

ONE EARLY SATURDAY MORNING, GEOGIRL WOKE UP TO TINY SCREAMS FOR HELP SOMEWHERE INSIDE HER HOUSE. TIRED BUT CURIOUS, SHE STUMBLED INTO THE LIVING ROOM TO INVESTIGATE.



AAAHH!!
HELP!

...ALKALINE BATTERIES? WHY ARE YOU SCREAMING? IT'S TOO EARLY FOR THIS...



AAAHH!!

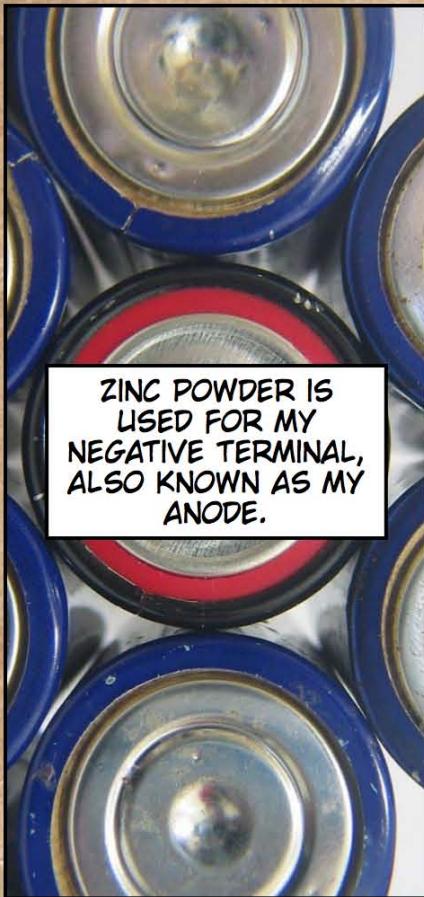
BECAUSE WE NEED HELP! ZINC ZERO IS TRYING TO DESTROY OUR FAMILIES!

THE VILLAIN THAT DISAPPEARED YEARS AGO? WHAT DO YOU MEAN?





THE ZINC PRODUCERS, THE ZINC MINES! HE'S SHUTTING THEM DOWN, AND WASTING AND THROWING AWAY THE REST OF THE ZINC!



ZINC POWDER IS USED FOR MY NEGATIVE TERMINAL, ALSO KNOWN AS MY ANODE.



THE "CURRENT COLLECTOR", A BIG PIN THAT RUNS THROUGH MY BODY, IS MADE OF BRASS, AN ALLOY OF ZINC AND COPPER. IF THERE'S NO MORE ZINC, WE DIE OFF!



I THOUGHT ZINC ZERO WAS IN JAIL...? NEVER MIND. COME WITH ME, WE'LL FIGURE OUT WHAT'S GOING ON.

GEOGIRL AND BATTERY FLEW AWAY AT ONCE, HEADING FOR THEIR FIRST INVESTIGATION SITE IN A HURRY.

WH-WHERE ARE WE GOING?

WHOOOSH

A ZINC MINE! KIDD CREEK MINE IS IN TIMMINS, ONTARIO, AND IT'S RUN BY GLENCORE. IT'S HUGE, AND IT'S STILL RUNNING! IF ZINC ZERO IS ON THE LOOSE, I HAVE A FEELING HE'LL BE THERE.

WAIT, REALLY?! I THOUGHT ZINC ZERO SHUT DOWN THE MINES!

NO WAY! CANADA IS A TOP 10 PRODUCER OF ZINC. WE PRODUCED 310,000 TONS OF ZINC IN 2016. THERE ARE STILL MINES AND SMELTERS IN YUKON, BRITISH COLUMBIA, MANITOBA, ONTARIO, QUEBEC, AND NEWFOUNDLAND AND LABRADOR.

REALLY? YAY! THAT MEANS I'LL HAVE GRANDCHILDREN!



NO... BUT LET'S
KEEP LOOKING. WE'LL
STOP HIM IF WE SEE
HIM.



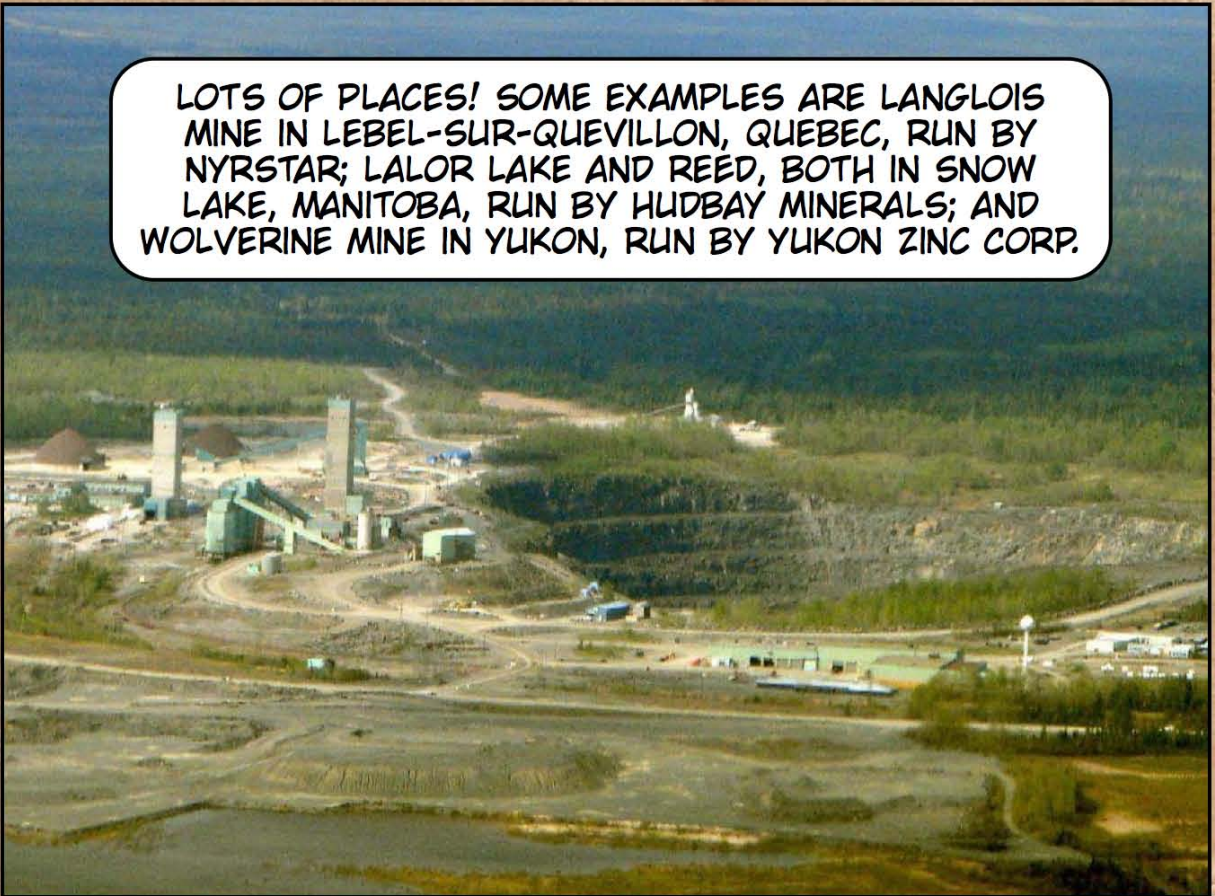
WOW, THIS PLACE IS
HUGE... HOW DOES THIS
WHOLE THING WORK? HOW
DO THEY GET ZINC OUT
OF THE GROUND?

GOOD QUESTION! THE MOST COMMONLY MINED ZINC ORE IS SPHALERITE. THERE ARE LOTS OF MINING METHODS USED TO MINE THE ORE, FROM OPEN-PIT TO UNDERGROUND METHODS. THE MOST COMMON UNDERGROUND METHOD IS "CUT-AND-FILL STOPING", WHICH IS WHEN YOU REMOVE THE ORE IN HORIZONTAL SLICES AND THEN FILL THE HOLES WITH WASTE. THIS MINE STARTED AS AN OPEN-PIT MINE, BUT NOW IT'S ONE OF THE DEEPEST UNDERGROUND MINES IN THE WORLD!



AWESOME! WHERE
ARE SOME OTHER MINES
THAT MINE ZINC IN
CANADA?

LOTS OF PLACES! SOME EXAMPLES ARE LANGLOIS MINE IN LEBEL-SUR-QUEVILLON, QUEBEC, RUN BY NYRSTAR; LALOR LAKE AND REED, BOTH IN SNOW LAKE, MANITOBA, RUN BY HUDBAY MINERALS; AND WOLVERINE MINE IN YUKON, RUN BY YUKON ZINC CORP.




WITH NO SIGHT OF ZINC ZERO, GEOGIRL TOOK FLIGHT AGAIN, BRINGING BATTERY TO THE NEXT PART OF THEIR ADVENTURE: THE PROCESSING.





WHERE ARE WE NOW?

WE'RE AT CEZINC REFINERY IN VALLEYFIELD, QUEBEC! IT'S RUN BY GLENCORE, AND IT'S A ZINC REFINERY. SOME OTHER REFINERIES IN CANADA ARE FLIN FLON, RUN BY HUDBAY MINERALS IN MANITOBA, AND TRAIL, RUN BY TECK RESOURCES, IN B.C. IF ZINC ZERO WASN'T AT THE MINES, MAYBE HE'LL BE HERE.



WOW! SO THIS IS WHERE THE ZINC IN MY BODY IS MADE?

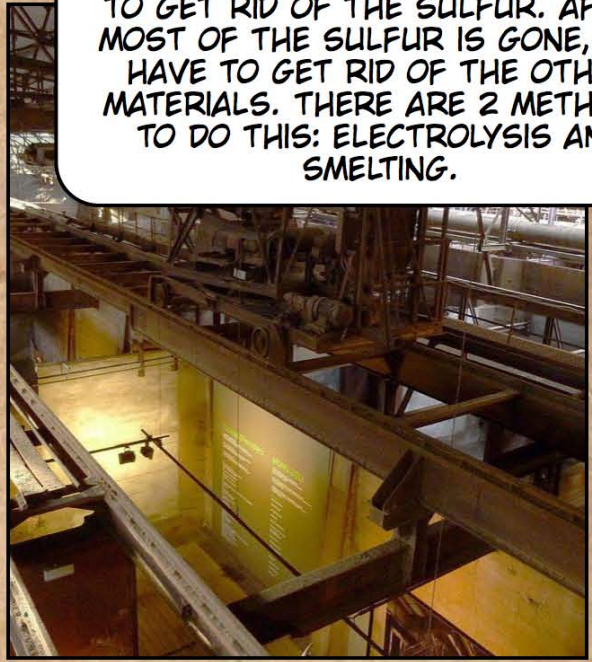
YEAH! THERE'S A LONG PROCESS TO GET FROM ORE TO PURE ZINC!

FIRST, THE ORE IS CRUSHED AND WATER IS ADDED TO FORM A MIXTURE CALLED "SLURRY". THE SLURRY IS PUMPED INTO FLOTATION TANKS THAT USE AIR BUBBLES AND CHEMICALS TO SEPARATE AND GATHER THE MINERAL PARTICLES.

GLUG



THEN, THE MINERALS ARE "ROASTED" TO GET RID OF THE SULFUR. AFTER MOST OF THE SULFUR IS GONE, YOU HAVE TO GET RID OF THE OTHER MATERIALS. THERE ARE 2 METHODS TO DO THIS: ELECTROLYSIS AND SMELTING.



ELECTROLYSIS INVOLVES RUNNING AN ELECTRIC CURRENT THROUGH THE IMPURE ZINC TO GET RID OF THE OTHER MINERALS. THEN, THE ZINC IS RE-MELTED AND CAST, PRODUCING VERY HIGH-GRADE, PURE ZINC.



THE ZINC IS THEN SHIPPED OFF TO THE FACTORIES THAT NEED IT.



SMELTING INVOLVES PUTTING THE IMPURE ZINC INTO A FURNACE. THE MINERALS ARE MANIPULATED WITH TEMPERATURE CHANGES, MIXING, AND FOLDING UNTIL THE MOLTEN ZINC SEPARATES ITSELF INTO A LAYER ON THE SURFACE, WHICH IS REMOVED.

THAT'S SO COOL! I NEVER KNEW THERE WERE SO MANY STEPS TO GET PURE ZINC. THERE'S JUST ONE PROBLEM... ZINC ZERO ISN'T HERE!

YEAH, HE'S NOT HERE. MY GPS SENSES AREN'T SEEING ANYTHING, EITHER. OH WELL, LET'S JUST GO HOME.



GEOGIRL AND BATTERY ARRIVED AT HOME WITHOUT A SINGLE SIGHTING OF ZINC ZERO.

THAT WAS A LOT OF WORK! YOU'RE SURE PEOPLE WON'T SHUT ALL OF THAT DOWN ON THEIR OWN, EVEN WITHOUT ZINC ZERO TO DO IT FOR THEM?



NO, OF COURSE NOT! YEAH, IT IS A LOT OF WORK, BUT ZINC IS VERY USEFUL, SO IT'S WORTH THE EFFORT. LOTS OF EVERYDAY ITEMS USE ZINC, NOT JUST BATTERIES!

REALLY?



YEAH! OUR AMERICAN NEIGHBOURS USE A PENNY THAT'S 97.5% ZINC. ZINC OXIDE IS USED FOR WHITE PAINT, MEDICINES, SUNSCREEN, RUBBER, AND MORE.



ZINC IS ALSO CORROSION-RESISTANT, SO IT'S OFTEN USED TO "GALVANIZE" STEEL, WHICH IS WHEN STEEL IS COATED IN A LAYER OF ZINC TO MAKE IT CORROSION-RESISTANT. GALVANIZED STEEL IS USED FOR TRASH CANS, LINK FENCES, AND HUGE STRUCTURES LIKE BRIDGES AND BUILDINGS.



WHOA... OUR CITIES WOULD FALL APART IN NO TIME! THANK GOODNESS FOR ZINC!

PLUS, BRASS IS AN ALLOY OF COPPER AND ZINC, AND BRASS IS USED IN A LOT OF ITEMS, SUCH AS LOCKS, GEARS, DOORKNOBS AND MUSICAL INSTRUMENTS. ZINC IS ALSO SPECIAL IN MANY ORGANISMS, INCLUDING HUMANS. IT'S AN ESSENTIAL "TRACE ELEMENT", WHICH MEANS IT'S EXTREMELY IMPORTANT OUR BODIES.



WOW! I NEVER KNEW ZINC WAS SO SPECIAL BESIDES IN BATTERIES! I MEAN, NOT TO TOOT MY OWN HORN, BUT WITHOUT BATTERIES, YOU WOULDN'T HAVE REMOTE CONTROLS, ALARM CLOCKS, TOYS, AND ALL SORTS OF OTHER STUFF!

EXACTLY!... SAY, WHO TOLD YOU ZINC ZERO WAS ON THE LOOSE? WE DIDN'T SEE HIM ANYWHERE...



HE'S RIGHT THERE!!!

A BATTERY, DRAPED IN A SMALL CAPE AND MASK, GROWLED AT GEOGIRL. GEOGIRL LAUGHED AND DEFEATED THE SMALL BULLY IN SECONDS.



THAT'S NOT ZINC ZERO, SILLY!

HA HA HA HA HA

OH, THAT'S A RELIEF. SO ZINC ZERO ISN'T GOING TO MAKE MY FAMILY DIE OFF?

WELL, NOT ZINC ZERO... MAYBE THIS TIME IT'LL BE THE HUMANS THAT ARE THE VILLAINS.

WHAT DO YOU MEAN?

WELL, HUMANS USE A LOT OF NON-RENEWABLE RESOURCES, AND WE'RE NOT TOO GOOD AT CONSERVING OR REUSING THOSE RESOURCES. ZINC IS A NON-RENEWABLE RESOURCE, AND IT'S SUPER IMPORTANT IN OUR EVERYDAY LIVES.



THERE ARE LOTS OF OTHER NON-RENEWABLE RESOURCES THAT ARE IMPORTANT, TOO, LIKE FOSSIL FUELS. WE NEED TO CONSERVE WHAT WE HAVE, OR ELSE WE'LL RUN OUT. THEN WE DON'T HAVE ALL THE WONDERFUL THINGS MADE OF NON-RENEWABLE RESOURCES, LIKE YOU!





References

Content:

- Battery. (2017). In *Encyclopedia Britannica*. Retrieved February 3, 2017, from <http://school.eb.com/levels/high/article/106044#>
- Blake, L. (2009). *On science 9*. Toronto, ON: McGraw-Hill Ryerson.
- Chevalier, P., Wright, P., & Gauvin, M. (2013). *Zinc*. Retrieved February 3, 2017, from <http://www.thecanadianencyclopedia.ca/en/article/zinc/>
- Gray, T.W. & Mann, N. (2009). *The elements: a visual exploration of every known atom in the universe*. New York: Black Dog & Leventhal.
- Kable. (2017). *Kidd Creek copper and zinc mine, Ontario, Canada*. Retrieved February 3, 2017, from http://www.mining-technology.com/projects/kidd_creek/
- McDowell, J. (2008). *Metals*. New York: Chelsea House.
- Mining. (2017). In *Encyclopedia Britannica*. Retrieved February 3, 2017, from <http://school.eb.com/levels/high/article/110656>
- Mining Association of Canada. (2015). *Facts and figures of the Canadian mining industry 2015*. Retrieved February 3, 2017, from <http://mining.ca/sites/default/files/documents/Facts-and-Figures-2015.pdf>
- Natural Resources Canada. (2016). *Canadian mineral production*. Retrieved February 3, 2017, from <http://www.nrcan.gc.ca/mining-materials/publications/17722>
- United States Mint. (2015). *Coin specifications*. Retrieved February 3, 2017, from https://www.usmint.gov/about_the_mint/index583f.html?action=coin_specifications
- U.S. Department of the Interior. (2017). *Mineral commodity summaries 2017*. Retrieved February 3, 2017, from <https://minerals.usgs.gov/minerals/pubs/mcs/2017/mcs2017.pdf>
- Zinc. (2017). In *Encyclopedia Britannica*. Retrieved February 3, 2017, from <http://school.eb.com/levels/high/article/78379>
- Zinc processing. (2017). In *Encyclopedia Britannica*. Retrieved February 3, 2017, from <http://school.eb.com/levels/high/article/110671#>

Images:

- BBC World Service. (Photographer). (2009). *The smelting works at Rustenburg 2* [Photograph]. Retrieved February 3, 2017, from <https://www.flickr.com/photos/bbcworldservice/3530049589>

- Borvan53. (Photographer). (2012). *Iron ores sintering before mixing* [Photograph]. Retrieved February 3, 2017, from https://commons.wikimedia.org/wiki/File:Iron_ores_mixing_before_sintering_V%C3%B6lklingen_Ironworks.JPG
- Boutsayaphat, J. (Photographer). (2006). *Roomz 6* [Photograph]. Retrieved February 3, 2017, from <http://www.freeimages.com/photo/roomz-6-1231916>
- Camilo, A. (Photographer). (2002). *Pennies* [Photograph]. Retrieved February 3, 2017, from <http://www.freeimages.com/photo/pennies-1254659>
- Embley, R. (Photographer). (2002). *Kidd Creek open pit mine* [Photograph]. Retrieved February 3, 2017, from http://oceanexplorer.noaa.gov/explorations/02fire/logs/yr_sum/media/sites.html
- Enthoven, N. (Photographer). (2004). *Tenerife from above* [Photograph]. Retrieved February 3, 2017, from <http://www.freeimages.com/photo/tenerife-from-above-1505449>
- Geomartin. (Photographer). (2010). *Prominenthill-flotation* [Photograph]. Retrieved February 3, 2017, from <https://simple.wikipedia.org/wiki/Flotation#/media/File:Prominenthill-flotation.jpg>
- Giron, C.C. (Photographer). (2007). *Cortadora de metal* [Photograph]. Retrieved February 3, 2017, from https://commons.wikimedia.org/wiki/File:Cortadora_de_metal.JPG
- Heins, C. (Photographer). (2008). *New York from above* [Photograph]. Retrieved February 3, 2017, from <http://www.freeimages.com/photo/new-york-from-above-1209275>
- Infrogmation (Photographer). (2007). *La Rocca House front door*. [Photograph]. Retrieved February 3, 2017, from <https://commons.wikimedia.org/wiki/File:UptownLaRoccaHouseFrontDoorTigarRag.jpg>
- Katpatuka. (Photographer). (2009). *ThyssenKrupp Duisburg 016* [Photograph]. Retrieved February 3, 2017, from https://commons.wikimedia.org/wiki/File:ThyssenKrupp_Duisburg_016.jpg
- Namavar, E. (Photographer). (2005). *Factory* [Photograph]. Retrieved February 3, 2017, from <http://www.freeimages.com/photo/factory-1418216>
- P199. (Photographer). (2010). *Kidd mine 2* [Photograph]. Retrieved February 3, 2017, from https://commons.wikimedia.org/wiki/File:Kidd_Mine_2.JPG
- Santana, E. (Photographer). (2007). *Fence 5* [Photograph]. Retrieved February 3, 2017, from <http://www.freeimages.com/photo/fence-5-1311796>
- Schuetz-mediendesign. (Photographer). *Saxophone music gold gloss* [Photograph]. Retrieved February 3, 2017, from <https://pixabay.com/en/saxophone-music-gold-gloss-546303/>

Talib, W. (Photographer). (2005). *Batteries 1* [Photograph]. Retrieved February 3, 2017, from <http://www.freeimages.com/photo/batteries-1-1425354>

Talib, W. (Photographer). (2005). *Batteries 4* [Photograph]. Retrieved February 3, 2017, from <http://www.freeimages.com/photo/batteries-4-1425348>

tom def. (Photographer). (2005). *Strip mine* [Photograph]. Retrieved February 3, 2017, from <http://www.freeimages.com/photo/strip-mine-1565019>

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