.J. Somerville's recent "Cold comfort" column was published in newspapers throughout the country.

"…On the contrary, the data don't support the claims made by climate scientists—but they just keep making them. Apparently, they believe the "big lie" propaganda technique used so effectively by Adolf Hitler.

In Somerville's column, he offers several familiar, easily disproven statements:

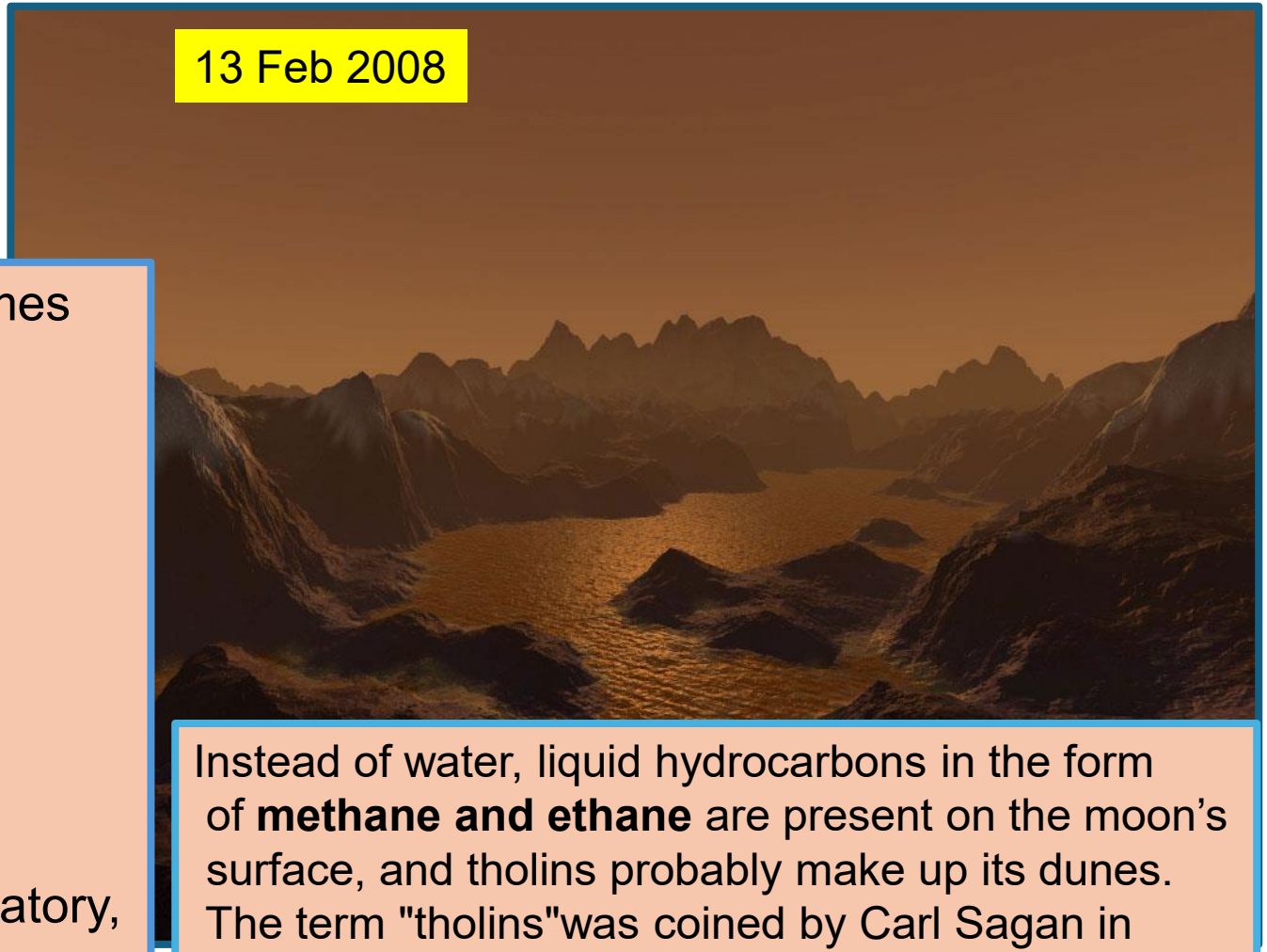
•"Low-lying areas are threatened by sea-level rise" which will result in "millions of environmental refugees" and
•"major threats to agricultural productivity as rainfall patterns change and as heat waves, floods, droughts and other weather extremes worsen…"

"Because my expertise is in communications not climate, I reached out to someone who could help me: Robert Endlich—who does in fact have both the education and experience.
Endlich, who served as a USAF weather officer for 21 years and holds a BS in geology and an MS in meteorology, offered me pages of data and documentation, which I've summarized for my readers."

https://www.jpl.nasa.gov/news/titans-surface-organics-surpass-oil-reserves-on-earth/

Titan's Surface Organics Surpass Oil Reserves on Earth

Jet Propulsion Laboratory
California Institute of Technology



Saturn's orange **moon Titan** has hundreds of times more liquid hydrocarbons than all the known oil and natural gas reserves on Earth, according to new data from NASA's **Cassini spacecraft.**

The hydrocarbons rain from the sky, collecting in vast deposits that form lakes and dunes.

The new findings from the study led by Ralph Lorenz, Cassini radar team member from the Johns Hopkins University Applied Physics Laboratory, Laurel, Md., are reported in the Jan. 29 issue of the Geophysical Research Letters.

Instead of water, liquid hydrocarbons in the form of **methane and ethane** are present on the moon's surface, and tholins probably make up its dunes. The term "tholins"was coined by Carl Sagan in 1979 to describe the complex organic molecules at the heart of prebiotic chemistry.

Geology of the Rio Grande Rift Valley

Potrillo Mountains

Kilbourne Hole

https://geoinfo.nmt.edu/tour/state/leasburg/home.html

Exposures of Mantle Rock in New Mexico:

Proximity/Association with the Rio Grande Rift

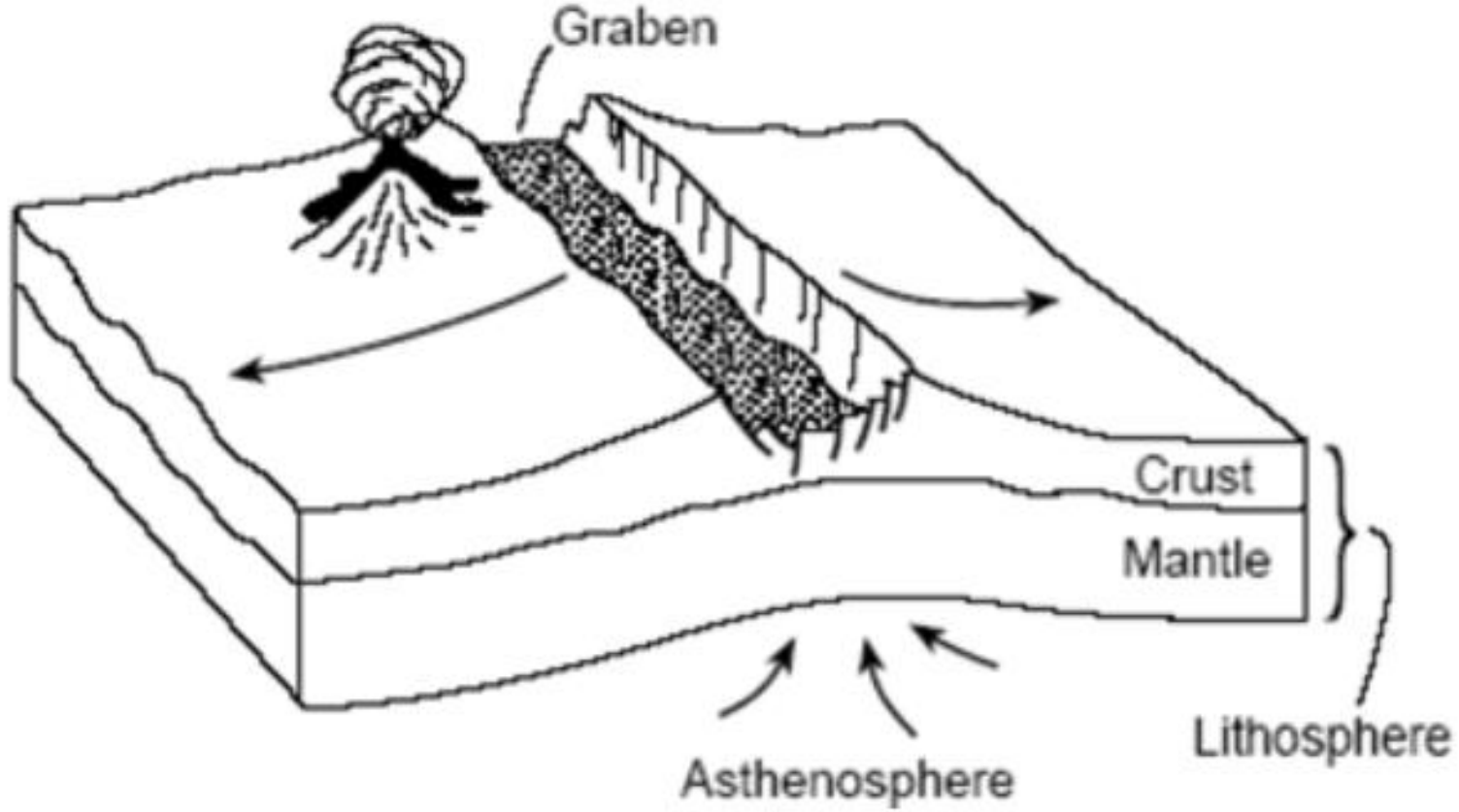
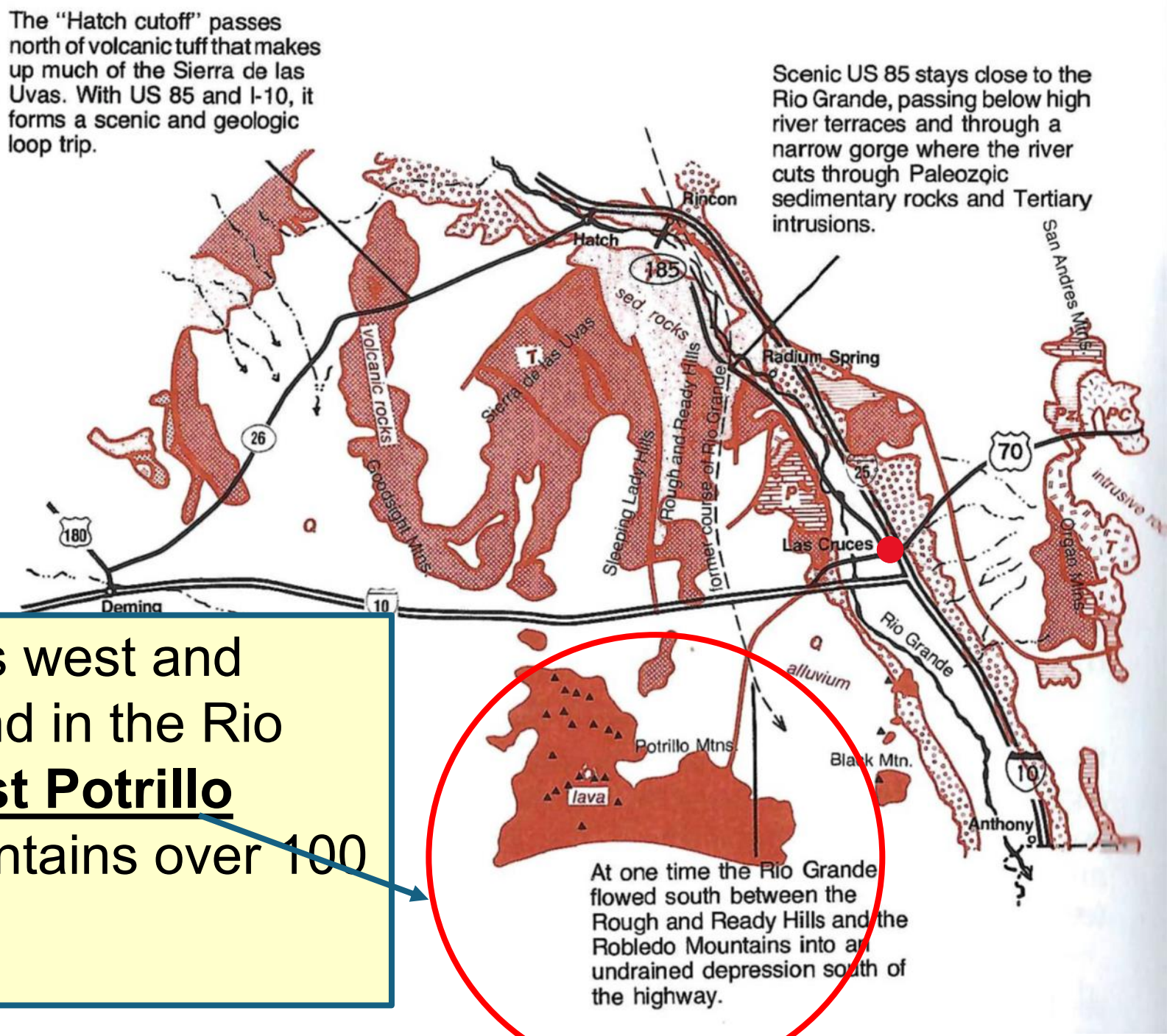


Figure 2 – Diagram of formation of the Rio Grande rift .

This map is from Page 84
Roadside Geology of New Mexico
by Halka Chronic,
Mountain Press Publishing Co,
Missoula, MT.



Southwest of Las Cruces west and south of Interstate 10, and in the Rio Grande Rift, lies the **West Potrillo Volcanic Field** which contains over 100 small volcanoes.

https://en.wikipedia.org/wiki/Potrillo_volcanic_field#/media/File:LANDSAT_Potrillo_Volcanic_Field.jpg

Landsat false color image of the West Potrillo Volcanic Field

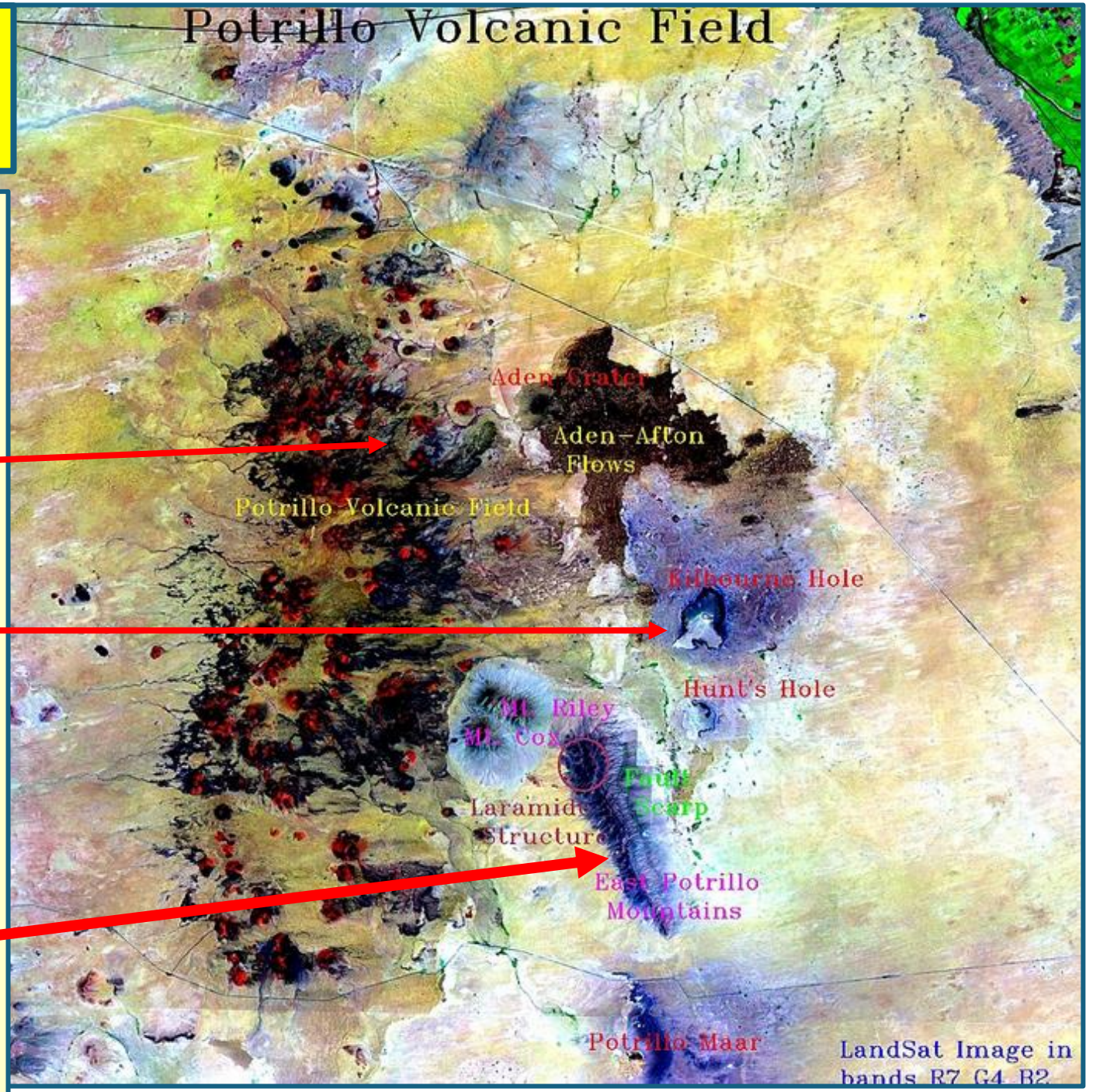
The monogenetic West Potrillo volcanoes appear as red dots/spots.

Kilbourne Hole

Many lava flows appear in Black.

Roads and UPRR stand out well.

East Potrillo Mountains, tilted Mesozoic sediments, stand in stark contrast.
Mesozoic: Triassic Jurassic, Cretaceous



https://en.wikipedia.org/wiki/Monogenetic_volcanic_field

Monogenetic volcanic field

7 languages

Article Talk Read Edit View history Tools

From Wikipedia, the free encyclopedia

A **monogenetic volcanic field** is a type of volcanic field consisting of a group of small monogenetic volcanoes, each of which erupts only once, as opposed to polygenetic volcanoes, which erupt repeatedly over a period of time. The small monogenetic volcanoes of these fields are the most common subaerial volcanic landform.[1]

Many monogenetic volcanoes are cinder cones, often with lava flows. <**The West Potrillo volcanic field** is such a monogenetic volcanic field.>

Monogenetic fields occur only where the magma supply to the volcano is low or where vents are not close enough or large enough to develop plumbing systems for continuous feeding of magma. Monogenetic volcanic fields can provide snapshots of the underlying region beneath the surface, and may be useful in studying the generation of magma and the composition of the mantle since the single eruption produced would match that of the chamber from which it erupted. The magma supplying such fields is thought to have rapidly ascended from its source region, with only short resident times (decades or less) in shallow magma chambers.

https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2008RG000270

Reviews of Geophysics

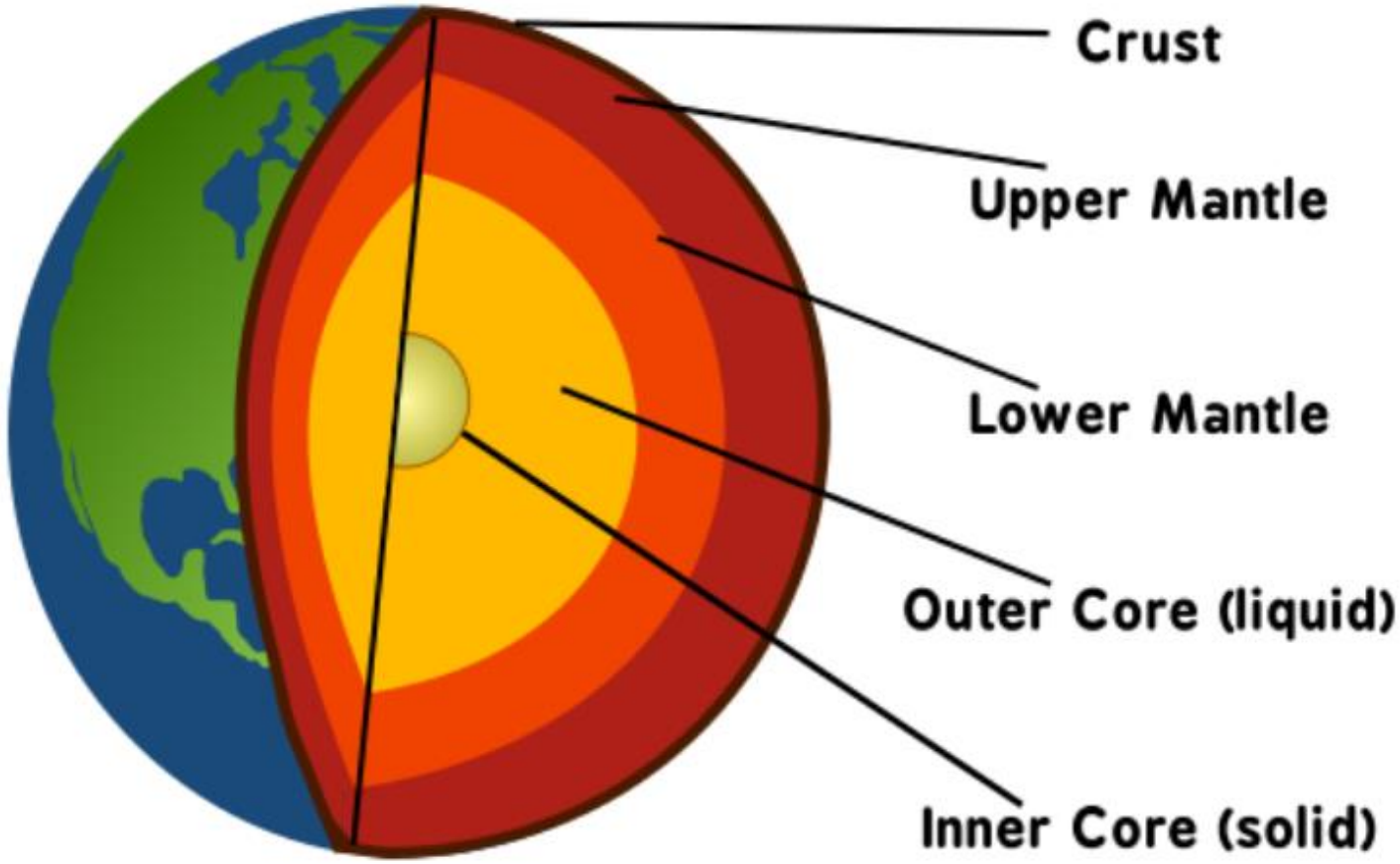
Free Access

Deep-seated abiogenic origin of petroleum: From geological assessment to physical theory

Back to the abiogenic origin of petroleum:

https://allinonehomeschool.com/layers-of-the-earth/

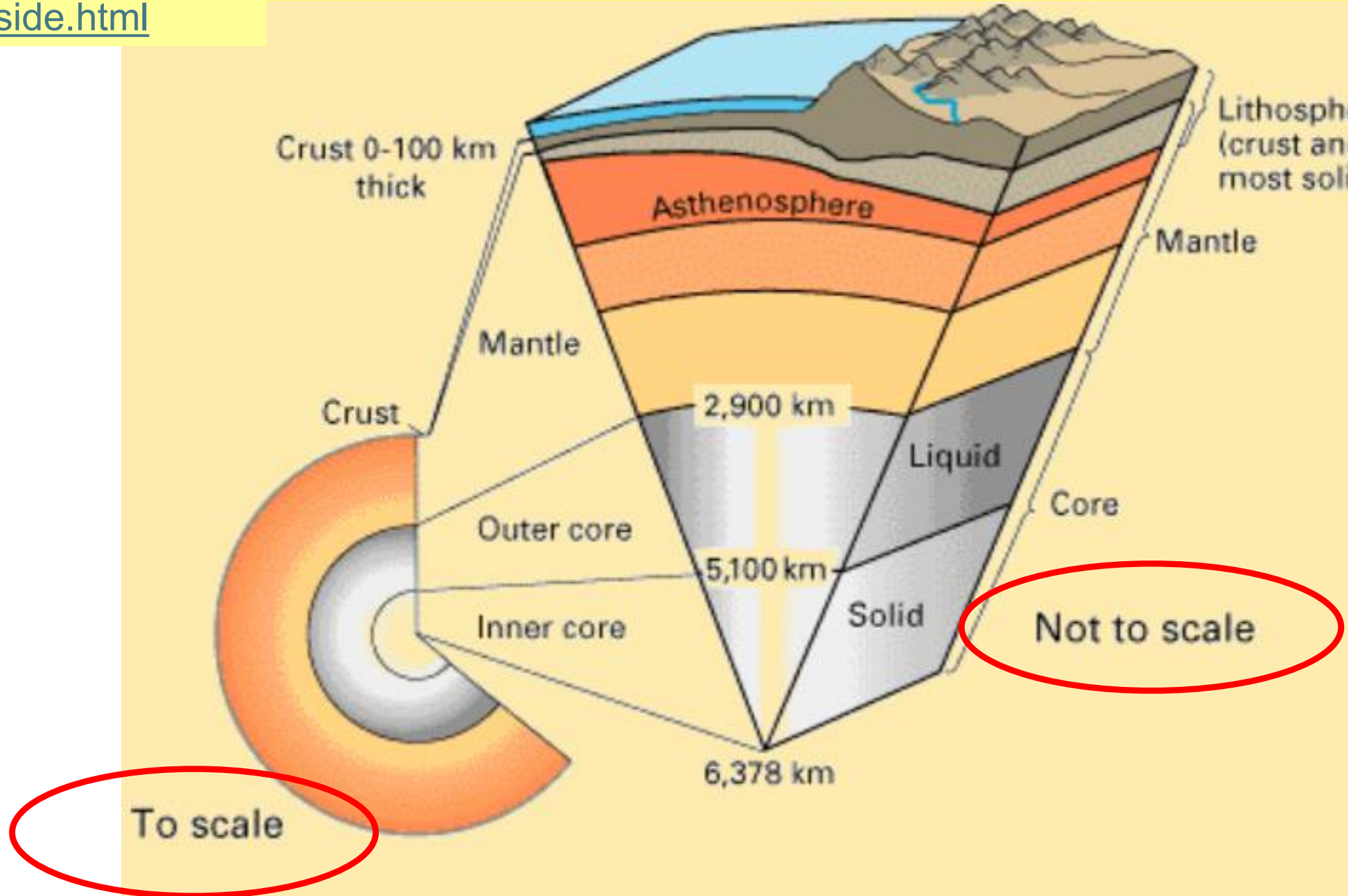
Layers of the Earth



Cutaway diagram of the earth's layers

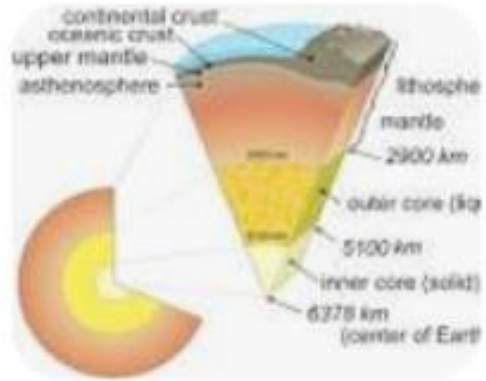
https://pubs.usgs.gov/gip/dynamic/inside.html

Oceanic Crust is thinner than Continental Crust



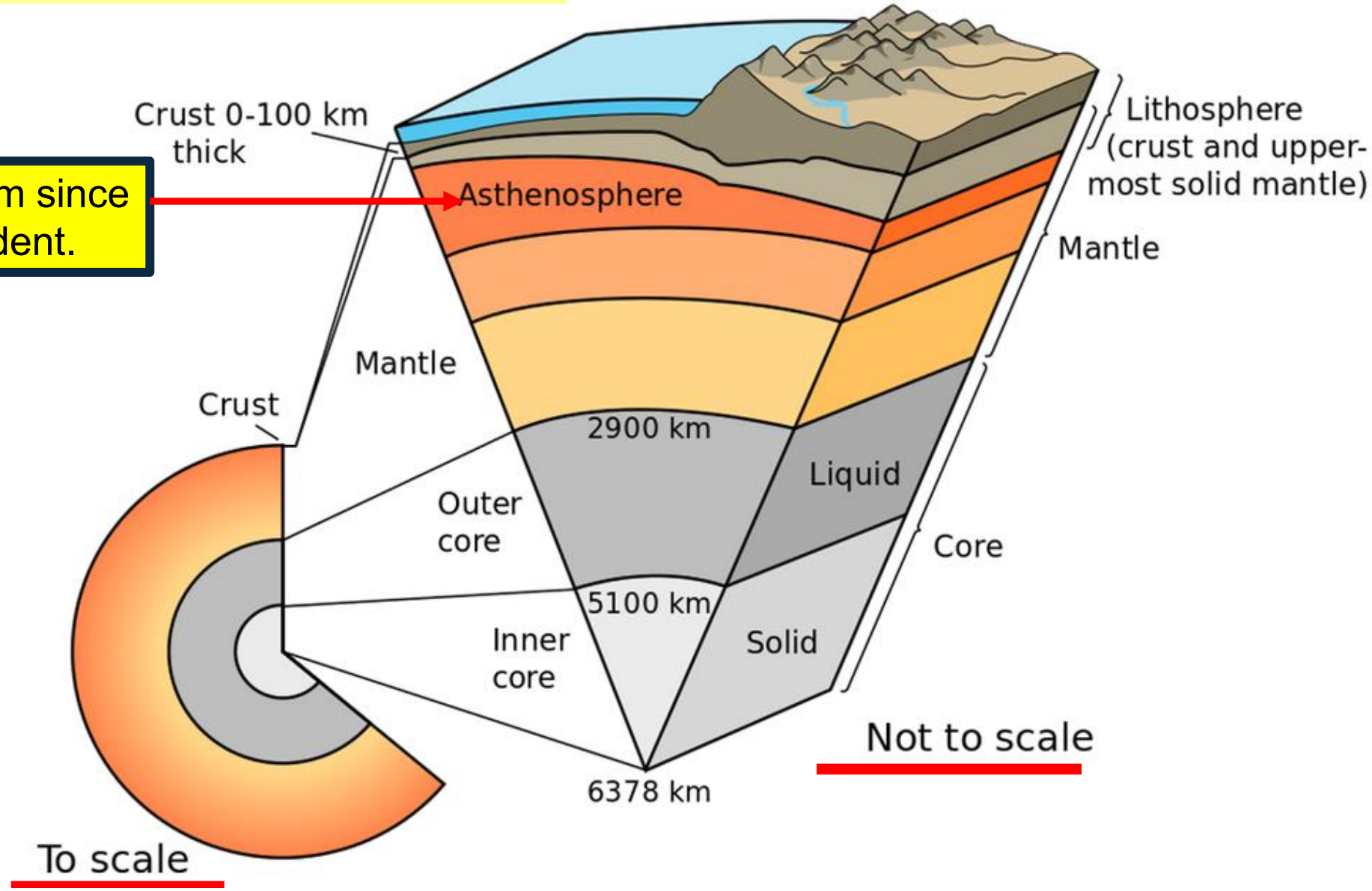
asthenosphere definition

The asthenosphere is a hot, weak, semi-fluid layer in Earth's upper mantle, located just below the rigid outer shell (lithosphere), that behaves like thick, slow-moving tar or butter, allowing tectonic plates to slide and move on top of it, driving plate tectonics and shaping the Earth's surface.



https://www.snexplores.org/article/explainer-earth-layer-layer

Asthenosphere. A new term since my time as a Geology student.



A cut-away of Earth's layers reveals how thin the crust is when compared to the lower layers.

https://issuu.com/uteplib/docs/geology-of-el-paso-complete

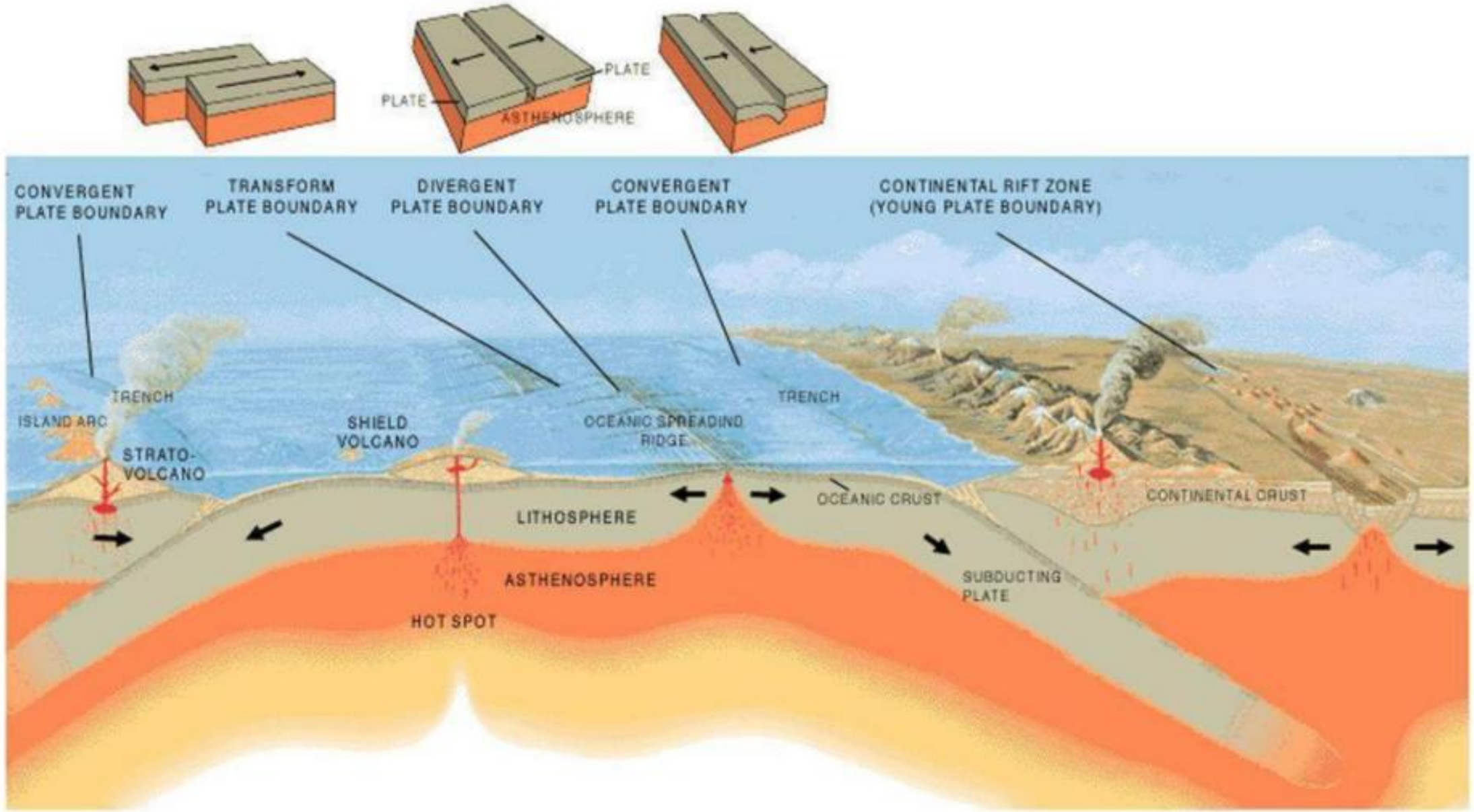


Figure 1-6. Lithosphere, asthenosphere and plate tectonics (by J. Vigil, U.S. Geological Survey).

Volcanoes

Shiprock, an example of a volcanic neck, is composed of fractured volcanic breccia and black dikes of igneous rock called minette. It is the erosional remnant of the throat of a volcano, and the volcanic breccia formed in a volcanic neck. The rock probably was originally formed 2,500–3,000 feet below the Earth's surface, but it was exposed after millions of years of erosion. Wall-like sheets of minette, known as dikes, radiate away from the central formation. Radiometric age determinations of the minette establish that these volcanic rocks solidified about 27 million years ago.

https://en.wikipedia.org/wiki/Shiprock

https://geoinfo.nmt.edu/tour/landmarks/shiprock/shiprock-lg.jpg

https://www.thelostlongboarder.com/sunset-crater-national-monument-sights/

Sunset Crater is a **cinder cone volcano**.
Last Eruption was 1085 +/- 25 years.

https://www.arise.tv/hawaii-volcano-erupts-again-with-lava-fountains-reaching-1000-feet-amid-intermittent-activity/

In the foreground is the throat of **Kilauea**, and an eruption in progress. In the background is **Manua Loa**, almost the largest volcano in the world**. Both volcanoes are silica-poor**, meaning there is little quartz (SiO2) in their magmas, and little viscosity. Their summits are rounded (almost like a loaf of bread) because the lava has so little viscosity and flows freely. Kilauea erupts frequently, but never explosively.

Mauna Loa volcano eruption

https://en.meteorologiaenred.com/eruption-of-the-volcano-mauna-loa.html

Hot Lava from Kilauea and other low-silica lavas is not viscous at all and runs freely across the surface of Kilauea.

https://www.king5.com/article/news/local/kilauea-volcano-eruption-may-turn-explosive/281-550957271

Handout photo provided by the U.S. Geological Survey: lava from a fissure slowly advances to the northeast on Hookapu Street after the eruption of Hawaii's Kilauea volcano on May 5, 2018, in the Leilani Estates subdivision near Pahoa, Hawaii. Here the lava has cooled; you can see the crust on it. Even when you can walk on the crust, sometimes a tree or bush will burn spontaneously, as seen in the left of this image.

<Silica> makes the difference:

The concentration of silica <SiO2> in the underlying magma determines the shape of the volcano and the type eruption which results. Mauna Loa (L), is a huge volcano; eruptions send runny lava to the surface. A loaf-shaped volcano forms.

When the magma contains abundant silica, the melt is viscous, magma sticks in the volcano's throat, & explosive eruptions occur. Such volcanoes, e.g., Krakatoa, (R) are steep-sided.

May of 1883, people began reporting ash clouds and tremors coming from the uninhabited island of Krakatoa. Over the next months, people could hear explosions from nearly 100 miles away.

https://www.discovermagazine.com/5-of-the-most-explosive-volcanic-eruptions-44345

How Loud Was Krakatoa?

On August 26, 1883, the first of several eruptions began around 1 p.m. By 2 p.m., an ash cloud rose about 17 miles over Krakatoa. At 10 a.m. the following day — August 27 — the volcano gave way and exploded so forcefully that the sound carried nearly 2,200 miles away in Australia.

Mount Vesuvius Eruption, Italy

On August 24, A.D. 79, the people of the bustling cities of Pompeii and Herculaneum in Italy went about their day as usual. By noon, however, everything changed. Mount Vesuvius erupted with such force it propelled ash and pumice 10 miles into the sky in a mushroom cloud shape. However, a cloud of hot ash, toxic gas and volcanic mud eventually engulfed the city and those who remained.

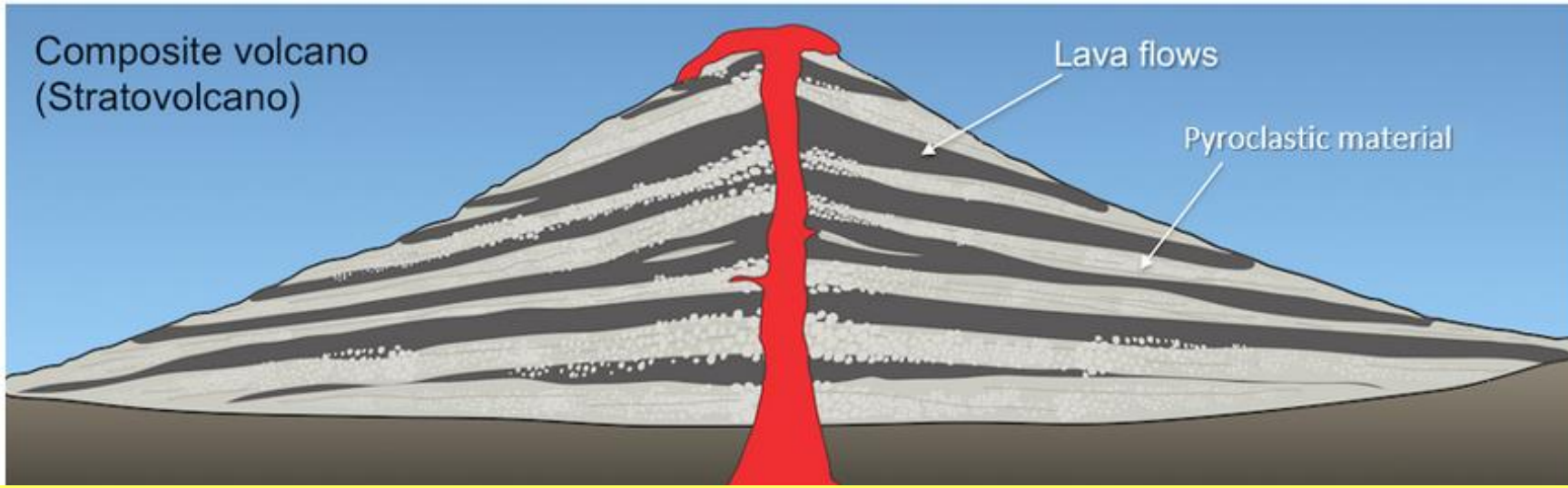
Mt Vesuvius: Steep-sided shape and explosive eruption history.

https://www.discovermagazine.com/5-of-the-most-explosive-volcanic-eruptions-44345

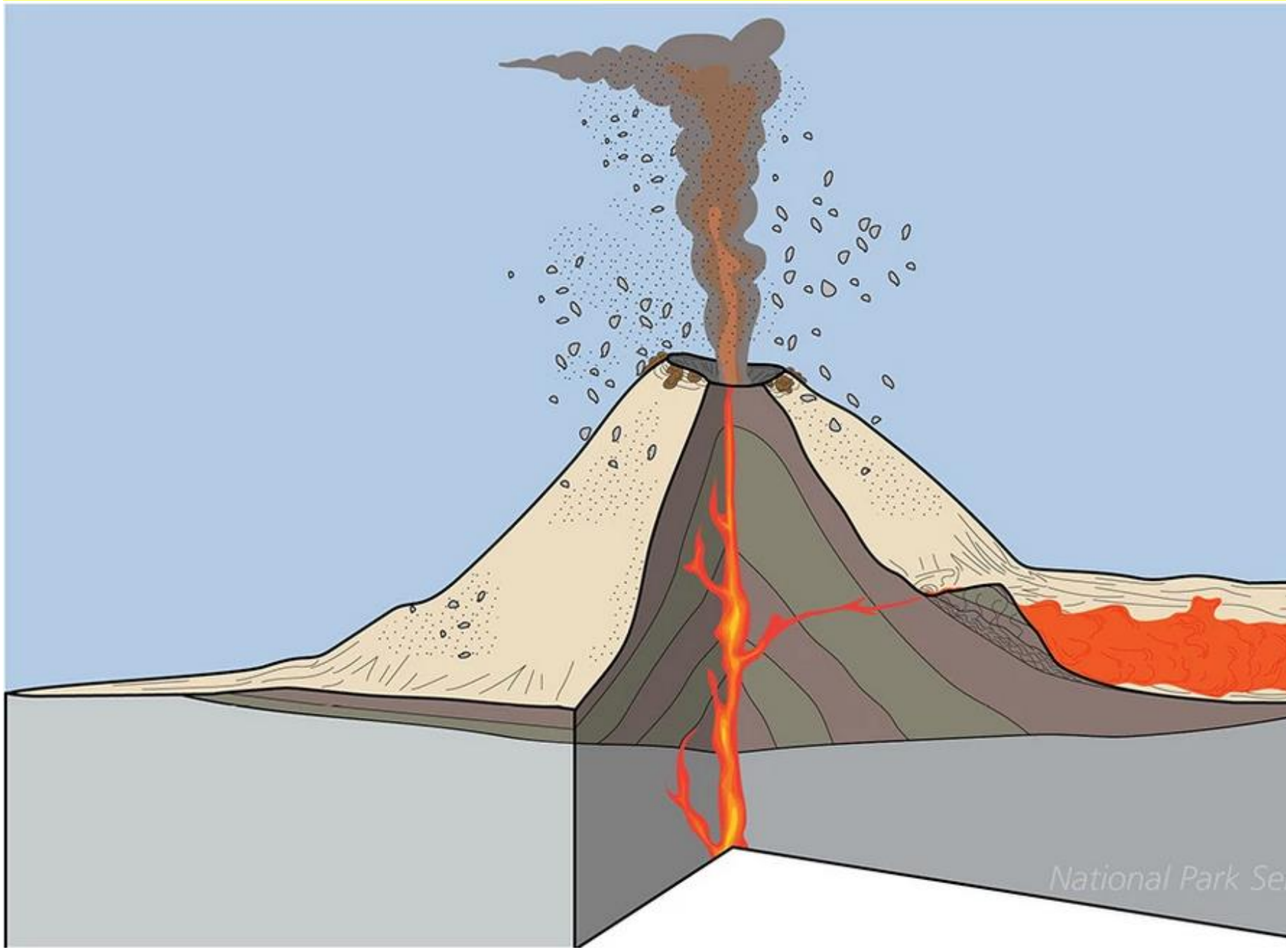
https://minnstate.pressbooks.pub/environmentalgeology/chapter/volcano-types

Stratovolcano. Top: Mt. Rainier, Washington shows the steep-sided cone shape characteristic of stratovolcanoes.

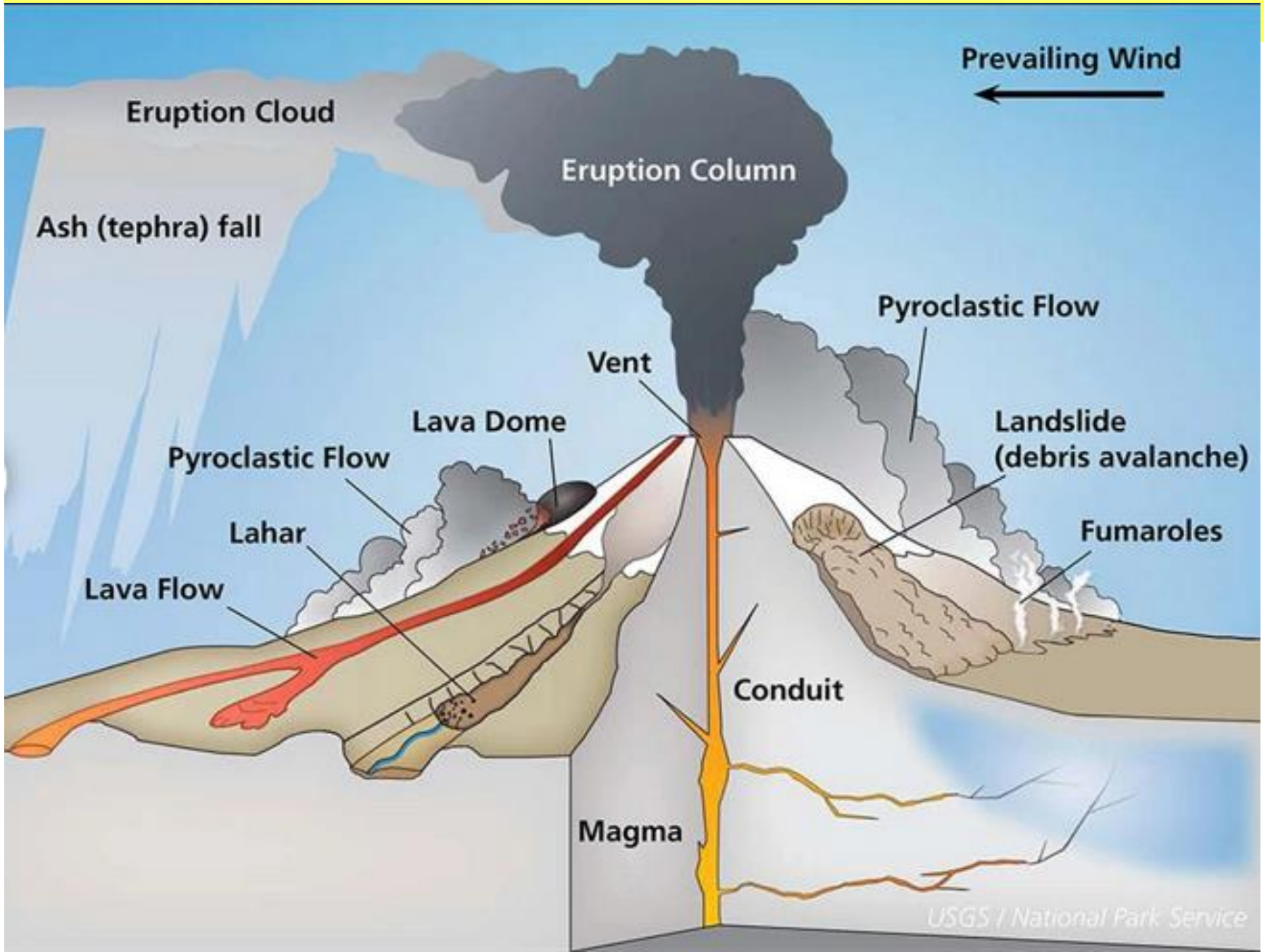
Bottom: Diagram of a stratovolcano showing alternating layers of lava (black layers) and pyroclastic material (light layers). Layers are not to scale



https://www.nps.gov/subjects/volcanoes/anatomy-of-a-volcano.htm



https://www.nps.gov/subjects/volcanoes/anatomy-of-a-volcano.htm



https://www.youtube.com/watch?v=XYK0IJ16_iI

The eruption of Mt. St. Helens in Washington State 18 May 1980

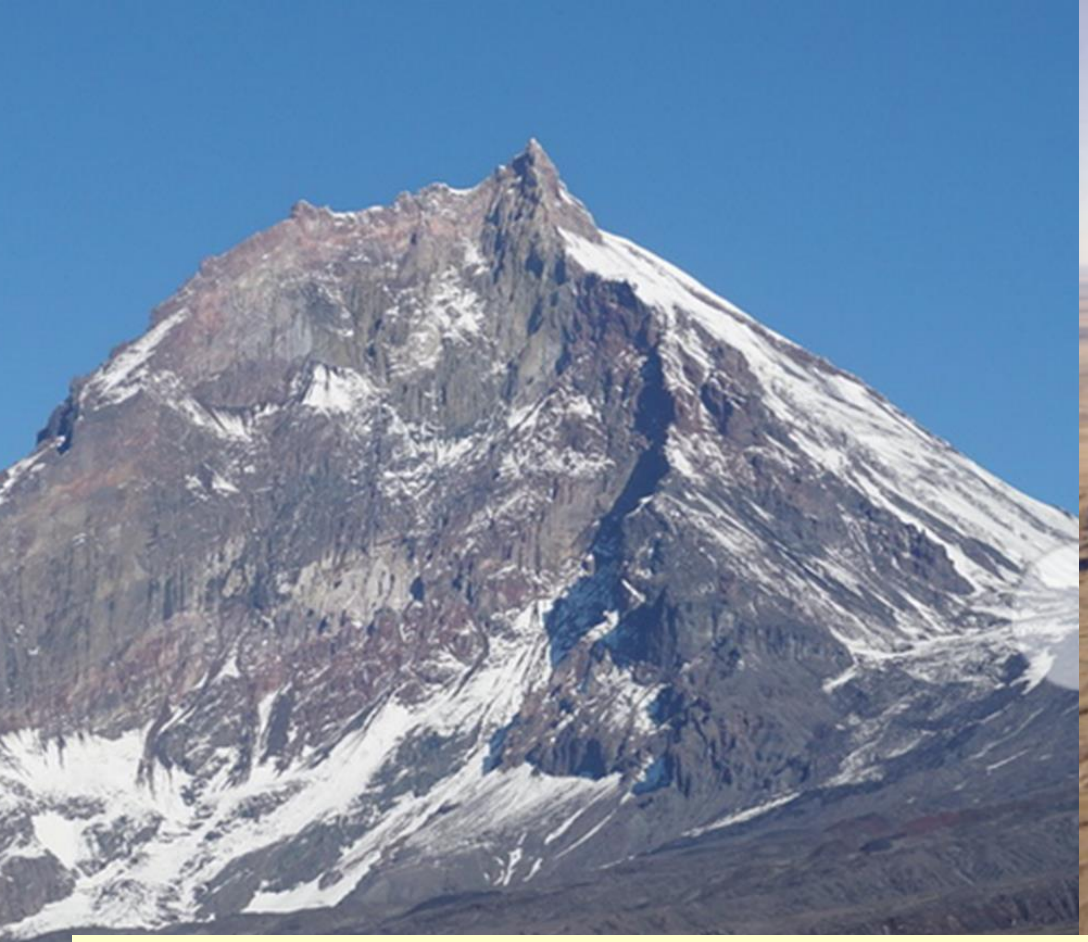
https://www.youtube.com/watch?v=XYK0IJ16_iI

The eruption of Mt. St. Helens in Washington State 18 May 1980

https://www.naturalworldheritagesites.org/sites/volcanoes-of-kamchatka

https://www.themoscowtimes.com/2023/10/31/in-photos-russias-largest-volcano-erupts-on-kamchatka-a82947

The Bezymianny, Kamen and Klyuchevskoi volcanoes are all part of the Volcanoes of Kamchatka UNESCO World Heritage Site. ***Notice wind shear based on the smokes' directions***



https://volcanoesland.com/attractions/kamen/

https://en.wikipedia.org/wiki/Shiprock

Dikes with volcanoes:

Left: Prominent Dike facing the camera on Kamen Volcano, Kamchatka Peninsula, Russia. Right: Dike leading to Shiprock, the volcanic plug in Northwest New Mexico.

https://volcanoesland.com/attractions/kamen/

“**Kamen Volcano** in Kamchatka features prominent volcanic dikes, which are vertical or near-vertical fissures filled with magma that act as pathways for lava to reach the surface, building up the stratovolcano over time. These dikes, sometimes massive (up to 2km long, 5m thick), show a genetic link to the volcano's lavas, indicating they're part of its plumbing system, feeding eruptions, and revealing similar geochemistry, helping scientists understand the evolution of Kamen and neighboring volcanoes such as Bezymianny.”

https://www.themoscowtimes.com/2023/10/31/in-photos-russias-largest-volcano-erupts-on-kamchatka-a82947

Klyuchevskaya Sopka is a stratovolcano, a conical volcano with steep sides made up of layers of lava, rock, and ash from previous eruptions.

https://www.themoscowtimes.com/2023/10/31/in-photos-russias-largest-volcano-erupts-on-kamchatka-a82947

https://www.naturalworldheritagesites.org/sites/volcanoes-of-kamchatka/

Are mantle rocks exposed at the surface?

From 30 miles deep, under the continental crust?

They are rare, but some do exist…in New Mexico

1) Near Cimmaron, east of Eagle Rock

2) At Kilbourne Hole, west of La Union

From pg. 121 of Roadside Geology of New Mexico, describing US 64 from Raton to Taos, this,

“the Cimmaron Palisades, west of Milepost 243:

‘dark glittery coarsely crystalline gabbro, the intrusive equivalent of lava, of Pre-Cambrian Age, derived directly from the Earth’s Mantle.’”

Left:

Image of gabbro sample for sale at a rock shop…

…probably not from the Cimmaron Palisades

https://gotbooks.miracosta.edu/fieldtrips/volcanoes/images/Fig18.png

Mafic Rocks

Intrusive
Gabbro

Black Canyon of the Gunnison National Monument, Colorado

Extrusive
Basalt

Amboy Crater National Natural Landmark, California

https://nmgs.nmt.edu/publications/guidebooks/downloads/64/64_p0143_p0151.pdf

Yellow arrow points to possible location of Gabbro near Cimmaron Palisaides

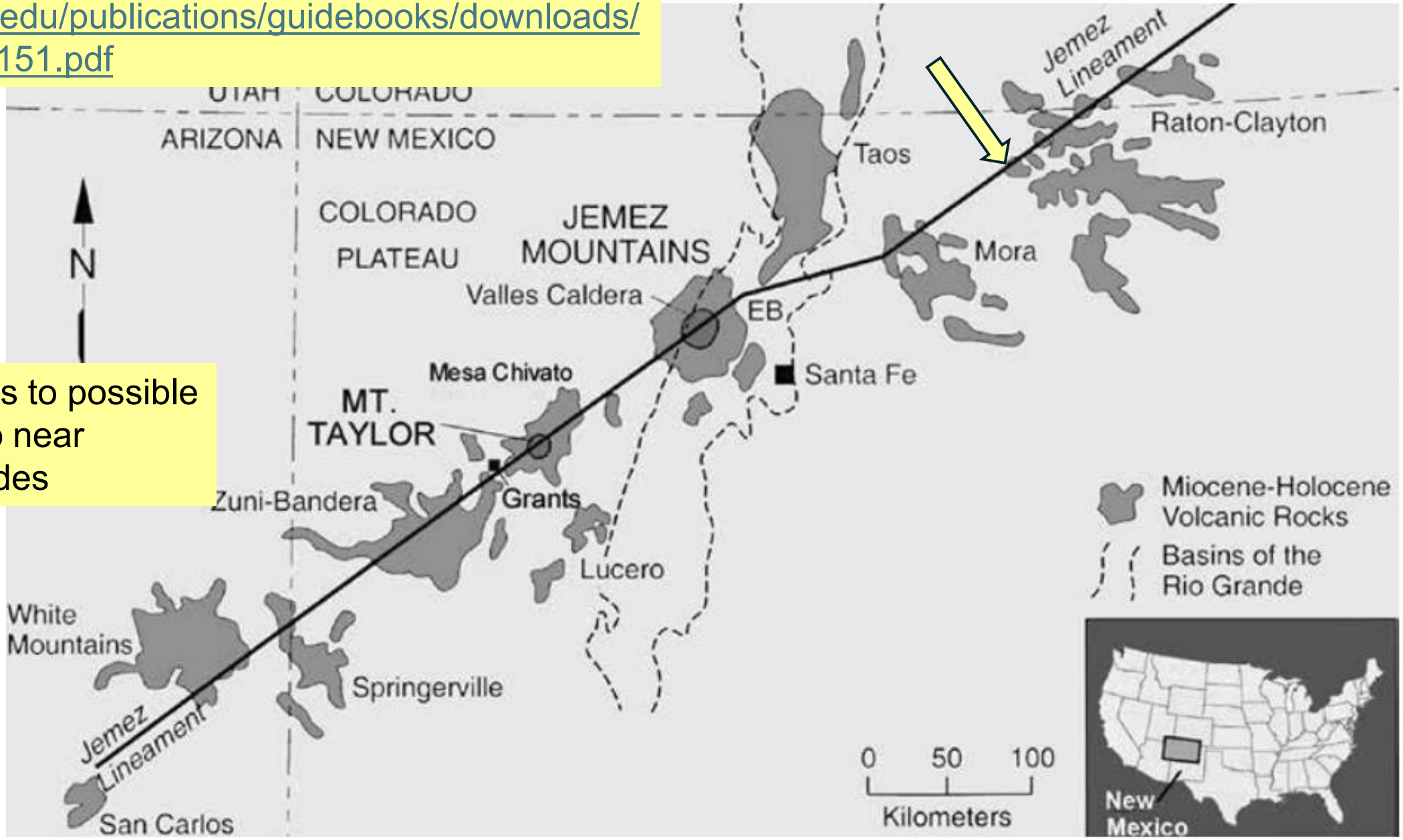


FIGURE 1. Map showing location of Mount Taylor with respect to other volcanic features of the Jemez Lineament and to basins of the Rio Grande rift (EB = Espanola Basin).

KILBOURNE HOLE

Exposures of mantle rock are rare, since usually the mantle is 30 miles in depth below the surface, under continental crust.

We have here in Dona Ana County a good example where mantle rocks have been brought to the surface, in Kilbourne Hole.

https://en.wikipedia.org/wiki/Kilbourne_Hole

Kilbourne Hole is a **maar volcanic crater**, located 30 miles west of the Franklin Mountains of El Paso, Texas, in the Potrillo volcanic field of Doña Ana County, New Mexico. Another maar, Hunt's Hole, lies just two miles south. Kilbourne Hole is notable for the large number of mantle xenoliths (solid fragments of mantle rock) that were carried to the surface by the eruption.

Estimates of the age of the crater vary from about 24,000 to about 80,000 years.

In 1975, Kilbourne Hole was designated as a National Natural Landmark by the National Park Service. It is now part of Organ Mountains–Desert Peaks National Monument.

<Edited for emphasis and clarity>

Kilbourne Hole (center) and Hunt's Hole (lower right), with White Sands National Park lit by the sun in the distance beyond the Organ Mountains

https://www.nps.gov/articles/000/maars-and-tuff-rings.htm

MAAR VOLCANOES

"Maar volcanoes are wide, low-rimmed volcanic craters formed by extremely explosive phreatomagmatic eruptions **(steam-driven explosions)** that happen when rising magma violently interacts with groundwater, often creating a bowl-shaped depression…"

Maars and tuff rings are low-standing volcanoes with wide, bowl-shaped craters. They commonly have a donut-like profile, and may be breached. Their low edifices consist of shallowly-dipping deposits of tuff made mostly of ash and angular, nonvesicular pebble-sized pyroclasts (lapilli).

A maar is a volcanic crater in which the crater lies below the surrounding ground level and is surrounded by a low pyroclastic cone. Because they are topographic lows, maars frequently contain lakes in their craters.

A tuff ring is a pyroclastic cone with a crater above the surrounding ground surface. Tuff ring craters are usually dry.

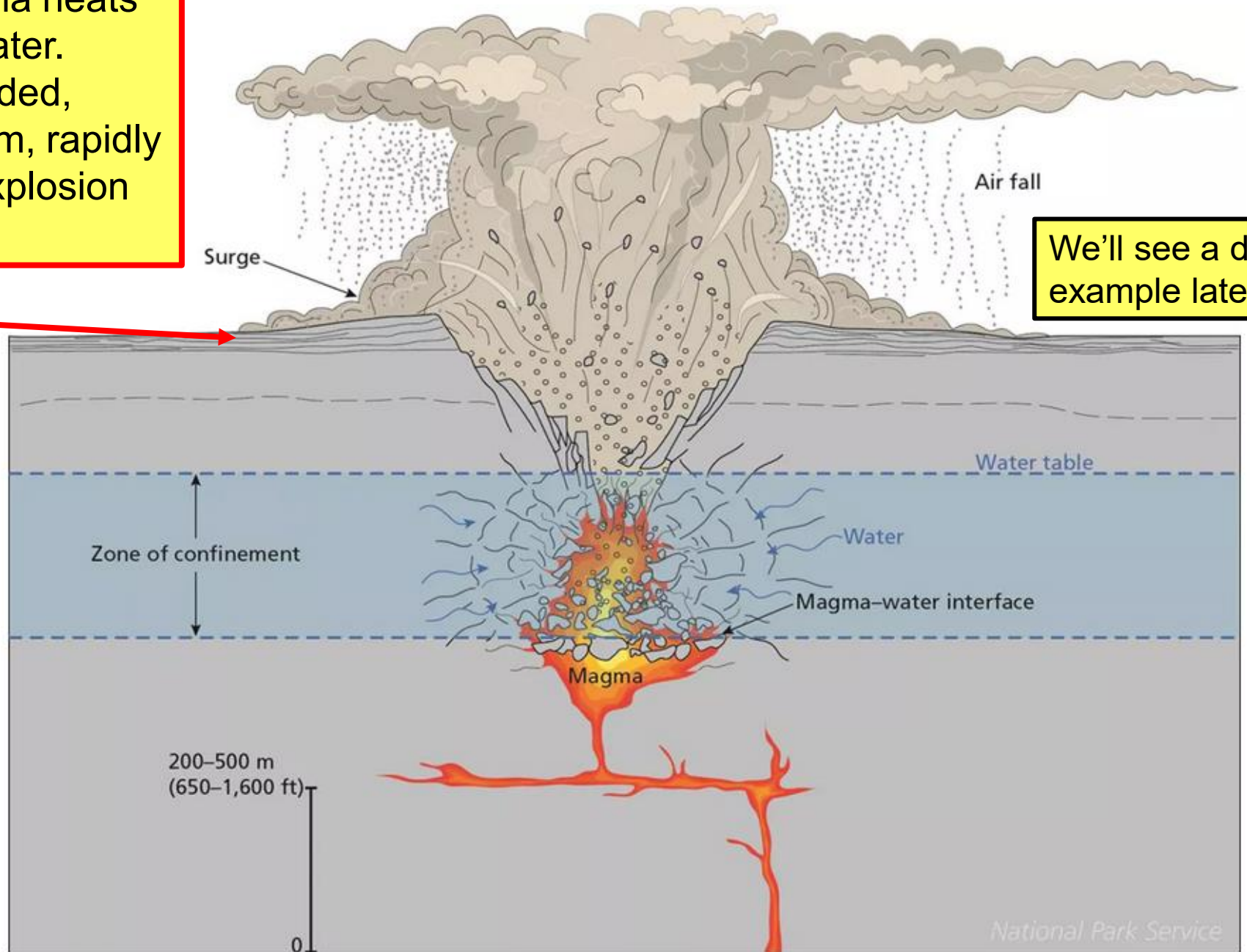
https://www.nps.gov/articles/000/maars-and-tuff-rings.htm

MAAR VOLCANO

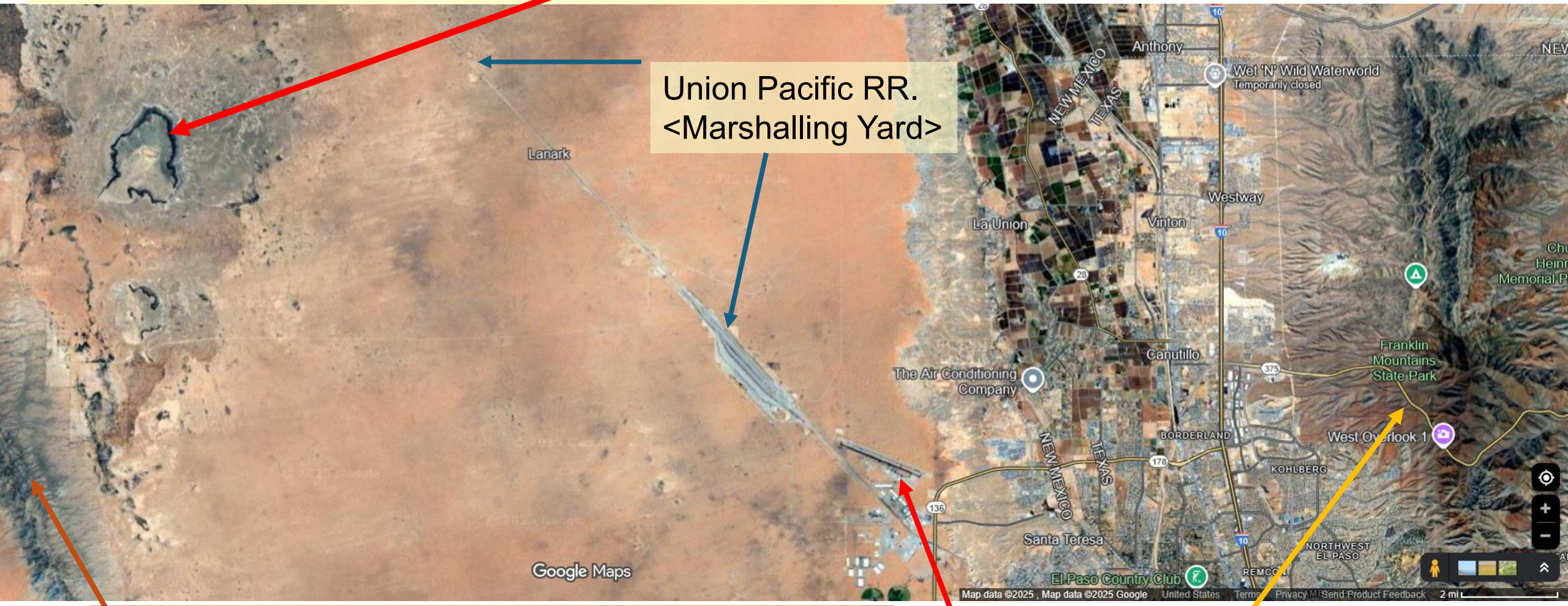
In a maar volcano, magma heats confined underground water. After sufficient heat is added, the water flashes to steam, rapidly expands, and a steam explosion occurs.

Tuff, not lava

We'll see a dropstone example later



Google Map of Kilbourne Hole



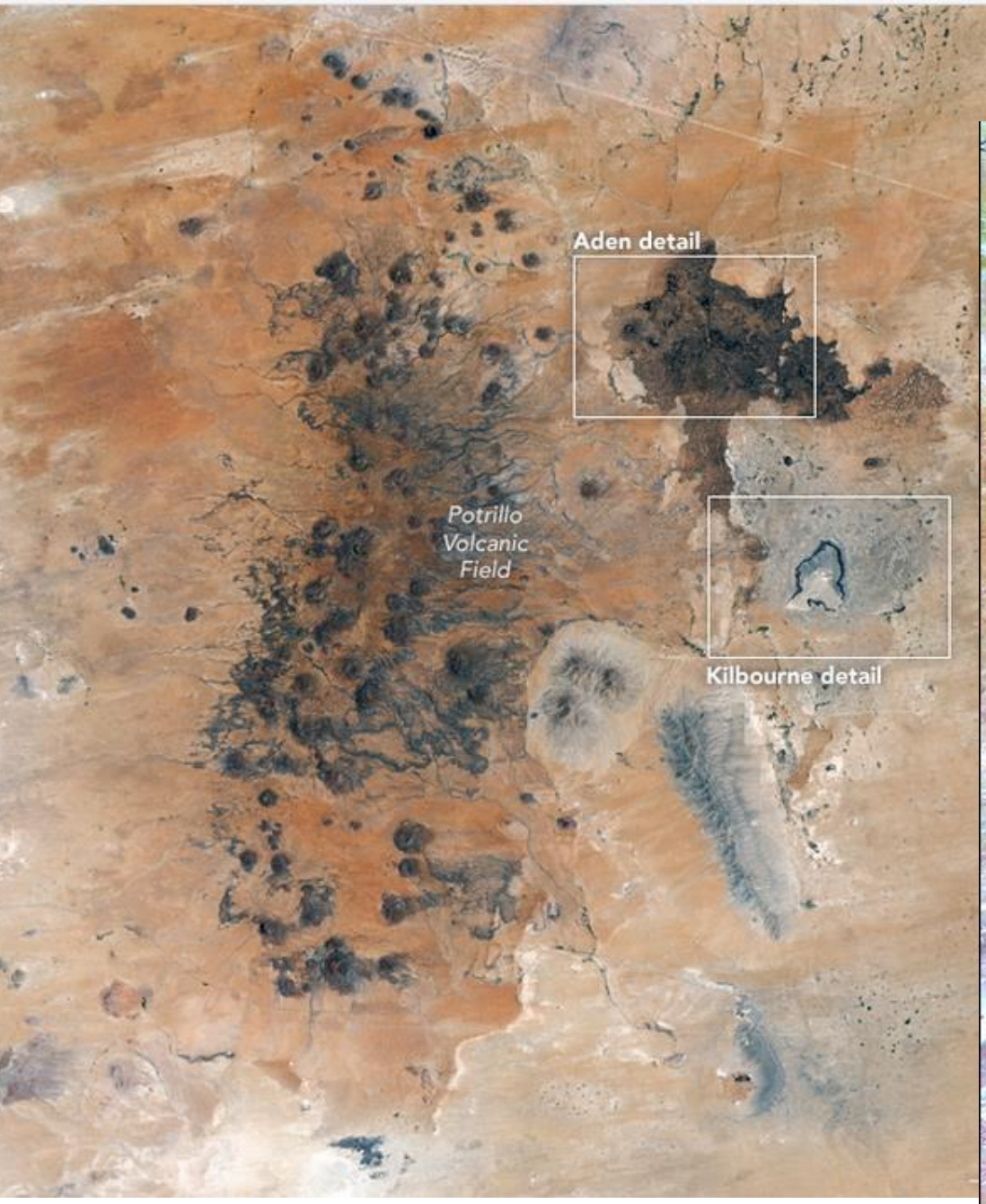
East Potrillo Mountains, this ridge line.

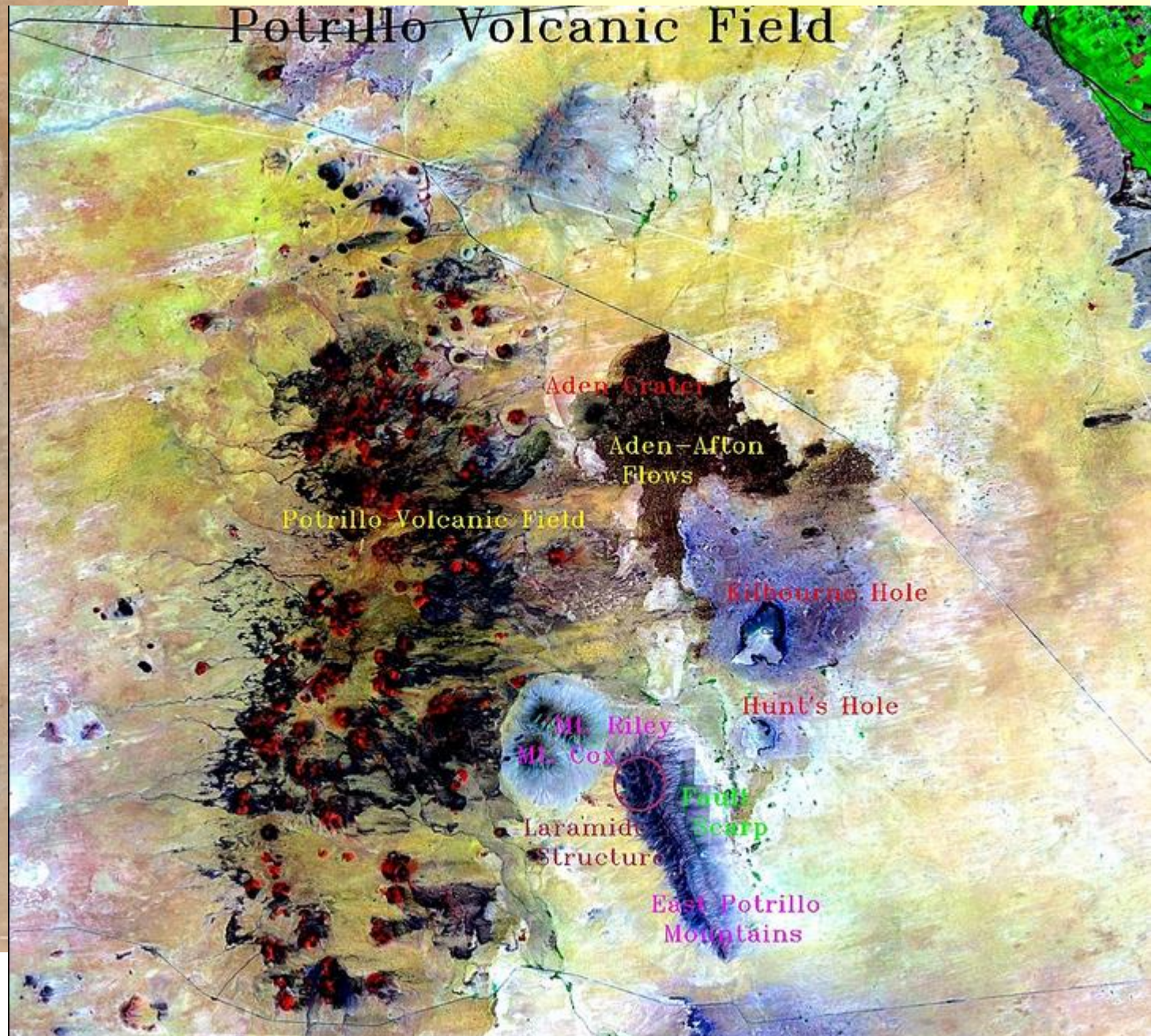
War Eagles Airport, runway, and NOAA Forecast Office, KEPZ

Trans–Mountain Highway

Kilbourne Hole lies about 16 miles west from La Union, NM.

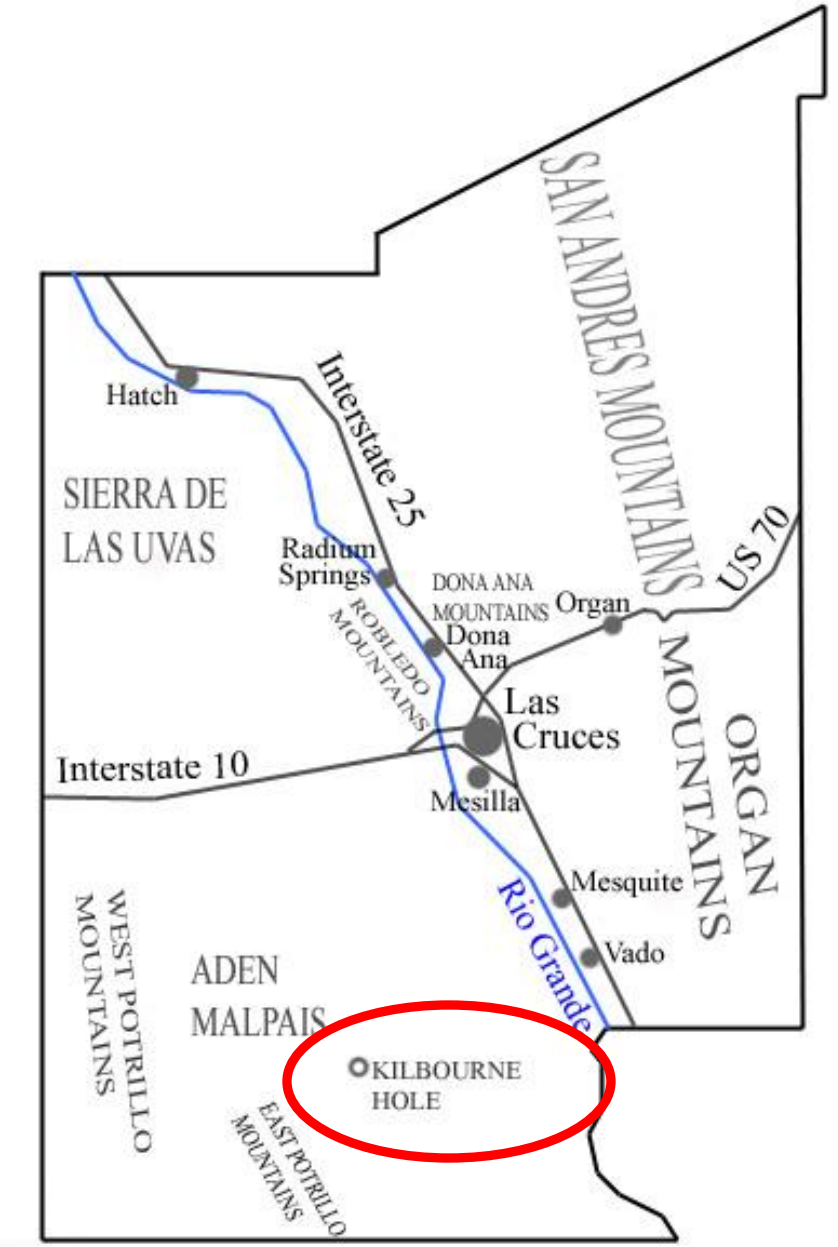
https://en.wikipedia.org/wiki/Potrillo_volcanic_field#/media/File:Potrillo_volcanics_from_space_2017.jpg





https://en.wikipedia.org/wiki/Kilbourne_Hole

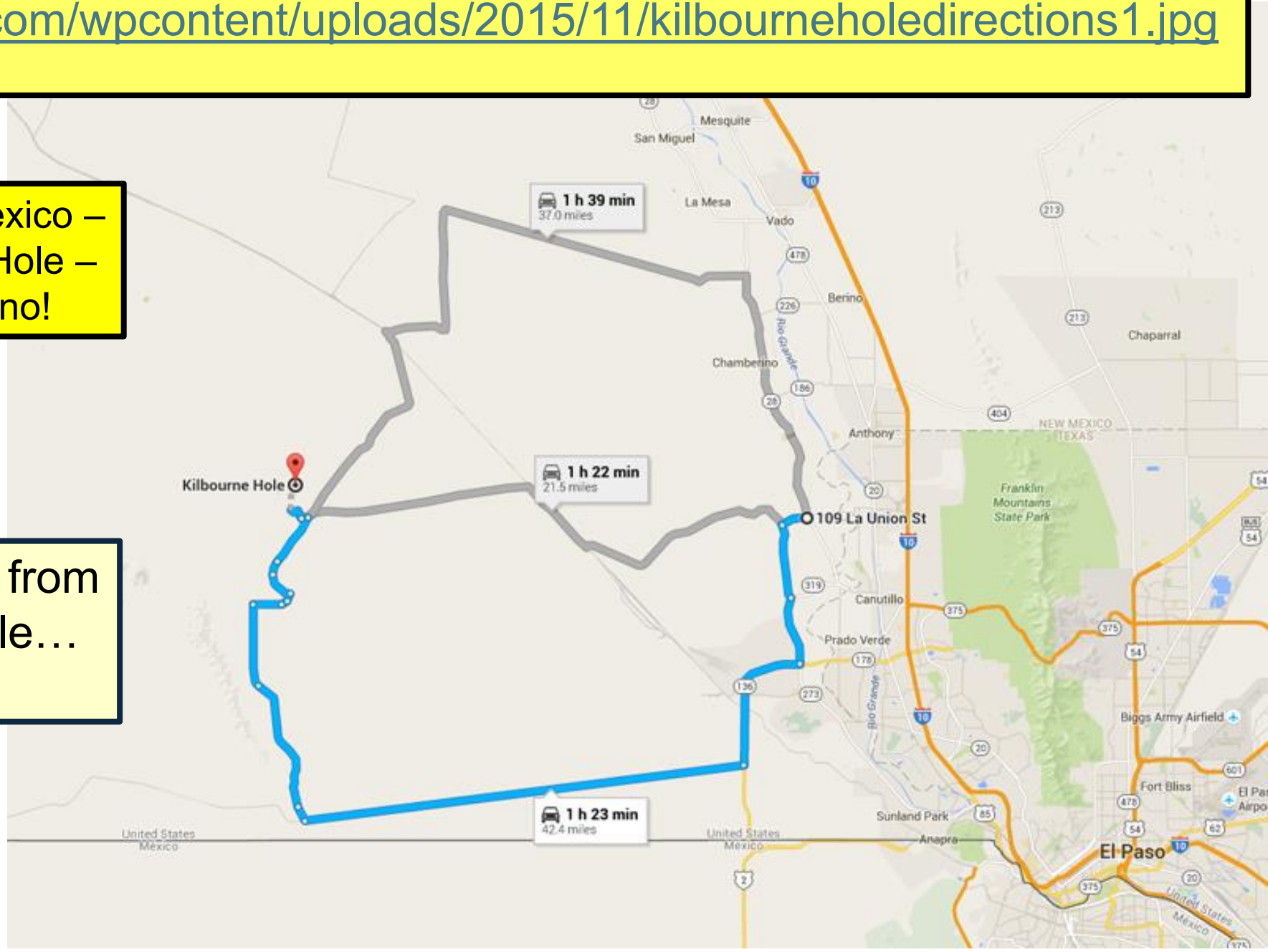
The eastern and northern rim of the hole have low rim deposits of ejecta from the maar eruptions. These rest on the basalt flow where it is present or on older sediments. The ejecta at Kilbourne Hole contains dropstones launched as bombs, usually greater than 2.5 inches across and a large number of xenoliths derived from the lower crust and mantle. These have been closely studied by geologists to learn more about geologic processes deep underground.



https://wheretofindrocks.com/wpcontent/uploads/2015/11/kilbourneholedirections1.jpg

Collecting Peridot in New Mexico – Olivine Bombs at Kilbourne Hole – Find Green Rocks in a Volcano!

Google Map of directions from La Union to Kilbourne Hole… three different routes!



https://en.wikipedia.org/wiki/Kilbourne_Hole

A maar forms when rising magma encounters sediment beds saturated with groundwater. The magma heats the groundwater to the point where the vapor pressure overcomes the weight of the overlying beds (the overburden pressure) and the beds are catastrophically blown out. Country rock is fragmented and expelled into the atmosphere together with fragments of the magma, creating a deep crater, the bottom of which sits below the pre-eruptive ground surface. This eruption was dated to around 20,000 years. As a result of the eruption, the maar also experienced a collapse similar to that of a caldera.

A view of the Kilbourne Hole from the trail at the southwest corner. Everything visible in this photo is the maar, bottom lands and rim with basalt cliffs.

https://en.wikipedia.org/wiki/Dropstone#Volcanoes

Dropstones are isolated fragments of rock found within finer-grained water-deposited sedimentary rocks or pyroclastic beds. They range in size from small pebbles to boulders. The critical distinguishing feature is that there is evidence that they were not transported by normal water currents, but rather dropped in vertically through the air or water column, such as during a volcanic eruption.

Dropstone in pyroclastic surge beds at Kilbourne Hole

https://en.wikipedia.org/wiki/Kilbourne_Hole#/media/File:Kilbourne_Hole_embedded_xenolith.jpg

Mantle xenolith embedded in basalt

Probably olivine gabbro.

https://en.wikipedia.org/wiki/Kilbourne_Hole

Most of the mantle xenoliths at Kilbourne Hole are composed of lherzolite, a rock composed mostly of **olivine** and pyroxene. The **olivine** has a distinctive pale green color in which the pyroxene forms black flecks

Deep crustal rocks include a variety of granulites of both high-silica (felsic) and low-silica (mafic) compositions, mostly charnockite and anorthosite. **These likely took fewer than three days to reach the surface from their place of origin and show pristine composition and texture. Their characteristics show that they were little altered from their formation 1.6 to 1.8 billion years ago, other than some reheating during the opening of the Rio Grande rift.**

End Section on Kilbourne Hole

Back to abiogenic sources of petroleum

https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2008RG000270

“Deep-seated abiogenic origin of petroleum: From geological assessment to physical theory”

Editorial Comments.

When I was on active duty in the Air Force, Officers frequently took seminar coursework in Air Command and Staff College and Air War College.
Readings were in booklet form, published by the Air University and distributed to we students.

Some of the material we read was translated from the Russian into English by Air University or by others. This was my introduction.

Russian literature is formal, heavy, interwoven, and written in a cumbersome, overbearing style..

Reading the English language translation in AGU's **Review of Geophysics' "Deep-seated abiogenic origin of petroleum: From geological assessment to physical theory"** by Kutcherov and Krayushkin was for me, similar: cumbersome and laborious.

I've tried to edit this material from AGU for clarity, but even the translation is as thick as the mud around Ft Hood after rain…we called it "Texas Gumbo."

https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2008RG000270

FORMATION OF OIL AND GAS FIELDS IN LIGHT OF ABIOGENIC ORIGIN OF PETROLEUM

The theory of abyssal abiogenic origin of petroleum rejects the lateral migration of oil and gas in their reservoirs unless a hydrodynamic (hydraulic) fluid movement exists.

Capillary forces which are related to the pore radius and to the surface tension across the oil-water (or gas-water) interface (the process is described by Laplace's equation) are, generally, 12–16 thousand times stronger than the buoyancy forces of oil and gas (according to the Navier-Stokes equation) in the natural porous, permeable media of the subsurface.

In experiments, natural gas was injected in the bottom part of water-saturated sands placed in a transparent tank, a model of a gas bed. In all experiments, injected gas remained in the bottom part of the tank.

Updip gas migration was never observed.

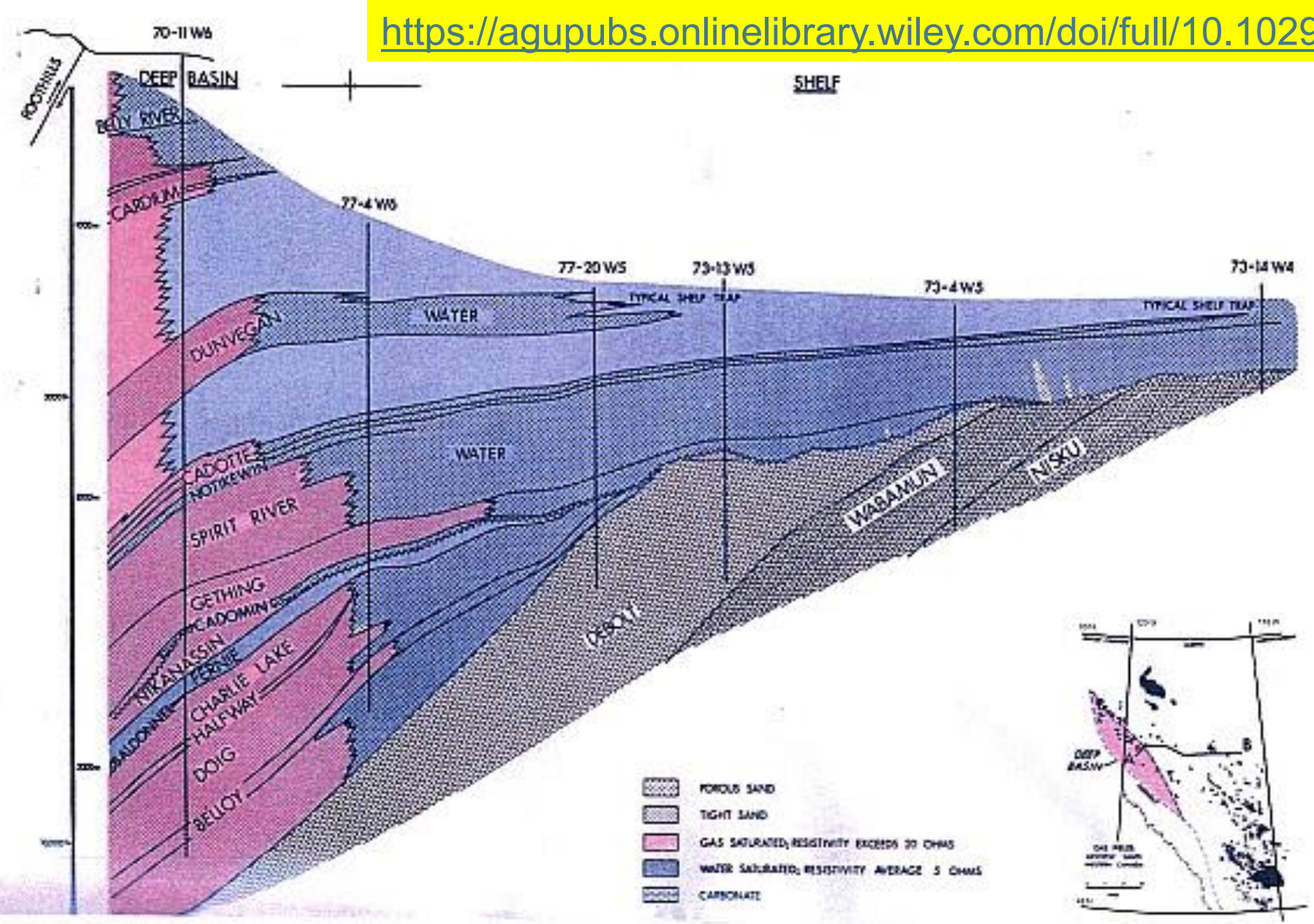
https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2008RG000270

FORMATION OF OIL AND GAS FIELDS IN LIGHT OF ABIOGENIC ORIGIN OF PETROLEUM

Rising from subcrust zones through the deep faults and their feather joints or fissures, the **petroliferous fluid of the mantle is injected under high pressure into any rock and distributed there**. The hydrocarbon composition of oil and gas accumulations formed this way depends on the cooling rate of the fluids during their injection into the rocks of the Earth's crust.

‘When and where the further supply of injected hydrocarbons from the mantle stops, the fluids do not move further into any forms of the Earth's crust (anticline, syncline, and horizontal and tilted beds) without the restarting the injection of the abyssal petroliferous fluids.’

https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2008RG000270. Figure 4



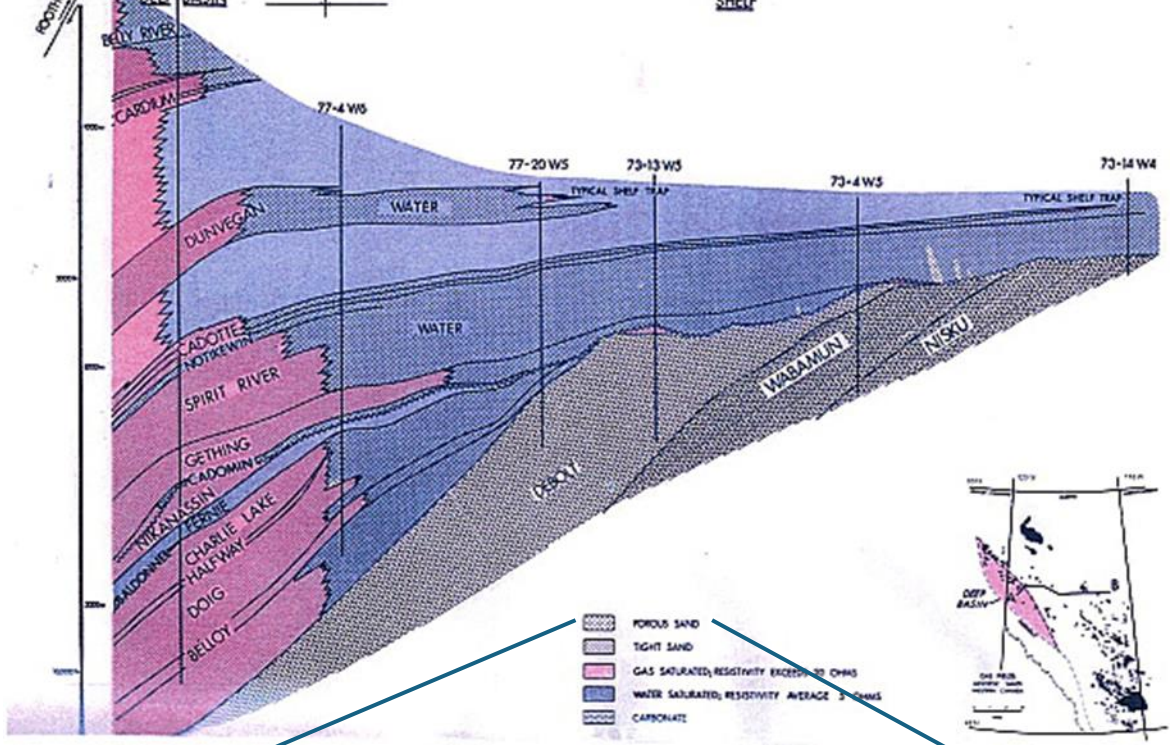
Cross section of Alberta showing gas-saturated sands of Deep Basin.

Gas is concentrated in the tight impermeable sand, which is transformed progressively and continuously updip into the coarse-grained, highly porous, and highly permeable sand saturated by water.

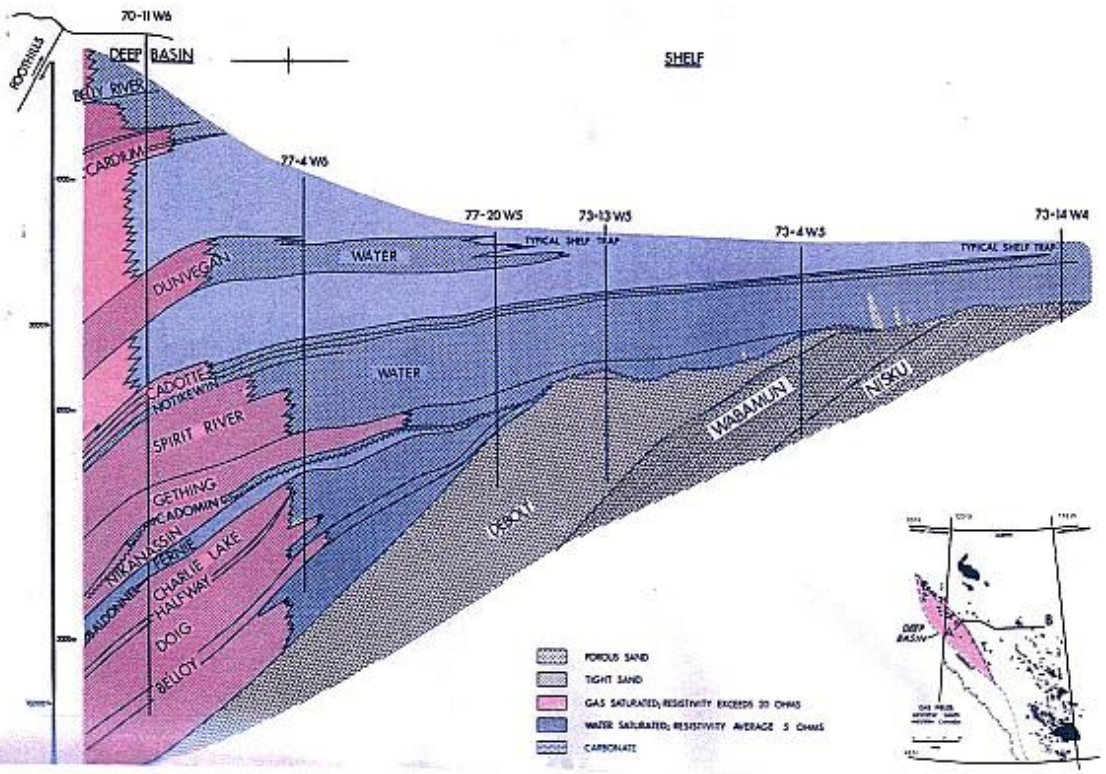
I tried downloading Figure 4 with PowerPoint download, and PowerPoint's internal copy>paste function.

The Legend does not copy in a legible manner in either method.

Right, below, and next, my efforts to make the Legend more legible.



Porus Sand
Tight Sand
Gas Saturated, Resistivity Exceeds 32 Ohms
Water Saturated, Resistivity Average 5 ohms
Carbonate



EDITED The theory of the abyssal abiogenic origin of petroleum requires the lateral migration of oil and gas in their reservoirs when a hydrodynamic (hydraulic) fluid movement exists. Capillary forces, related to the pore radius and to the surface tension across the oil-water (or gas-water) interface (the process is described by Laplace's equation) are, generally, 12–16 thousand times stronger than the buoyancy forces of oil and gas (according to the Navier-Stokes equation) in the natural porous, permeable media of the subsurface.

Rising from subcrust zones through the deep faults and their feather joints or fissures, the petroliferous fluid of the mantle is injected under high pressure into any rock and distributed there.

Therefore, the tremendous gas volumes of the above-mentioned gas fields have tremendous buoyancy but never overcome capillary resistance in pores of the water-saturated reservoir rocks.

These fields were formed from migration of the mantle's petroliferous fluid from the mantle's depths to the Earth's Crust.

NATURAL GAS AND OIL IN THE RECENT SEAFLOOR SPREADING CENTERS

EDITED: Subbottom convectional hydrothermal systems discharge hot (170°C–430°C) water through the sea bottom's black and white “smokers.” Up to now, more than 100 hydrothermal systems of this kind have been identified and studied in scientific expeditions using submarines in the Atlantic, Pacific, and Indian oceans. Their observations pertaining to the deep abiogenic origin of petroleum are as follows:

The bottom smokers of deepwater rift valleys vent hot water, methane, some other gases, and petroleum fluids. Active “plumes” with heights of 800–1000 m venting methane have been discovered along the Mid-Atlantic Ridge (MAR) over a distance of 1200 km.

At one site, there were no bottom sediments, sedimentary rocks, buried organic matter, or any <petroleum> source rocks. **The hydrothermal fluid is too hot (290°C–321°C) for any microbes**.

At 13°N the axis of East Pacific Rise is free of any sediment, but here aliphatic hydrocarbons are present in hot hydrothermal fluids of black smokers.

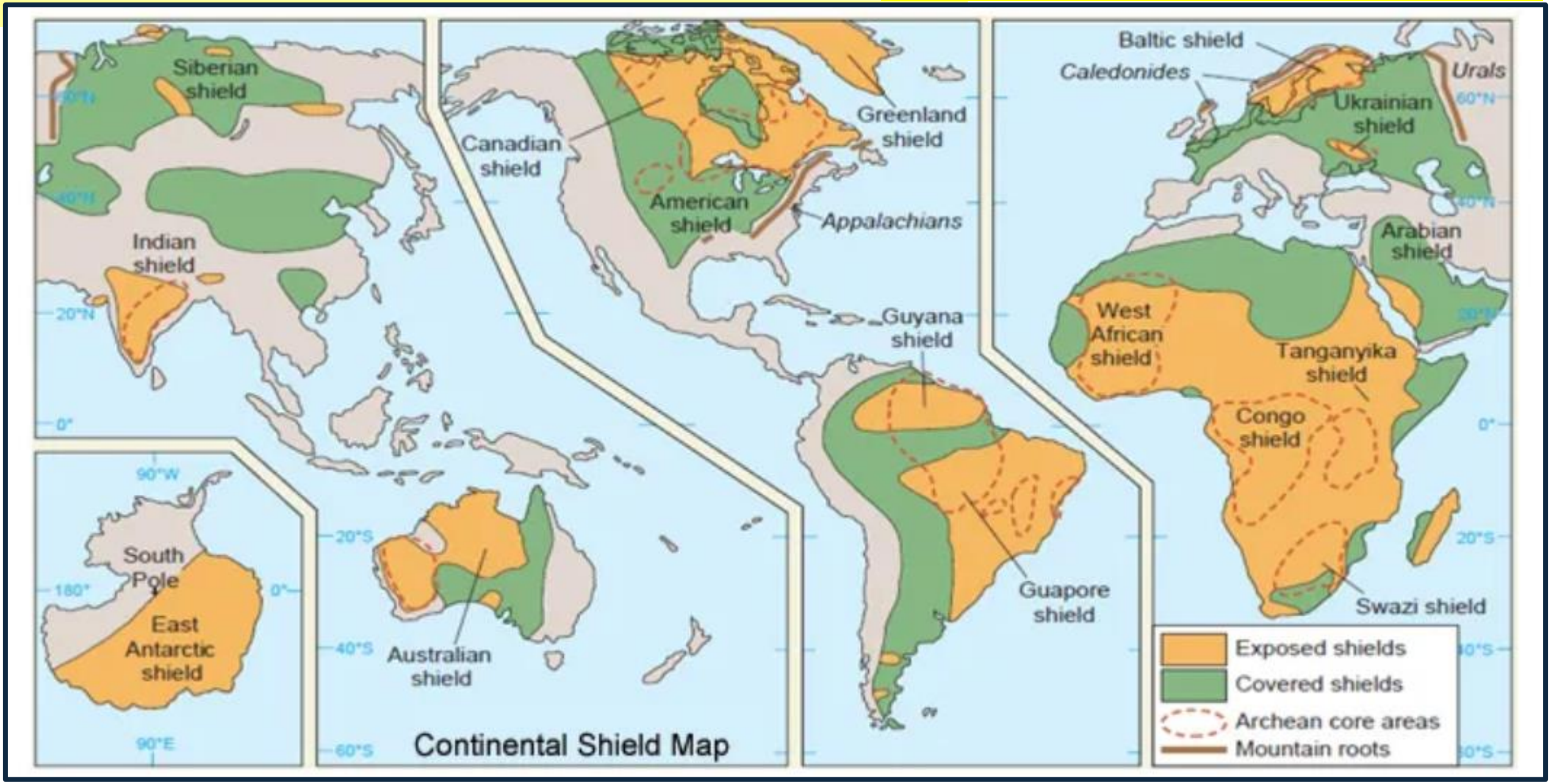
SHIELDS, and abiotic hydrocarbons found under (!) them.

First, we locate **shields of crystalline rock** that seem to anchor the continents.

Next, the Canadian Shield of North America.

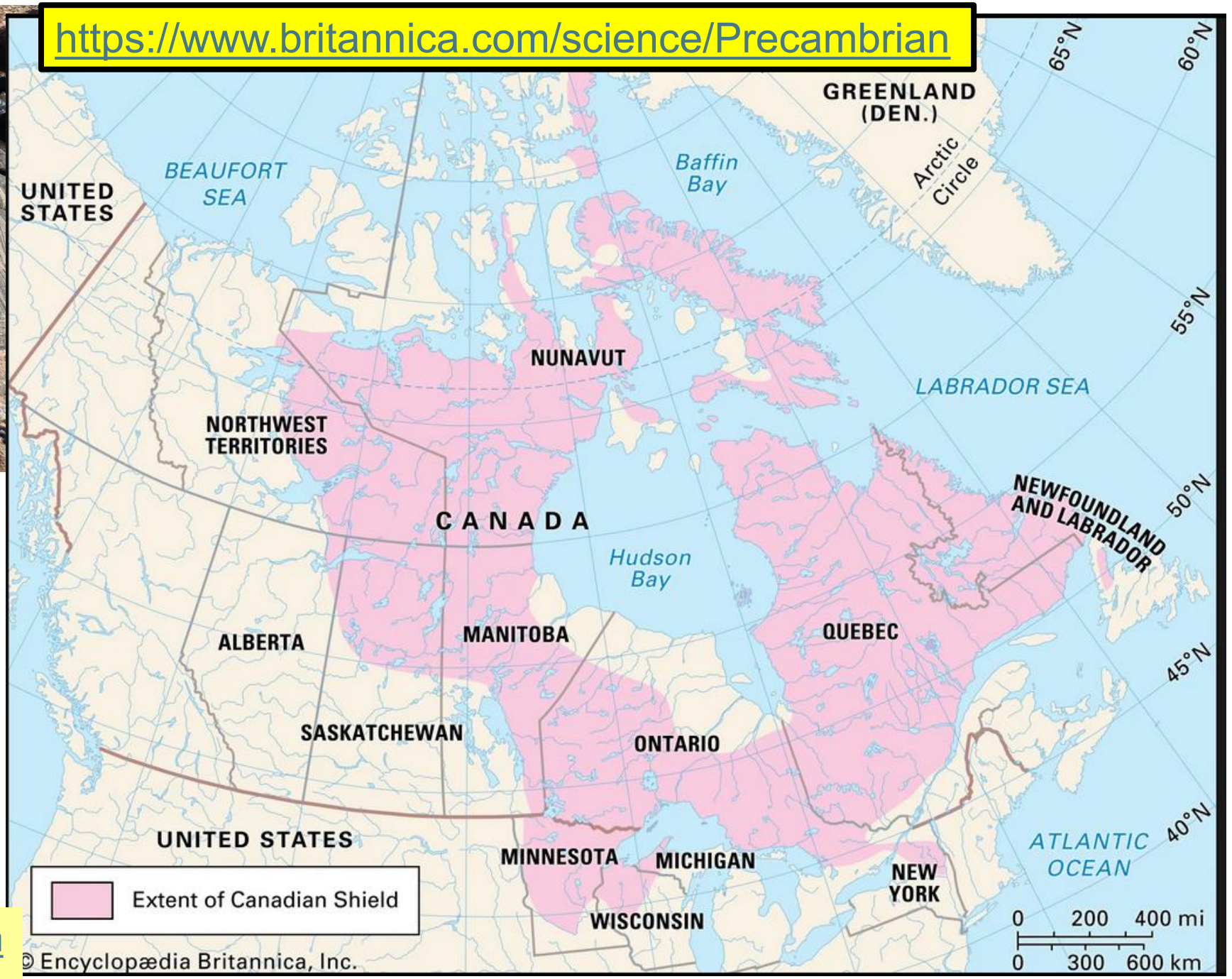
https://www.gktoday.in/the-six-geological-provinces/

The ORANGES are exposed shields



https://georgianbaybiosphere.com/the-canadian-shield-rocks/

https://www.britannica.com/science/Precambrian



Canada

The **pulse influx of methane** along with chloride-saturated solution under the abnormally high pressure (8.1 MPa at the depth of 510 m) **was met in the Precambrian shield crystalline rocks** during the work to increase the depth of the Underseal Mine.

This mine is very rich in **native copper** which occurs in the voids, interstices, and fractures of the Precambrian crystalline rocks near Lake Superior, Ontario, Canada. In the adjacent Central Patricia Mine, which is also rich in commercial copper ores, the **methane emissions from the Archean crystalline rocks were very abundant**: 135 flashes and explosions of methane were registered in both mines during 1940–1950 .

In the White Pine mining district that is situated on the Michigan shore of Lake Superior, **Precambrian crystalline rocks** comprising copper ores in commercial grade and quantity **are impregnated with liquid crude oil**.

This **crude seeps from fractures, fissures, and caverns** in the face, top, and walls of the copper mine and consists of the full and typical petroleum spectrum hydrocarbons including the optically active alkanes, porphyrins, phytane, and pristane.

United States

Studies of the **volatiles in amphiboles** from the mantle xenoliths, **Vulcan's Throne, Grand Canyon, Arizona,** United States contain CH_4, C_2H_4, C_3H_8, and the heavier hydrocarbons.

Methane concentrations vary from 200 to 500 g/t.

The above-mentioned hydrocarbons have $\delta^{13}C$ equal to $-26.0‰ \pm 0.5‰$ that is typical for the noncarbonate carbon in ultramafic igneous rocks where $\delta^{13}C$ varies from $-22.2‰$ to $-27.1‰$.

According to experiments, amphibole-bearing xenoliths crystallize **at the depth of 65 km**.

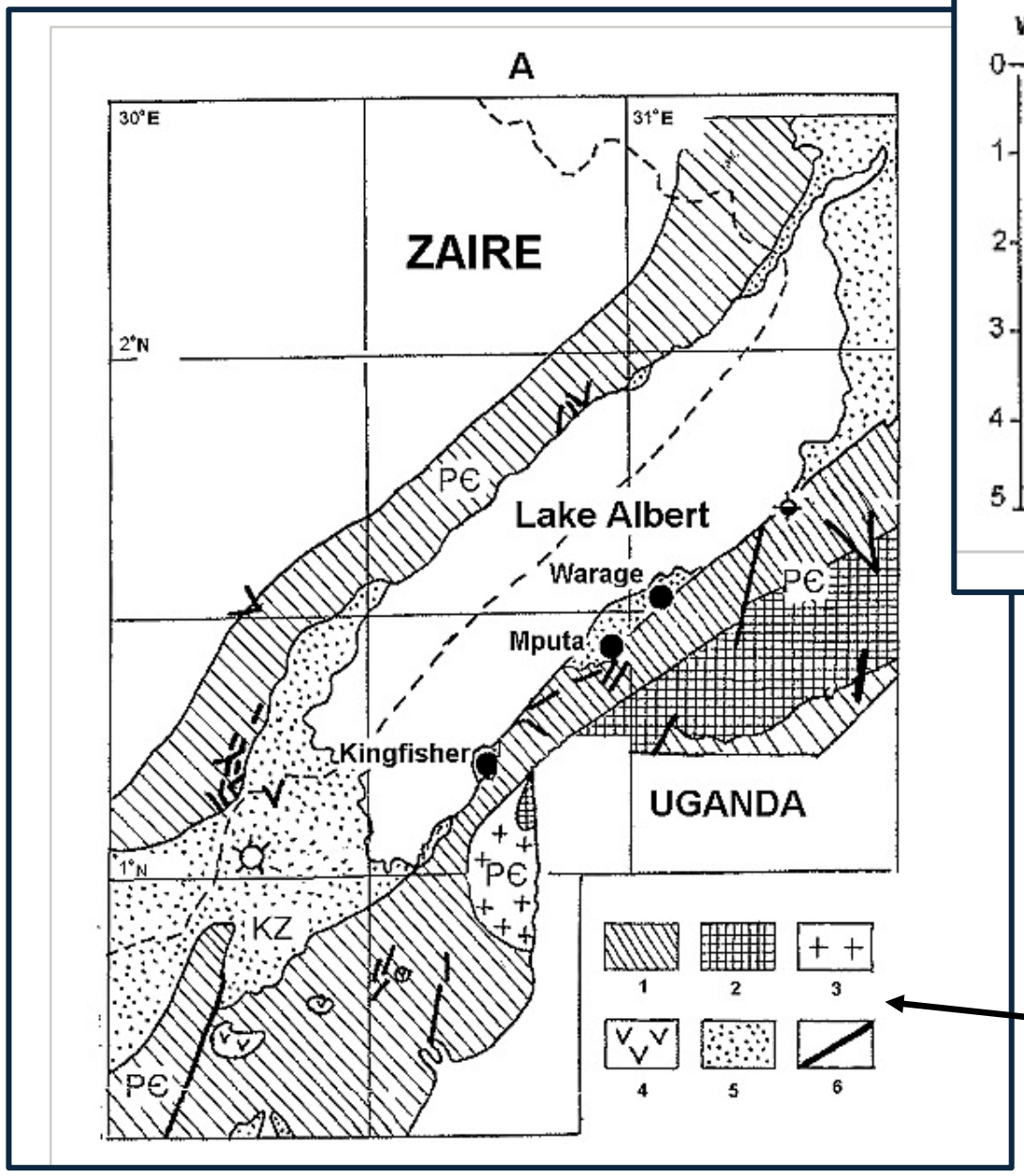
5. NATURAL GAS AND PETROLEUM FLUIDS IN THE PRECAMBRIAN CRYSTALLINE SHIELDS

[28] Additional evidence confirming the abyssal abiogenic petroleum origin is an abundant presence of natural gas and petroleum fluids in the Precambrian crystalline shields (African, Baltic, Canadian, Greenlandian, Sino-Korean, and Ukrainian shields) with no source rocks around as follows.

5.1. Africa

An abundant presence of natural gas in the Precambrian igneous and crystalline metamorphic rocks of the Caapvaal Craton, South Africa, has been observed. In many gold mines of the Witwatersrand mining district, natural gas is abundantly detected to occur in Archean crystalline rocks filling an ancient graben. Till 1958, more than 190 explosions of hydrocarbon gas were registered in only one of the mines mentioned above.

"In-place" oil resources on the eastern coast of Lake Albert in Uganda (Figure 5) oil fields are 210 × 106 T. **There are only Precambrian crystalline rocks and Quaternary clays surrounding Lake Albert. See Fig 5, next.**



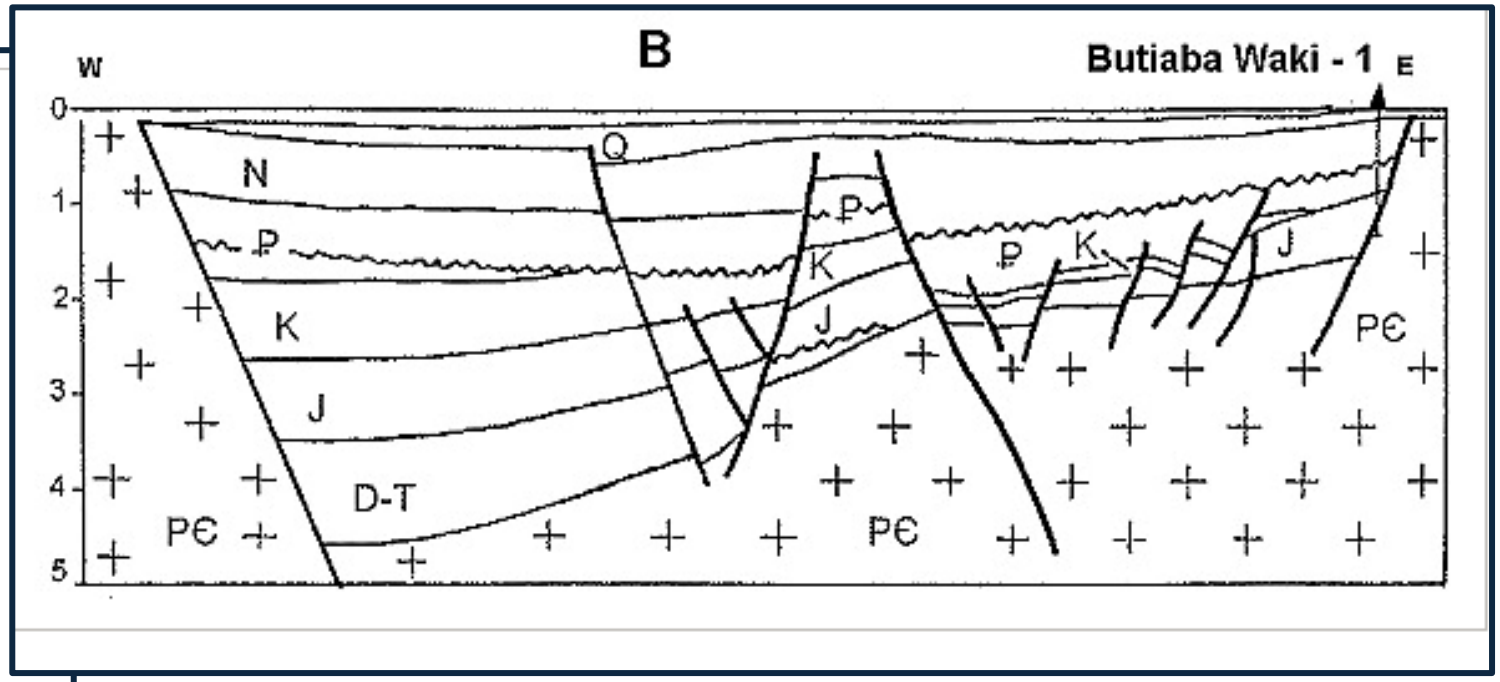


Figure 5

A) Geological map of the Albert Graben and its commercial petroleum fields.

B) Generalized structural section, Alberta Graben. **Patterns** are as follows: 1, gneisses and granite gneisses; 2, crystalline schist; 3, granites; 4, volcanic; 5, sand; 6, fault.

Africa

Primary petroleum fluid inclusions (PFI) are frequently reported in the Precambrian shield rocks of southwest Africa. PFI of quartz contain CH_4, C_2H_6, C_3H_8, CO, CO_2, H_2O, H_2, N_2, and Vaseline-like heavy crude oil .

This oil is geochemically prominent because it has an extraordinarily high concentration of isoprenoidic hydrocarbons.

Primary fluid inclusions of this oil comprise identical quantities of hydrocarbon molecules with their odd and even carbon atom numbers as well as the noncyclic isoprenoids, pristane, phytane, and pharnesane.

Antarctica

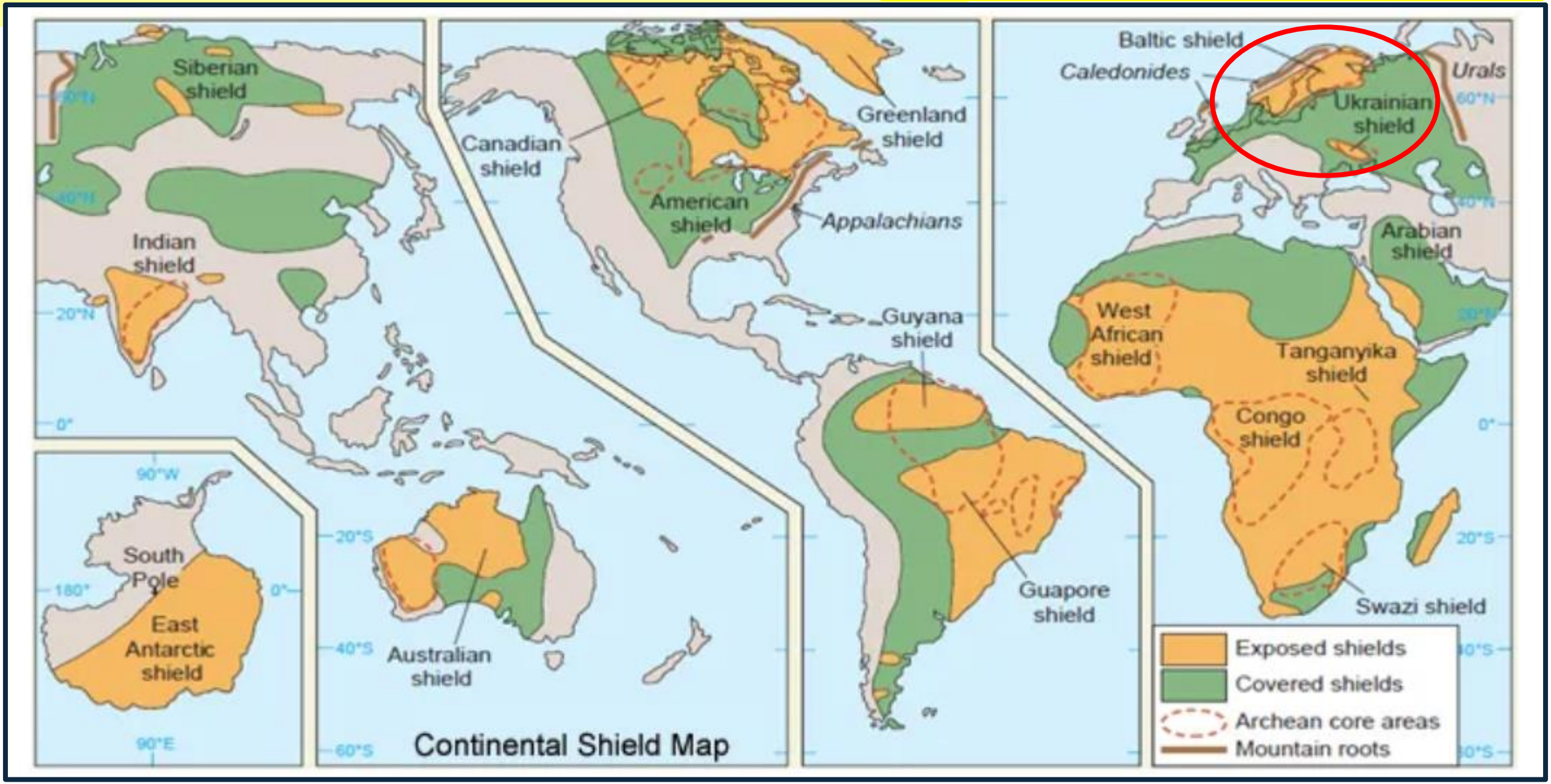
The Shackleton Ridge of eastern Antarctica is rich in Precambrian supracrustal volcanogenic sedimentary rocks and their zonal metamorphic forms (kyanite-sillimanite facial series).

Primary fluid inclusions of 13 garnet crystals samples from parametamorphites of the Shackleton Ridge comprise methane and heavy hydrocarbons.

Mantle xenoliths found in the Quaternary lavas of Mount Erebus Volcano (Ross Island, East Antarctica) are dunites, garzburgites, and pyroxenites**. Gas content of their primary fluid hydrocarbon fluid inclusions is 0.2–1.0 g/t.**

https://www.gktoday.in/the-six-geological-provinces/

The ORANGES are exposed shields



Baltic Region

In the **Baltic Shield**, 240 km northwest of Stockholm**, oil was discovered at the depth of 2883 m in the 1 Stenberg well and at the depth of ~6800 m in the 1 Gravberg well.** Both of these wells were drilled in the Precambrian granites only. Precambrian igneous rocks in the Kola segment of the Baltic Shield contain from 90 to 110 g/t of Vaseline-like bitumen consisting of n-C27–n-C31 alkanes (32% of mass) as well as cycloalkanes and arenes. **The 3-SG-Kola ultradeep well penetrating Precambrian rocks discovered the same oil-saturated igneous rocks at the depth range of 7004–8004 m.**

<This is more than 26,000 ft deep!>

Brazilian Shield and Baltic Shield

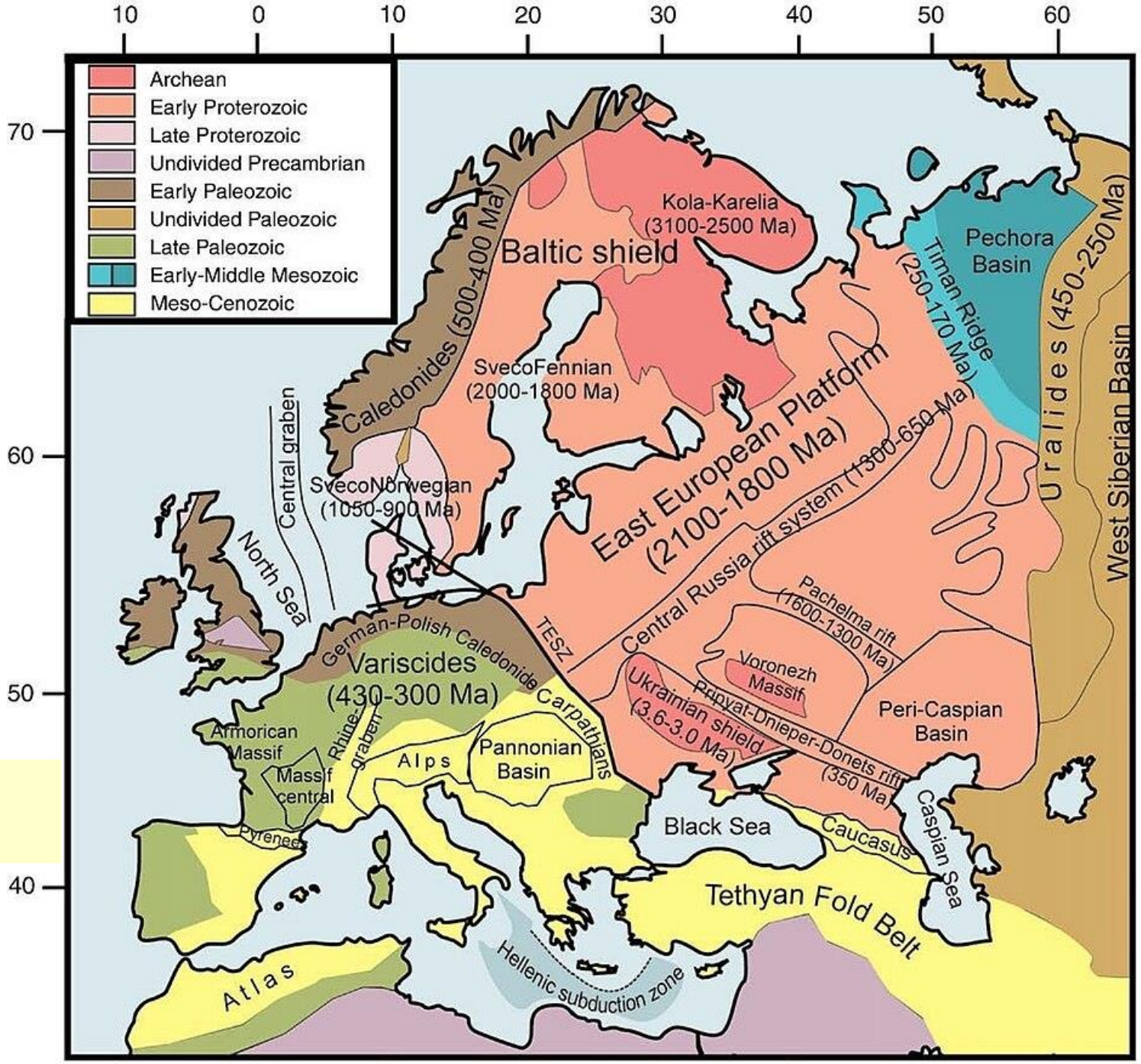
Mesozoic age basalts breaking through the Precambrian crystalline rocks of the Brazilian shield (Santa Catarina) are unweathered; poor in fractures; and rich in geodes, voids, and interstices filled with liquid crude oil

Something similar was also found in the **Baltic Shield, Sweden.**

Although there are no sedimentary rocks in or around **Norway's Arendal area,** the **dolerite** (crystallization temperature is more than 1000°C–1200°C**) dykes intersecting the Archean gneisses have many interstices and amygdaloidal voids filled with liquid petroleum of *n*-C_{10}–*n*-C_{22} alkanes with some admixture of isoprenoid hydrocarbons**.

***Evans et al.* [1964] have concluded that this petroleum doubtlessly is of nonbiogenic origin.**

Baltic Shield and
Ukrainian Shield
in European context



https://en.wikipedia.org/wiki/Baltic_Shield
#/media/File:Simplified_Tectonics_Europe.jpg

Russia and Ukraine 1

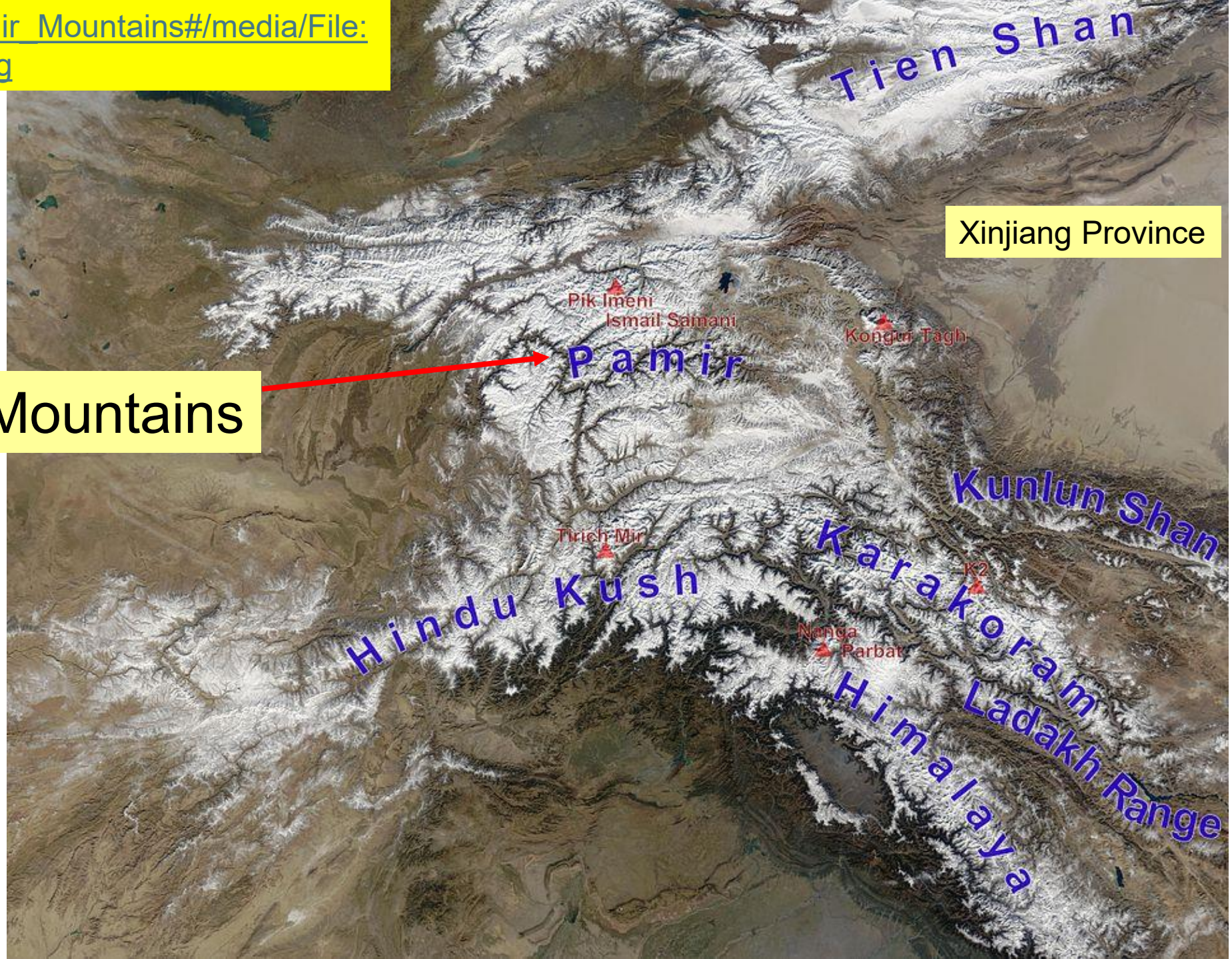
Lherzolites from the recent Baikal Rift Belt are rich in primary fluid inclusions. Methane concentrations of of 3 g/kg were reported.

C1-C6 **alkanes with concentrations from 4.09 to 63.35 L/t were found in primary fluid inclusions** of albite, apatite, nepheline, sphene (titanite), aegirine, and eudialite from the **olivine-titanium-augite gabbro** and urtites in east Siberia.

In the Pamir Mountains bitumen was found in the mantle xenoliths embedded in igneous rocks.

Primary <hydrocarbon> fluid inclusions occur in xenoliths of the garnet pyroxenites (the mantle rocks), explosion pipe rocks, and dykes of fergusite-porphyres or tinguaites (derivatives of mantle magma), amphibolites, granites, hyperbasites, charnockites, basic granulites, and eclogites (granulite-basite layer).

https://en.wikipedia.org/wiki/Pamir_Mountains#/media/File:High_Asia_Mountain_Ranges.jpg



Pamir Mountains

Russia and Ukraine 2

The average **petroleum fluid concentration of the primary fluid inclusions** varies in the range of 6–8 g/t, decreasing regularly in the direction from the Earth's mantle to the granite/gneiss layer.

This is evidence of the abyssal nonbiogenic origin of bitumen.

In Ukraine, primary fluid inclusions of pegmatite quartz comprise n-C1–n-C4 alkanes in the Proterozoic age Korosten, Korsun-Shevchenkovo, and Novomirgorod plutons of the **Ukrainian shield.**

Ukraine 1

Covered predominantly with the Tertiary and Quaternary beds and being exposed in the deep entrenched river valleys and ravines, the **Ukrainian Precambrian shield** with its surface area of 200,000 km2 is an uplifted geologically complex crystalline basement of the East European Platform.

The Archean rock mass of that shield consists of amphibolites, apoporphyrites, calciphyres, crystalline schists, diorites, ferriferous quartzites, gneisses and graphitic gneisses, granites, marbles, metaconglomerates, metasandstones, and quartzites intruded with the Proterozoic igneous rock bodies such as the Korosten, Korsun-Shevchenko, near–Azov Sea, and Novomirgorod plutons.

Ukraine 2

The Proterozoic crystalline complex of the shield is distributed broadly and comprises amphibolites, gabbro, gabbro-norites, labradorites, norites, gneisses and graphitic gneisses, granites, diabases, carbonatites, calciphyres, crystalline schists, ferriferous quartzites, felsites, leptites, marbles, metasandstones, tuffs, and alkali ultrabasites.

Both the Archean and the Proterozoic rocks here do have petroleum fluid indications over large areas. **Liquid crude oil was observed in fissures and fractures of amphibolites and granite core samples** recovered from several boreholes at the depth of 380–900 m in the northeast area **of the Ukrainian shield**.

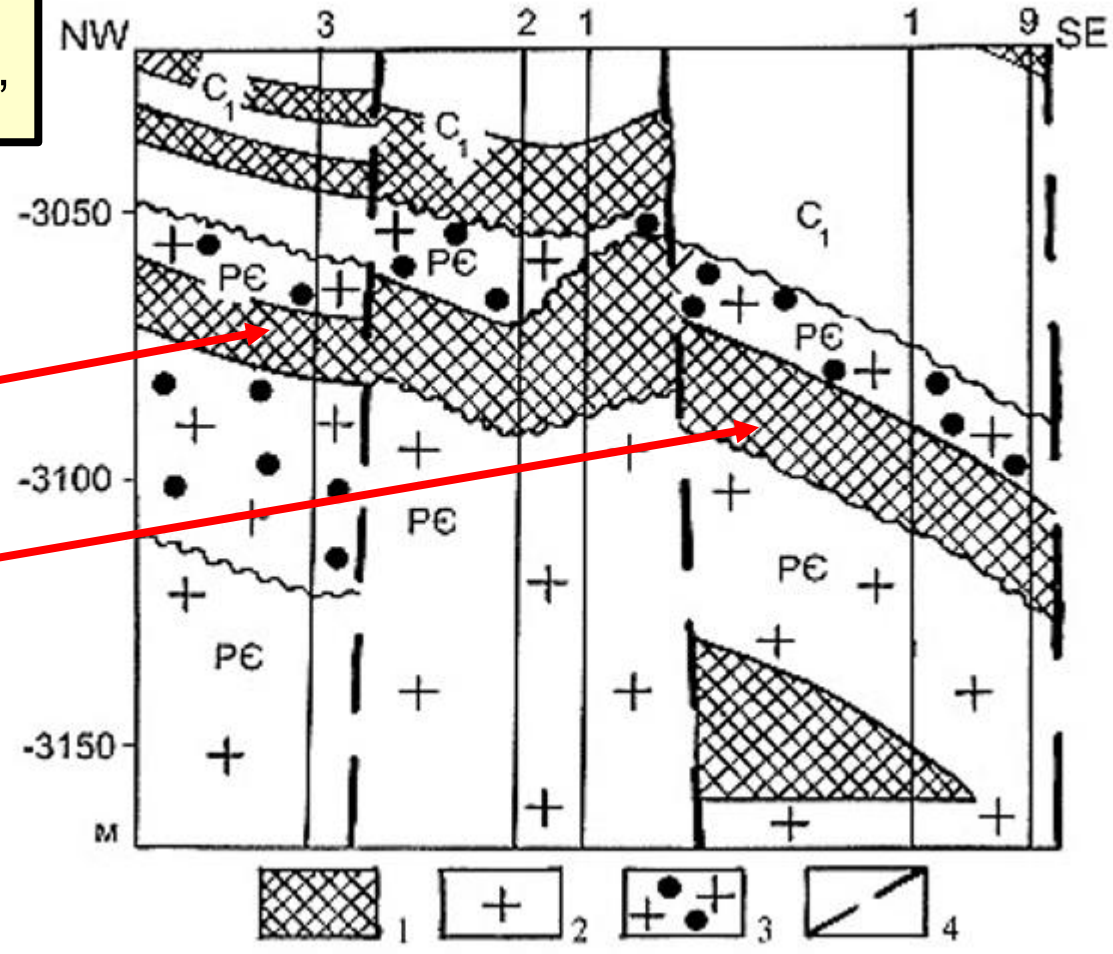
As indicated by gas chromatography of gas mixture samples from **pulverized Precambrian rocks of the Ukrainian shield,** they **contain 0.001–0.204 cm3/g of methane.**

Reviews of Geophysics, Volume: 48, Issue: 1, First published: 12 March 2010, DOI: (10.1029/2008RG000270)

PЄ

Especially in Earth Sciences, there is international agreement on notation. The symbol to the left is for “Pre-Cambrian”

Oil, located BELOW Pre-Cambrian basement rock! Ukraine.



Geological cross section of lower portion of the Chernetchinskoye (left and middle blocks denoted by the dashed lines) and Khukhrinskoye oil fields, **the Dnieper-Donets Basin, Ukraine.**
Patterns are as follows: **1, oil**; 2, crystalline basement granites; 3, basement crust of weathering; 4, fault.

Greenland 1

In western Greenland near Peninsula Nuussuaq the Precambrian crystalline rocks of the Greenlandian shield are dissected with numerous faults and intruded with the Tertiary age plateau basalts.

Having a total thickness of more than 6500 m they overlap regionally in the shield's rocks.

In 1993 one exploration well was drilled to a total depth (TD) of 448 m. This well penetrated to a series of porous zones in basalt and indicated the **presence of liquid petroleum down to the depth of 90 m in basalt.**

Greenland 2

In eastern Greenland, where the Paleocene plateau basalts overlap the Precambrian crystalline rock mass of the shield, the **liquid bitumen was found** in 1992 as an active natural seepage of heavy viscous oil/bitumen.

It seeps from the Tertiary plateau basalts exposed near a base of the Paleocene lava pillow.

All the interstices, voids, and vugs of lava and basalt **are filled fully with bitumen** in the area of ~1 km along the strike and of several hundred meters capwise.

Sino-Korean Region

In northern China, the Yanshan **aulacogen** is filled predominantly with the Middle and Later Proterozoic crystalline limestones, dolomites, and marbles. Their total thickness exceeds 9000 m, ***over 29,500 ft deep.***

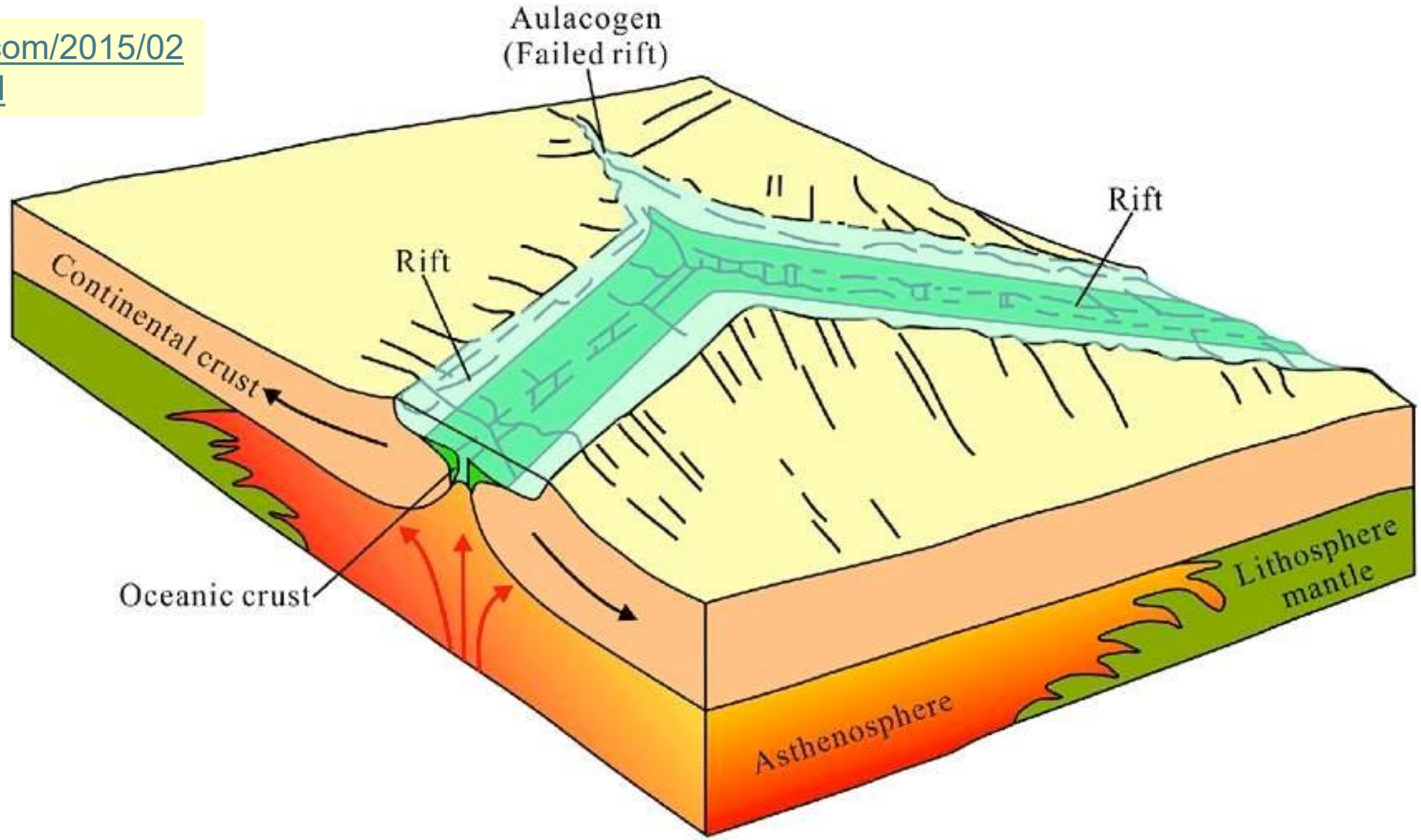
<*definition of aulacogen, next slide*>

The isotopic age of carbonates varies from 800 to 1850 Ma.

Here 65 native **liquid oil and solid bitumen shows have been mapped in outcrops of Tilin and Vumishan crystalline carbonates,** whereas the Lontangchou lenticular bituminous basal quartzite (the isotopic age is 1000 Ma) occurs on the more ancient crystalline rocks of the aulacogen.

The concentration of bitumen In this quartzite varies from 8% to 15% of mass. The host rock of the bituminous quartzite (Zyamalyang Formation) was intruded with the gabbro-diabase sills (the isotopic age is ~763 Ma). The bitumen of the above-mentioned quartzite is considered to be a residue or remnant of an ancient oil accumulation which has undergone a thermodestruction during the early Riphean time.

https://www.geologyin.com/2015/02/what-is-aulacogen.html



PETROLEUM FLUID INCLUSIONS IN MINERALS OF IGNEOUS AND OTHER CRYSTALLINE ROCKS

Victoria, SE Australia

The **Pleistocene alkali basalts** of Victoria (SE Australia) are found at the southern termination of the Mesozoic-Recent basaltoid belt.

They contain mantle xenoliths.

These are the spinel lherzolites with **numerous primary fluid inclusions which contain up to 6 g/t of aliphatic hydrocarbons** with measured δ13C values of −28.9‰.

This is my Summary of
FORMATION OF OIL AND GAS FIELDS IN LIGHT OF ABIOGENIC ORIGIN OF PETROLEUM….the previous ~22 slides:

The information discussed those slides indicates that

(1) petroleum shows/deposits have been found in Precambrian crystalline shields all over the world,

(2) presence of oil and gas deposits in the Precambrian crystalline shields without sedimentary rocks cannot be explained from the traditional biotic petroleum origin point of view, and

(3) petroliferous fluid from the mantle could be the only possible source of petroleum deposits in the Precambrian crystalline shields.

https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2008RG000270

Deep-seated abiogenic origin of petroleum: From geological assessment to physical theory

16. CONCLUSIONS <From the AGU publication> <**bolds** added>

Geological data presented in this paper do not respond to the main questions related to the hypothesis of biotic petroleum origin.

Only the theory of the abyssal abiogenic origin of petroleum gives a convincing explanation for all the above-mentioned data.

The experimental results discussed in the paper confirm that **the CaCO3-FeO-H2O system spontaneously generates the suite of hydrocarbons** characteristic of natural petroleum.

https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2008RG000270

Deep-seated abiogenic origin of petroleum: From geological assessment to physical theory

CONCLUSIONS, <From the AGU publication Pg2> <**bolds** added>

Modern scientific considerations about the genesis of hydrocarbons confirmed by the results of experiments and practical results of geological investigations provide the understanding that **part of the hydrocarbon compounds could be generated at the mantle conditions and migrate through deep faults into the Earth's crust**, where they oil and gas deposits in any kind of rock and in any kind of structural position.

The **experimental results presented place the theory of the abyssal abiogenic origin of petroleum in the mainstream of modern physics and chemistry** and open a great practical application.

The theory of the abyssal **abiogenic origin of petroleum confirms the presence of enormous, inexhaustible resources of hydrocarbons** in our planet and allows us to develop a new approach to methods for petroleum exploration and to reexamine the structure, size, and location of the world's hydrocarbons reserves.