



The question:

How do we mine?

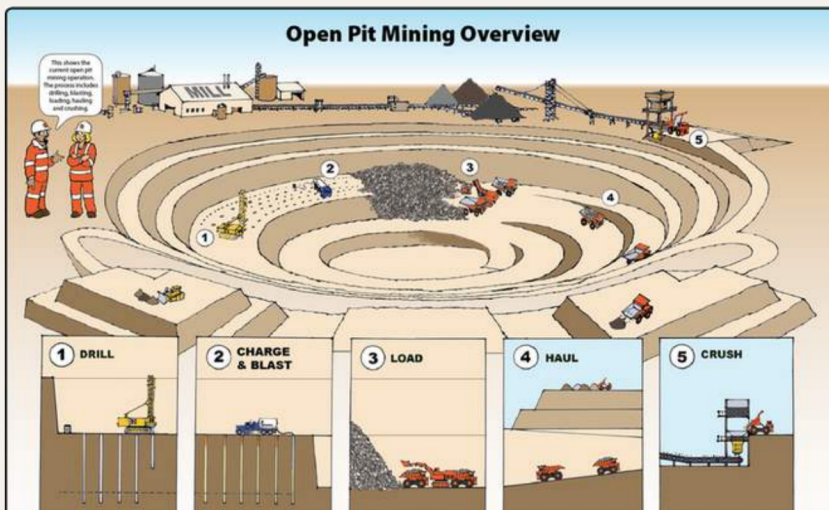


Mining is so much more than just picking a spot to start digging and just hoping to get lucky. Modern mining involves a lot of science. Local rocks and minerals, as well as the environment, are studied for suitability.

A mine will be started if there is evidence that there is enough of the desired material to be worth digging for and that it can be done in a way safe to the environment, nearby towns, and workers.

The type of mine used will depend largely on the geology of the area. What kind of rocks are there? How deep is the desired material buried? How does the desired material form?

There are actually many varieties of mines (strip, dredging, hydraulic mining, drift, slope, bell pit, borehole, room and pillar, seabed mining, etc.) but we'll look at two common ones.



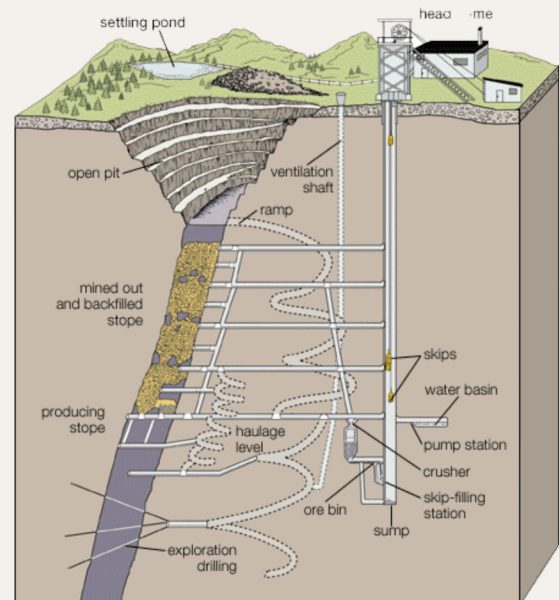
<https://mineralsed.ca/learning-resources/mining101/mineral-resources/>

Surface mines (like the open pit mine in this diagram) collect material simply by digging down (or sideways), collecting the material and hauling it in trucks to an area where it can be sorted and processed.

Materials commonly mined this way: Marble, Limestone, Salts, Coal, Granite, Diamonds, Gypsum, Metal ores (copper, gold, silver, etc.)

Underground mines (like the shaft mine in this diagram) need to be carefully planned so that miners can get down to the desired materials and collect them safely, as well as getting materials back to the surface. On top of normal mining dangers of falling rock, flooding, and large machinery extra risks like tunnel collapse, building air toxicity due to gas pockets or dusts mixed with poor circulation, claustrophobia, nyctophobia, or even being trapped for long periods if power is lost. Fortunately, since mines know about these dangers they can find ways to protect their workers.

Most commonly metals are mined this way: gold, silver, copper, zinc, platinum-palladium, etc. However, particularly productive surface mines may put in a shaft.



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<https://www.britannica.com/technology/mining/Underground-mining>

Let's try!

Dear adults: Watch the little fingers while we crush and help with the sharp part.
P.S. Recipe included to use those crumbs

All mines end up having to break down the materials they collect to a size that is appropriate for sorting and processing. But there are a lot of different ways to break down a material, so let's figure out what works best!

You will need:

- 3 freezer zipper bags or 6 sandwich bags
- 6 cookies (shortbread, digestive, sugar cookie, or similar)
- rolling pin or heavy jar
- grater or zester
- sieve/strainer with holes under 1 mm
- kitchen towel
- 4 bowls or plates for crumbs
- timer (cellphone!)
- kitchen scale (optional)



Instructions:

We have a delicious recipe to try, but we need cookie crumbs! What is the best way to make them?

Place two cookies in each bag and push out the air as you seal it. If you are using a thinner bag (like a sandwich bag), double bag it so you don't make a mess. Label the bags + bowls so you can tell them apart.

Method 1: Abrasion *damage caused by rubbing*

1. Set the timer for 1 minute.
2. Take the first bag of cookies and shake it vigorously until the time is up.
3. Use the sieve to separate any crumbs made by the process into a bowl and place the leftover cookies back in the bag.

Method 1: Abrasion - Take 2!

If you felt a little disappointed with your first try at abrasion, why not try it again with something harder to rub against?

1. Place your grater in a comfortable position, and take out the cookie leftovers from your first bag.
2. Set the timer for 1 minute.
3. Rub the cookies against the grater until the time is up.
4. Use the sieve to separate any crumbs made by the process into a bowl and place the leftover cookies back in the bag.



Compare your crumb piles and your leftover pieces. You can weigh them, or just look at them. What gave you the most crumbs in a minute? What gave the nicest crumbs? Which way would be best if you were trying to sort something out, like chocolate chips?

Method 2: Impact *damage caused by a sudden force*

1. Wrap the second cookie bag in a folded kitchen towel and place on a table or counter.
2. Set the timer for 1 minute.
3. Use your rolling pin or jar bottom to firmly stomp on the bag until the time is up.
4. Use the sieve to separate any crumbs made by the process into a bowl and place the leftover cookies back in the bag.

Method 3: Compression *damage caused by slow pressure*

1. Wrap the third cookie bag in a folded kitchen towel and place on a table or counter.
2. Set the timer for 1 minute.
3. Use your rolling pin or side of the jar to press down on the cookies and roll back and forth until the time is up.
4. Use the sieve to separate any crumbs made by the process into a bowl and place the leftover cookies back in the bag.



"Hello Dolly" Squares 8x8" pan recipe

Ingredients

1 1/2 cups	cookie crumbs
1/2 cup	butter (melted)
1 cup	shredded, unsweetened coconut
1 cup	chopped raw pecans or walnuts (or your fav. nut or replacement)
1 cup	milk or dark chocolate (chunks or chips)
1 can	sweetened condensed milk

This one can get a little sticky, so be sure to line your pan with parchment paper and give it a good spray.

1. Preheat the oven to 325F / 165 C.
2. Stir together the cookie crumbs and melted butter until they come together kind of like a squishy dough. Press the mixture firmly into the bottom of the pan, making sure it is covered completely.
3. Mix your chocolate, coconut, and nuts and sprinkle evenly over the crumb base.
4. Pour the sweetened condensed milk over everything, making sure to get all the edges.
(Alternately: you can mix the condensed milk with everything else before spreading over the cookie base if you want to really make sure it's all covered.)
5. Bake for 30-35 minutes, the edges should be turning golden brown.

Lemon Slice 9x13" pan recipe

Ingredients

3 cups	cookie crumbs
1 cup	butter (melted)
4	eggs (large)
1 1/2 cup	white sugar
1/4 cup	AP flour (cornstarch is a good GF option)
(approx. 2/3 cup)	juice + zest of two lemons (limes also work nice)
1/4 cup	icing sugar



Usually comes out of the pan very nicely, but pan spray never hurt anyone.

1. Preheat the oven to 350F / 165 C.
2. Stir together the cookie crumbs and melted butter until they come together kind of like a squishy dough. Press the mixture firmly into the bottom of the pan, making sure it is covered completely.
3. Beat your eggs until they just start to get foamy.
4. Beat in flour and sugar completely.
5. Stir in lemon just before pouring the mix over your crumb base.
6. Bake for 20-25 minutes, it should be just starting to brown. The lemon may still be somewhat liquid when removed, but it should set as it cools. (If it looks completely liquid, give it a few more minutes.)
7. Dust with icing sugar once cooled.