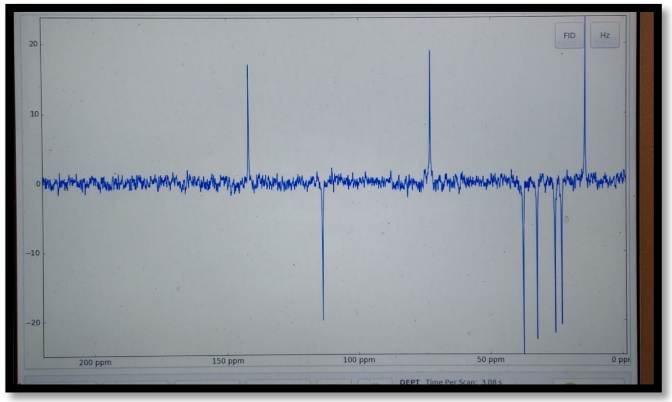
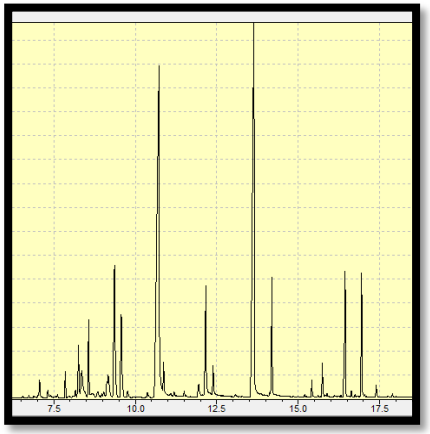
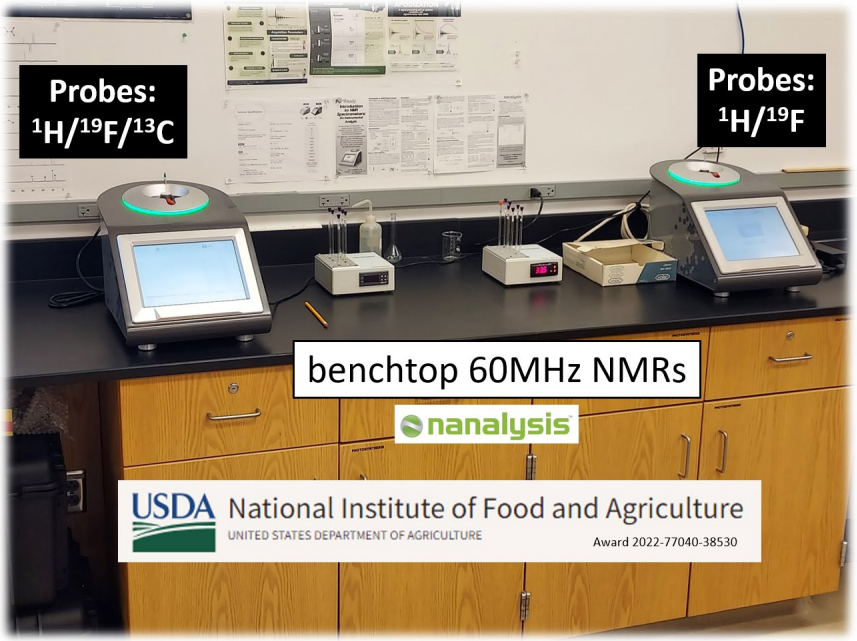
Advancing 21st Century Science Education at Arizona Western College



Scott Donnelly
Arizona Western College





Advancing 21st century science education two ways:

- how science is taught
- what is taught

- adoption of higher engagement teaching strategies (HETS)

- consistent use of HETS in the classroom

Emphasis:

- applications of scientific inquiry

- relevancy to local/regional scales, current events

Day 1

of Class

Why waste time?
Let's just get to work

select
colored
marker

What goes on the whiteboard?

All your:

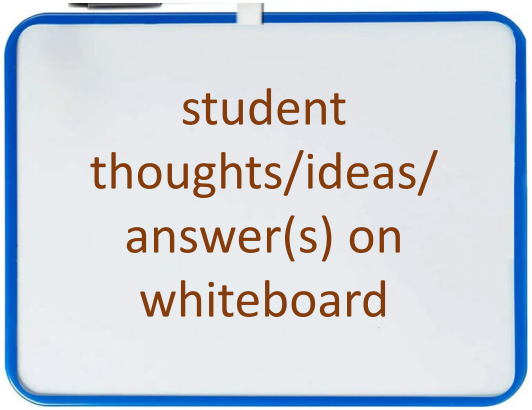
- ideas
- thoughts
- work
- calculations and so on…

Every student has whiteboard (11in x 14in), marker, and rag

How it works:

1. question (**Q**) is asked

2. students work on it individually
(no sharing…yet)



3. then when **prompted**, share/compare with others as *directed*.

Your:

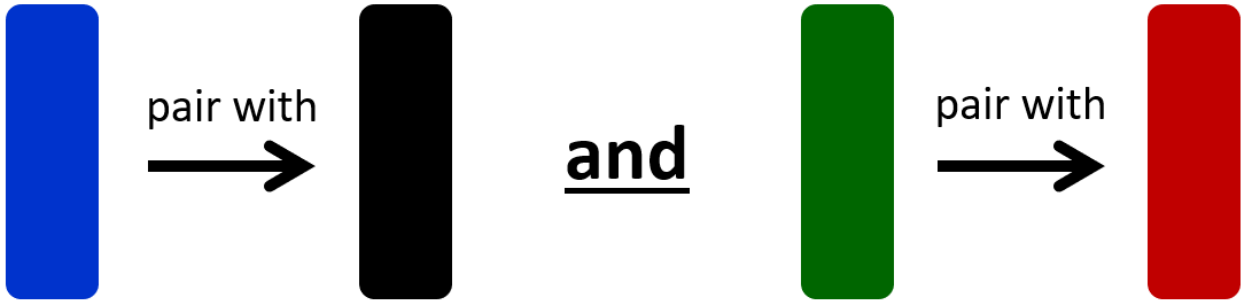
- answer(s)
- idea(s)
- thought(s)
- drawing(s)
- whatever

Same Q. Same data, graph, etc.
Wonder what <u>others</u> thought?

Ways to pair:

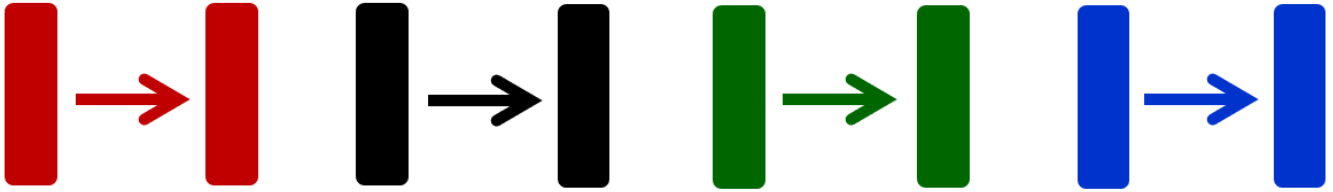
Think-Pair-Share (TPS)

Option 1:



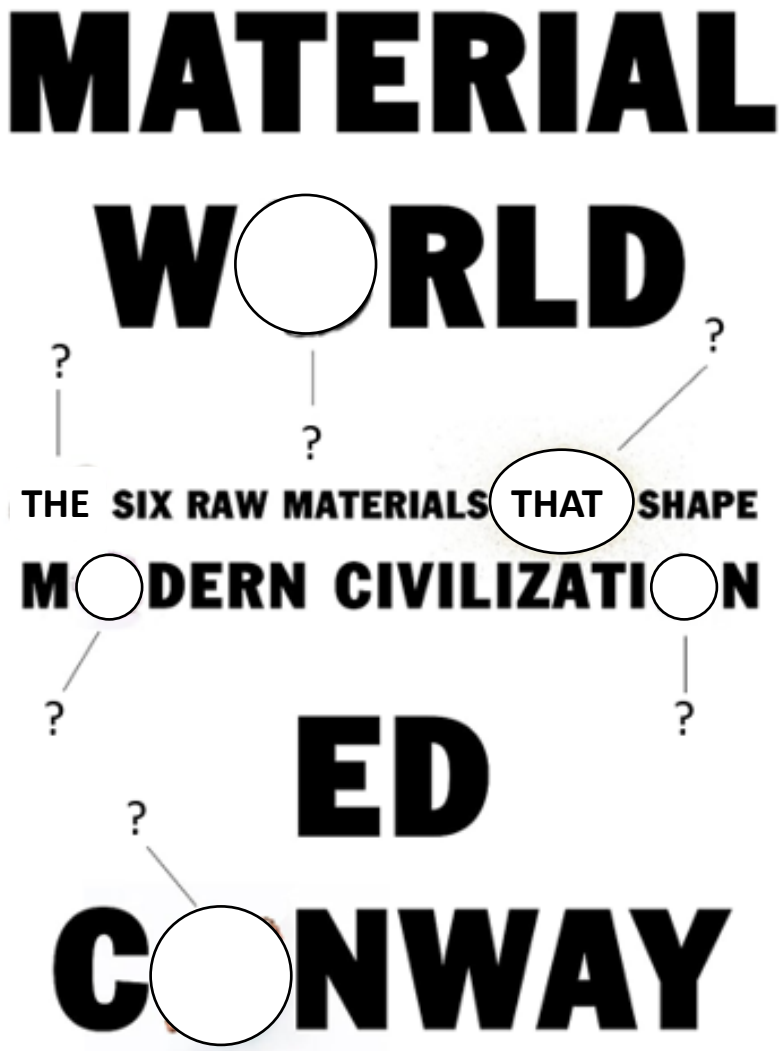
The Persistence of Memory
(*La persistencia de la memoria*)
by Salvador Dali

Option 2:



THE STORY OF
STUFF
PROJECT

Note: I hid the author's six choices with a **?** and white circle



Q: Six ***raw*** materials that shape modern civilization (= the world you and I use).

~3 minutes

Individually first…

1.
2.
3.
4.
5.
6.

Your list

1.
2.
3. Your list
4.
5.
6.

Wonder what others listed?

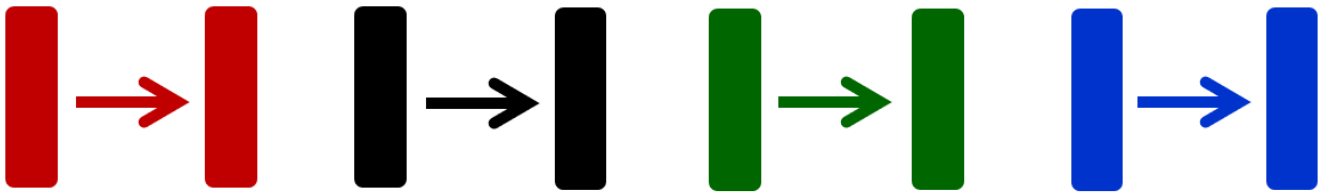
Ways to pair:

Think-Pair-Share (TPS)

When done with one conversation, find another person of the same marker pen color. Mingle. Mingle. Mingle.

~3 minutes

Option 2:



salt | sand | oil | iron | lithium | copper

Foreign Policy

FP

REVIEW

Living in a Material World

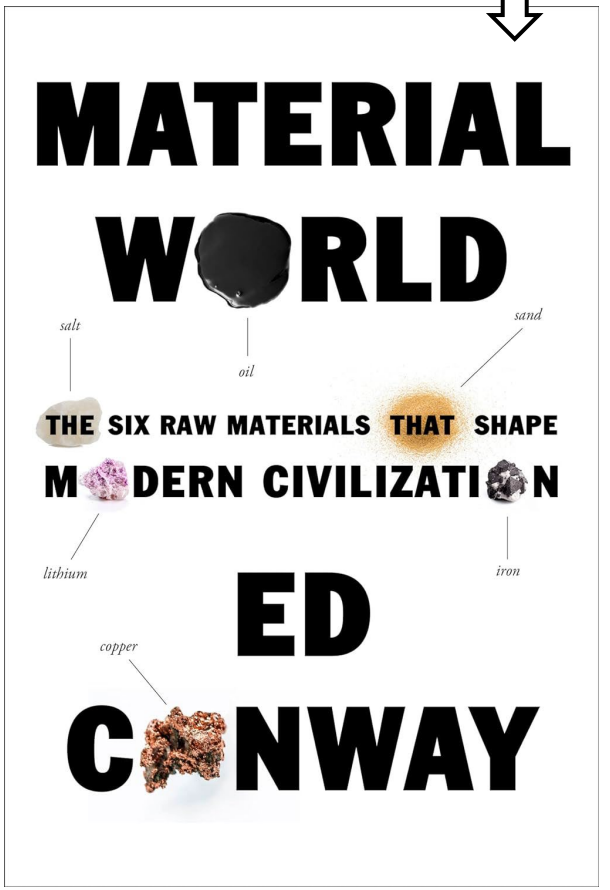
One of the defining features of modern supply chains is a distinct lack of human beings.

NOVEMBER 18, 2023, 6:00 AM | View Comments (1)

Link

By Bronwen Everill, a lecturer in history and fellow of Gonville & Caius College at the University of Cambridge.

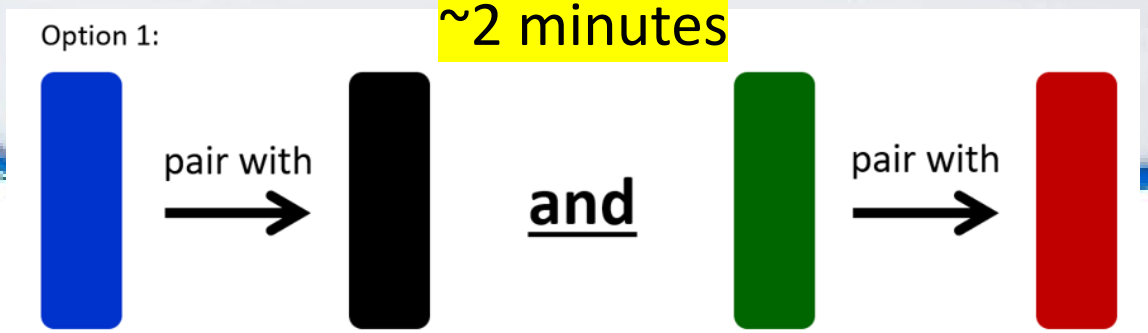
View of giant Komatsu trucks arriving with loads at the Chuquicamata copper mine, in the Atacama Desert of Chile, on Oct. 25, 2005. MARTIN BERNETTI/AFP VIA GETTY IMAGES



No students listed the same six raw materials as the author. But that is not the objective(s).

Q: What then is the overall objective(s) in beginning class Day 1 with such an activity?

~2 minutes



Objectives: Introductory Day 1 class activity had nothing to do with what students likely *expected* to do the first day. The goals:

1) introduce students to how to do Think-Pair-Compare (TPC),

2) encourage involvement, and

3) establish the class culture, what's expected.

a place

Los Angeles Times

CLIMATE & ENVIRONMENT

BY SAMMY ROTH | COLUMNIST

NOV. 28, 2023 6 AM PT

The ???? has even more ???? than previously thought, new report finds

an element

SFGATE

NEWS | CALIFORNIA NEWS

A struggling California region is suddenly poised to become very, very rich

By Ariana Bindman

Dec 4, 2023

???? at California's ???? could power millions of electric vehicles: Report

Jan 24, 2023 6:30 PM EST

The substance, often referred to by its nickname of "white gold" because of its silvery-white look, has come into demand in recent years amid the growing prevalence of electric vehicles.

Eric Lagatta and Erin Rode USA TODAY

USA TODAY

Published 12:23 p.m. ET Dec. 7, 2023 | Updated 12:25 p.m. ET Dec. 7, 2023

Column: The ??? revolution has arrived at California's ????

BY SAMMY ROTH | COLUMNIST

JAN. 25, 2024 6 AM PT

Los Angeles Times

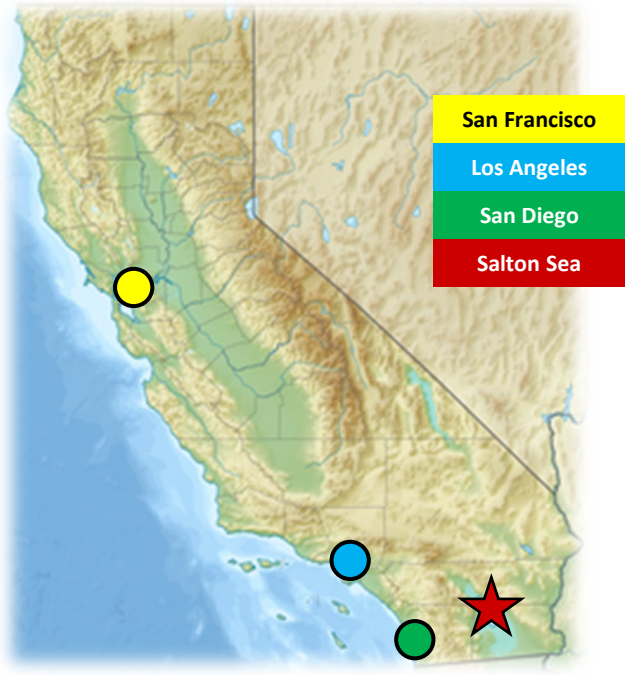
Mud pots bubble outside EnergySource's geothermal plant near the southern end of the ???? EnergySource is one of several companies building a ??? business in ???? (Carolyn Cole / Los Angeles Times)

CLIMATE & ENVIRONMENT

Los Angeles Times

BY SAMMY ROTH | COLUMNIST
NOV. 28, 2023 6 AM PT

The Salton Sea has even more lithium than previously thought, new report finds



NEWS | CALIFORNIA NEWS

SFGATE

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Mud pots bubble outside EnergySource's geothermal plant near the southern end of the Salton Sea. EnergySource is one of several companies building a lithium business in Imperial County. (Carolyn Cole / Los Angeles Times)

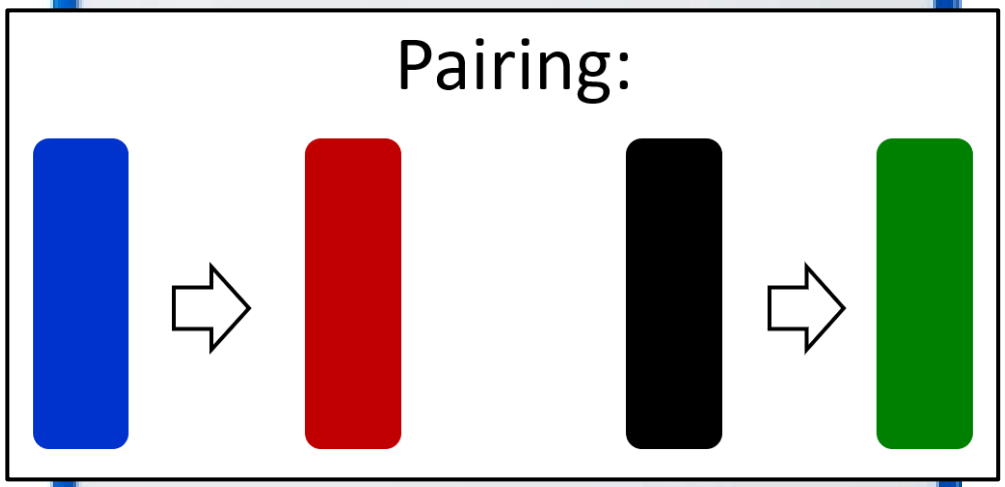
Google Earth Pro

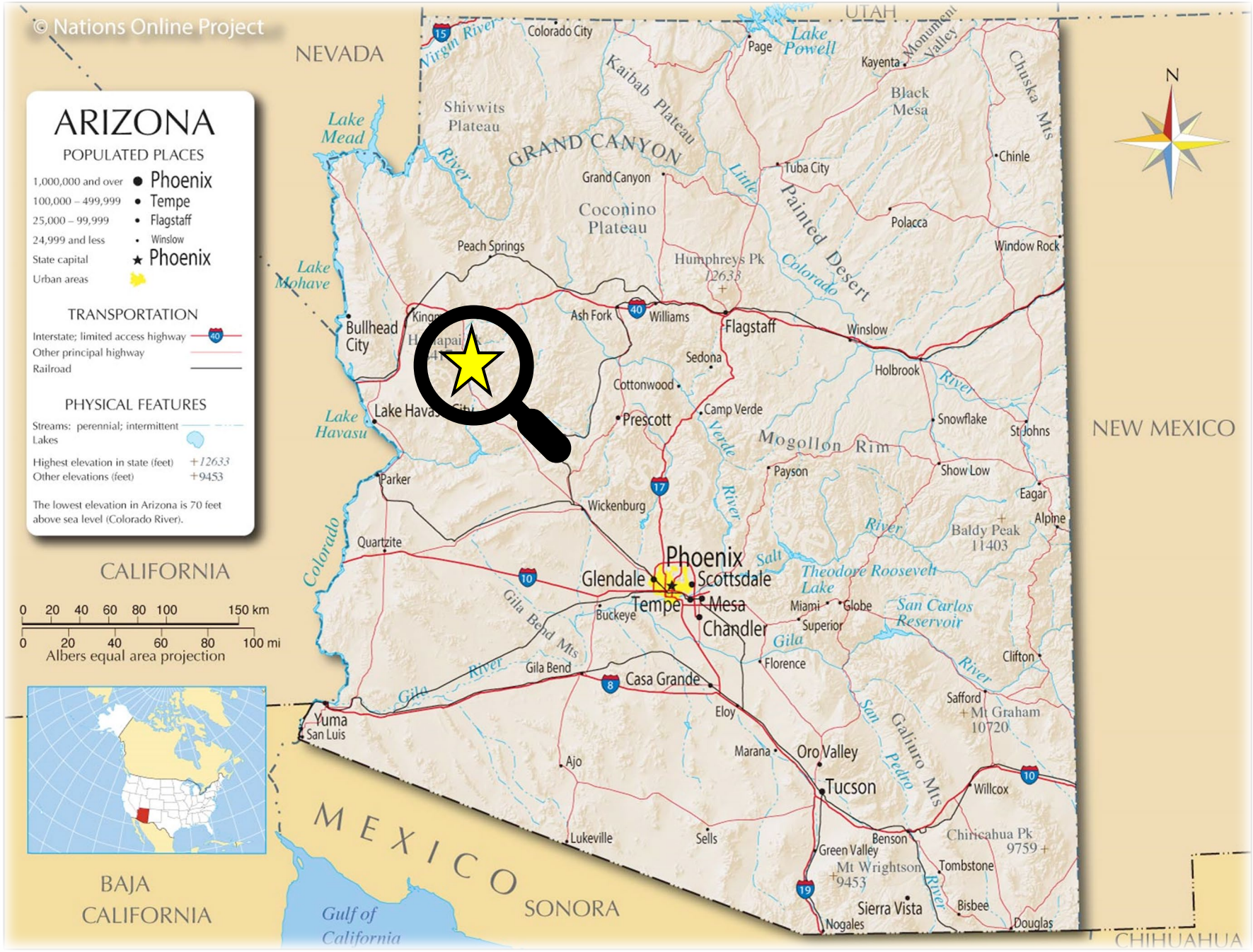
~3 minutes total

Q1: Draw the boundaries for the state of Arizona, *i.e.* draw a map of the state of AZ.

Q2: On your map place a star just a bit southeast of Kingman, ★

and a triangle where the town of Mammoth is located. ▲

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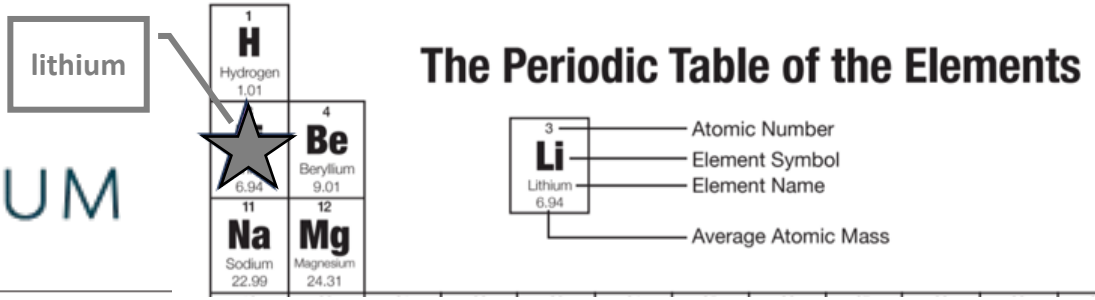
ARIZONA
POPULATED PLACES
1,000,000 and over
Phoenix
100,000 – 499,999
Tempe
25,000 – 99,999
Flagstaff
24,999 and less
Winslow
State capital
Phoenix
Urban areas
TRANSPORTATION
Interstate; limited access highway
Other principal highway
Railroad
PHYSICAL FEATURES
Streams: perennial; intermittent
Lakes
Highest elevation in state (feet) +12633
Other elevations (feet) +9453
The lowest elevation in Arizona is 70 feet above sea level (Colorado River).
0 20 40 60 80 100 150 km
0 20 40 60 80 100 mi
Albers equal area projection
NEVADA
UTAH
NEW MEXICO
CALIFORNIA
MEXICO
BAJA CALIFORNIA
SONORA
CHIHUAHUA
Gulf of California
N
Colorado City
Page
Lake Powell
Kayenta
Monument Valley
Chuska Mts
Black Mesa
Chinle
Tuba City
Polacca
Window Rock
Virgin River
Lake Mead
Shivwits Plateau
Kaibab Plateau
GRAND CANYON
Grand Canyon
Little Colorado
Painted Desert
Coconino Plateau
Peach Springs
Humphreys Pk 12633
Lake Mohave
Bullhead City
Kingman
Ash Fork
Williams
Flagstaff
Winslow
Sedona
Holbrook
Cottonwood
Lake Havasu City
Prescott
Camp Verde
Verde River
Mogollon Rim
Snowflake
St Johns
Payson
Show Low
Parker
Wickenburg
Eagar
Alpine
Baldy Peak 11403
Quartzite
Colorado River
Phoenix
Salt River
Glendale
Scottsdale
Theodore Roosevelt Lake
Tempe
Mesa
Buckeye
Chandler
Miami
Globe
Superior
San Carlos Reservoir
Gila Bend Mts
Gila River
Florence
Clifton
Gila Bend
Casa Grande
Safford
Mt Graham 10720
Eloy
Yuma
San Luis
Ajo
Marana
Oro Valley
Tucson
San Pedro River
Galiuro Mts
Willcox
Lukeville
Sells
Benson
Green Valley
Chiricahua Pk 9759+
Mt Wrightson +9453
Tombstone
Sierra Vista
Bisbee
Nogales
Douglas

Exploded view of Wikieup area

Google Earth Pro

ARIZONA LITHIUM



BIG SANDY LITHIUM
SEDIMENTARY PROJECT

HIGHLIGHTS

330KT
Resource Size

100% Owned Project
in the battery corridor of Arizona

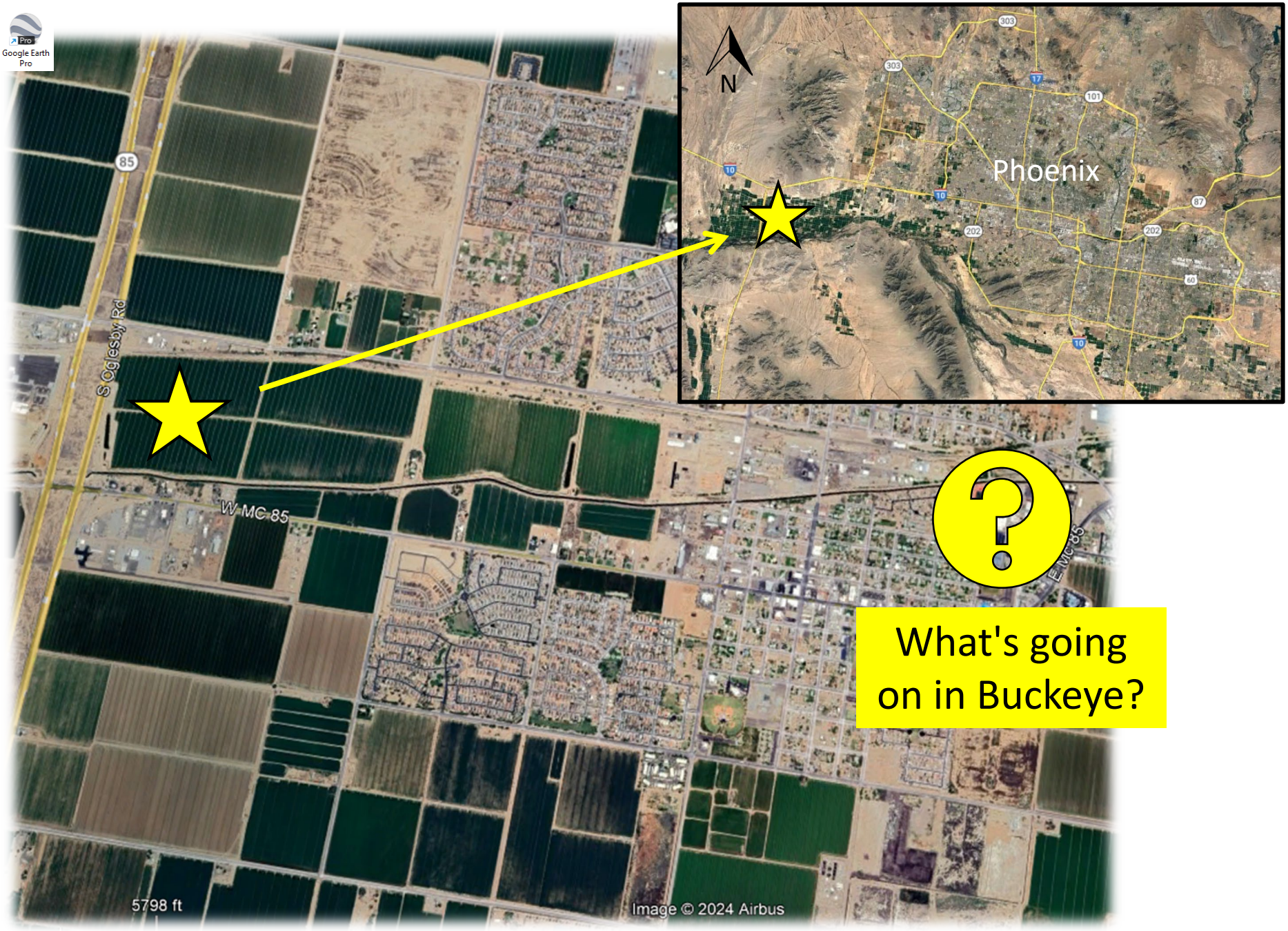
Net Zero Target
Emissions & Water Prod.

15-20 Year
Potential Mine Life

99.8% Purity
battery grade Lithium Carbonate

Arizona Lithium
Level 2, 10 Outram Street
West Perth WA 6005 Australia
T +61 (0) 8 6313 3936
E info@arizonalithium.com

ASX: AZL, AZLOA
OTC: AZLAF


Google Earth Pro
N
Phoenix
303
17
101
10
202
87
60
85
S Ogilesby Rd
W MC 85
E MC 85
5798 ft
Image © 2024 Airbus
What's going on in Buckeye?

KORE POWER SELECTS ARIZONA SITE FOR ONE MILLION SQUARE FOOT "KOREPLEX" LITHIUM-ION BATTERY MANUFACTURING FACILITY

12 GWh Manufacturing Facility Will Bring 3,000 Jobs to the state as First Domestic Battery Plant Owned by a U.S. Company Cell Manufacturer Nears Construction

ARIZONA
COMMERCE AUTHORITY

3 Nikola Coolidge Manufacturing Facility

4 Proposed Kore Power "Koreplex" Facility

5 Lucid Motors AMP Facility


© Nations Online Project
ARIZONA
POPULATED PLACES
1,000,000 and over
100,000 – 499,999
25,000 – 99,999
24,999 and less
State capital
Urban areas
Phoenix
Tempe
Flagstaff
Winslow
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Other principal highway
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0 20 40 60 80 100 150 km
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NEVADA
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CALIFORNIA
MEXICO
BAJA CALIFORNIA
SONORA
CHIHUAHUA
Colorado City
Virgin River
Page
Lake Powell
Kayenta
Monument Valley
Chuska Mts
Black Mesa
Chinle
Tuba City
Polacca
Window Rock
Lake Mead
Shivwits Plateau
Kaibab Plateau
GRAND CANYON
Grand Canyon
Little Colorado River
Painted Desert
Coconino Plateau
Peach Springs
Humphreys Pk 12633
Lake Mohave
Bullhead City
Kingman
Hualapai Pk 8417
Ash Fork
Williams
Flagstaff
Winslow
Holbrook
Sedona
Cottonwood
Camp Verde
Prescott
Lake Havasu City
Lake Havasu
Parker
Wickenburg
Payson
Mogollon Rim
Verde River
Quartzite
Colorado River
Phoenix
Glendale
Scottsdale
Tempe
Mesa
Chandler
Buckeye
Miami
Gila Bend Mts
Gila River
Gila Bend
Casa Grande
Florence
Eloy
Safford
Mt Graham 10720
Yuma
San Luis
Ajo
Maran
Tucson
Galiuro Mts
Willcox
Lukeville
Sells
Green Valley
Mt Wrightson 9453
Chiricahua Pk 9759+
Tombstone
Sierra Vista
Bisbee
Douglas
Nogales
Gulf of California
Salt River
N


77
10
77
10
86
Tucson
Saguaro National Park
21.4 mi
Image Landsat / Copernicus
Hmmm…what's going on in Mammoth?
Goggle Earth

ENVIRONMENT

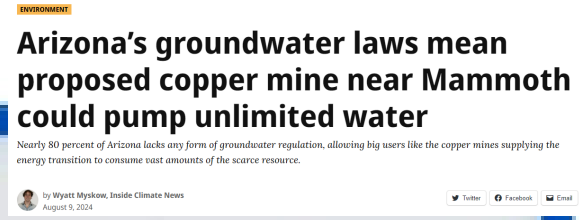
Arizona's groundwater laws mean proposed copper mine near Mammoth could pump unlimited water

Nearly 80 percent of Arizona lacks any form of groundwater regulation, allowing big users like the copper mines supplying the energy transition to consume vast amounts of the scarce resource.

by **Wyatt Myskow, Inside Climate News**
August 9, 2024

Melissa Crytzer Fry, left, and Steve Fry, right, show a reporter where the proposed mine will impact the Galiuro Mountains outside Mammoth, Arizona on March 14, 2024. Photo by Michael McKisson.

~4 minutes total



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Twitter Facebook Email

Q: What information in the article (next slide) caught your attention, if not wowed you?

Compare/share
with your neighbors.

ENVIRONMENT

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August 9, 2024

Link

One major copper mine with publicly documented groundwater consumption, Freeport-McMoran's Sierrita mine, located south of Tucson, withdrew 22,409 acre feet of groundwater in 2023 from one of its rights, according to records from the Arizona Department of Water Resources. That nearly 7.3 billion gallons of water heading to one mine is enough for more than 60,000 Arizona homes. A proposed manganese and zinc mine, both critical minerals, near the town of Patagonia in Southern Arizona, would pump out 6.5 million gallons of water a day just in the dewatering process, according to the mine's plans of operations. Another mine east of Phoenix uses 15,682 acre feet of water per year, which environmentalists allege has caused depleted flows at a local creek that supports two endangered species, leading them to file an intent to sue the U.S. Forest Service and U.S. Fish and Wildlife Service, claiming the decision to allow the mine to expand operations violates the Endangered Species Act.

period 4
group 11
transition metal

period 5
group 6
transition metal

acre-feet = af; a unit for volume

One major copper mine with public[illegible]groundwater consumption, Freeport-McMoran's Sierrita mine[illegible]f Tucson, withdrew 22,409 acre feet of g[illegible]023 from one of its rights, according to records from the Arizona D[illegible]Water Resources. That nearly 7.3 billion gallons of water heading to one mine is enough for more than 60,000 Arizona homes. A proposed manganese and zinc mine, both critical minerals, near the town of Patagonia in Southern Arizona, would pump out 6.5 million gallons of water a day just [illegible]ocess, according to the mine's plans of operations. Another [illegible]x uses 15,682 acre feet of water per ye[illegible]onmentalists allege has caused depleted flows at a local creek tha[illegible]endangered species, leading them to file an intent to sue the U.S. Forest Service and U.S. Fish and Wildlife Service, claiming[illegible]o allow the mine to expand operations violates the Endangered Spec[illegible]

billion = 10^9
7.3×10^9 gal
7,300,000,000gal

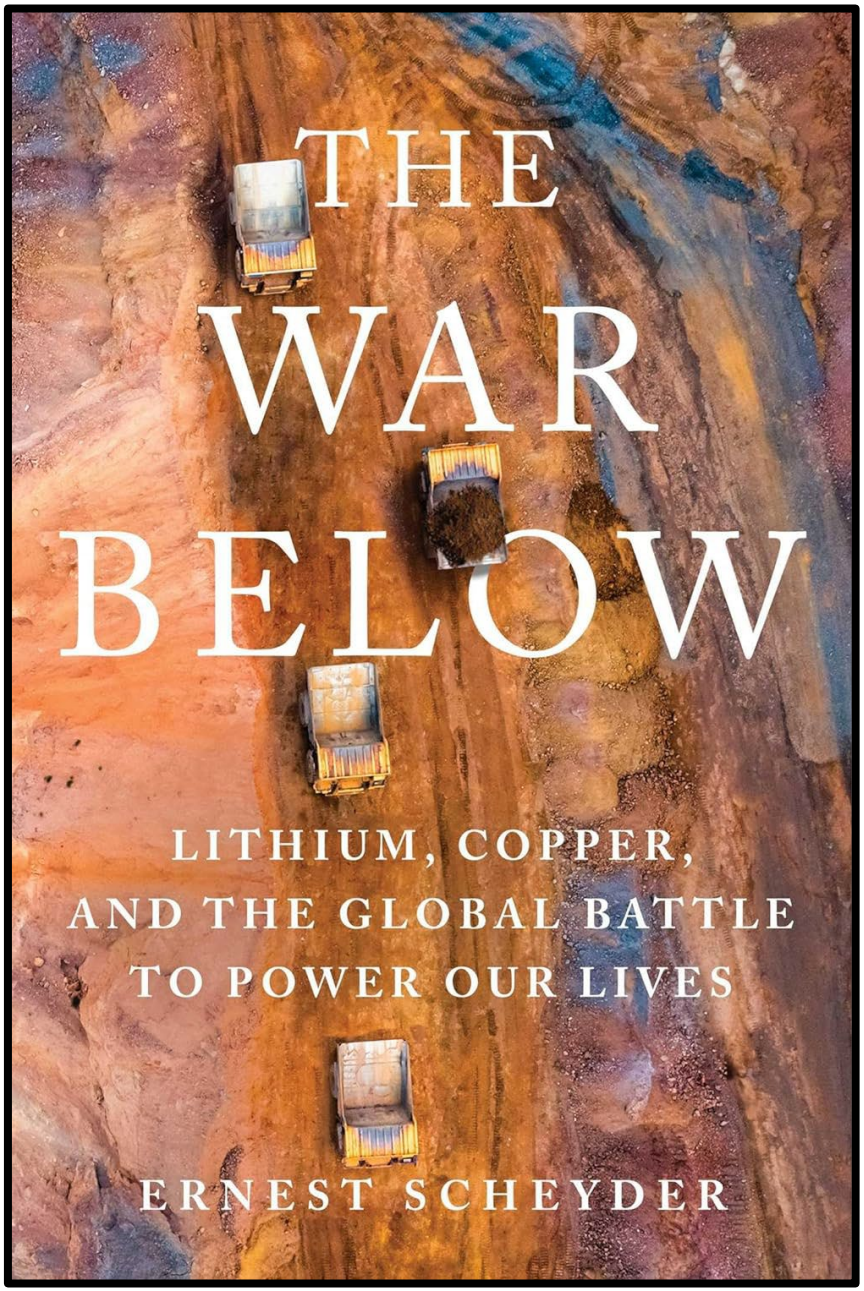
period 4
group 7
transition metal

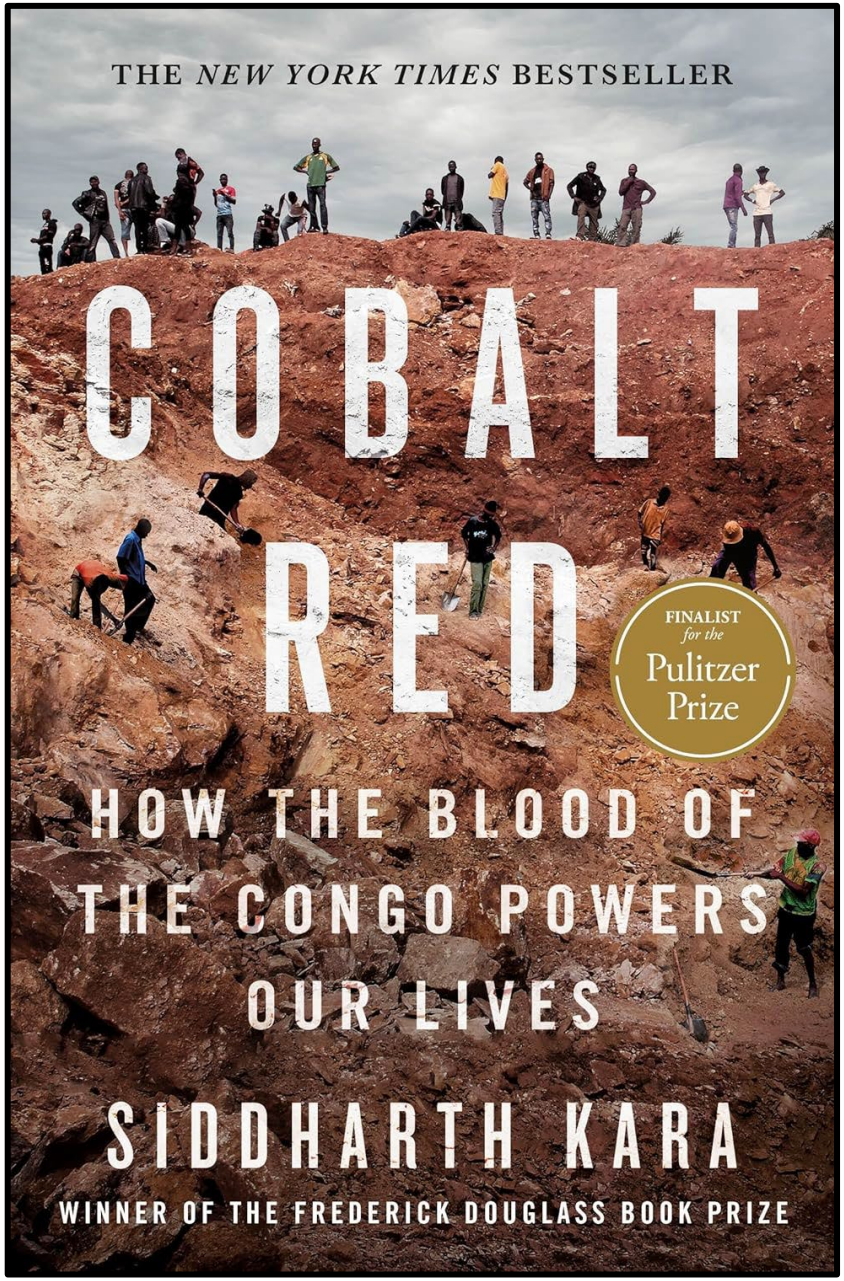
water use equivalent = 60,000 homes

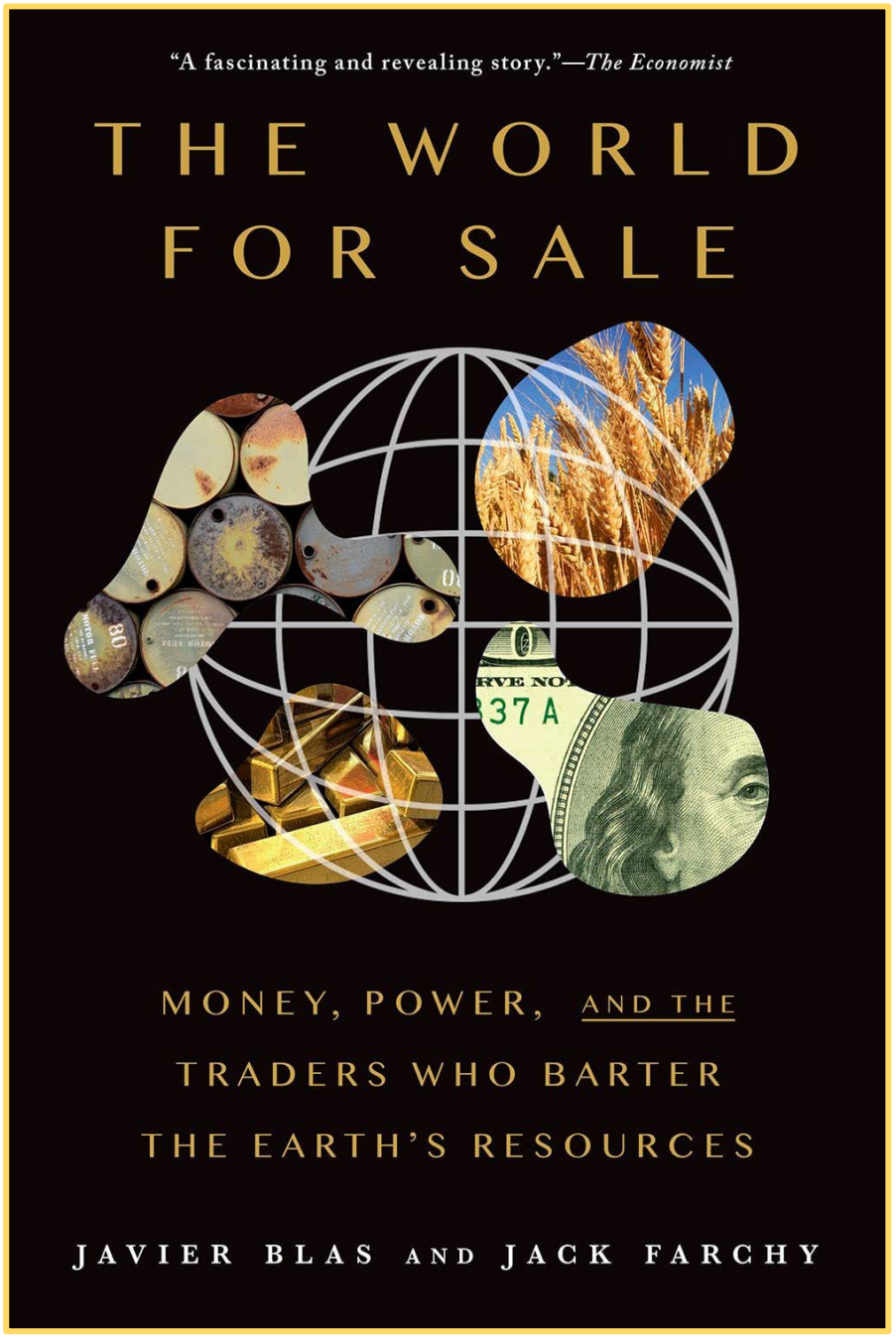
period 4
group 12
transition metal

million = 10^6
6×10^6 gal
6,000,000gal

acre-feet = af; a unit for volume


THE WAR BELOW
LITHIUM, COPPER, AND THE GLOBAL BATTLE TO POWER OUR LIVES
ERNEST SCHEYDER


THE NEW YORK TIMES BESTSELLER
COBALT RED
FINALIST for the Pulitzer Prize
HOW THE BLOOD OF THE CONGO POWERS OUR LIVES
SIDDHARTH KARA
WINNER OF THE FREDERICK DOUGLASS BOOK PRIZE

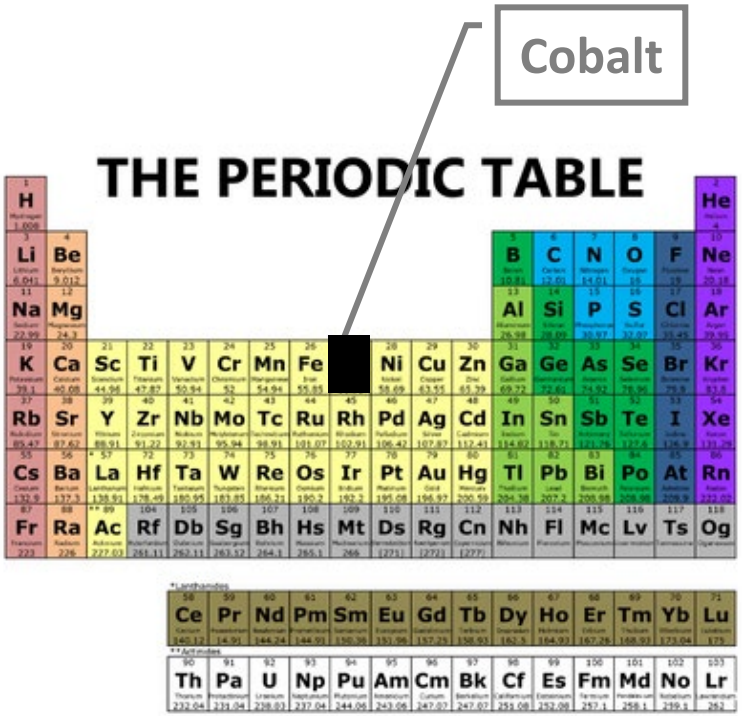


We're Not Mining Enough Copper to Meet Upcoming EV Projections: Report

Researchers from Cornell University and the University of Michigan say that going all EV by 2035 is unrealistic.

BY EMMET WHITE PUBLISHED: MAY 28, 2024 1:07 PM EDT

INTERNATIONAL ENERGY FORUM



https://www.youtube.com/watch?v=teuRjx7s_8k

Watch this video…

Opening scene…1968

The Last of Us zombie eco-thriller on HBO

In 2013 civilization begins to collapse as a fungal infection of the global food supply ravages the world. With a steadily warming world, over time fungi have evolved to survive temperatures above 94^{O}F.


Q: Think of all the cool, creative ways that you could insert this creepy introductory HBO series trailer into your course(s). *Mingle. Mingle. Mingle.*
Think. Share. Compare. Think some more. Be creative.

Centers for Disease Control and Prevention
CDC 24/7: Saving Lives, Protecting People™

EMERGING INFECTIOUS DISEASES®

EID Journal > Volume 30 > Number 3—March 2024 > Main Article

Volume 30, Number 3—March 2024

Another Dimension

The Last of Us and the Question of a Fungal Pandemic in Real Life

Georgios Pappas✉ and Georgia Vrioni
Author affiliations: Institute of Continuing Medical Education of Ioannina, Ioannina, Greece (G. Pappas); National Kapodistrian University of Athens, Athens, Greece (G. Vrioni)

Cite This Article

Abstract

The television series The Last of Us imagines a postapocalyptic world ravaged by a fungal pandemic caused by a *Cordyceps* species. We evaluate whether a fungal pandemic is possible (and reasons behind its current improbability). We further discuss the series' effect on public perception of fungi, fungal infections, and pandemic response.

Pappas, G., & Vrioni, G. (2024). The Last of Us and the Question of a Fungal Pandemic in Real Life. *Emerging Infectious Diseases*, *30*(3), 595-598. https://doi.org/10.3201/eid3003.230684.

Story #1

Grain bins stuffed with harvested corn

If interested in what this all about, contact Prof. Scott Donnelly (scott.donnelly@azwestern.edu)

Image: kentuckypestnews.wordpress.com/2014/08/19/shelling-corn-early-watch-that-moisture/

Story #2

Q: What is the deadliest^ animal* to humans on planet Earth?

^: # deaths annually

*: excluding our own species, *Homo sapiens*

If interested in what this all about, contact Prof. Scott Donnelly (scott.donnelly@azwestern.edu)

The Seattle Times **Inside the movement to revitalize tribal languages in WA schools**

Jan. 29, 2023 at 6:00 am | *Updated Jan. 29, 2022 at 10:21 am*

Story #3

Essential Oils

Bottle volume
black cap: 7.5mL
white cap: 15mL

If interested in what this all about, contact Prof. Scott Donnelly (scott.donnelly@azwestern.edu)

Atlas Cedarwood	Bergamot	Black Pepper	Cinnamon Leaf	Clary Sage	Clove Bud	Cypress	Eucalyptus	Frankincense	French Lavender	Fresh Ginger
Geranium	Grapefruit	Lemon	Lemon Eucalyptus	Lemongrass	Lavender	Lime	Myrrh	Oregano	Patchouli	Peppermint
Pine	Rosemary	Sage	Spearmint	Sweet Orange	Sweet Peppermint	Tangerine	Tea Tree	Vetiver	Wintergreen	Ylang Ylang III