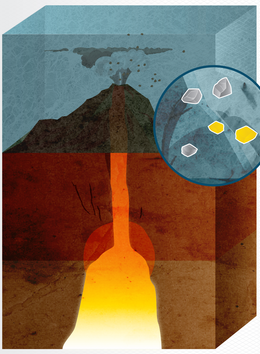
EVERYTHING YOU NEED TO KNOW ABOUT VMS

Volcanogenic Massive Sulphide Deposits



VMS deposits are rich in base metals such as copper, zinc, lead and other minerals.

VMS deposits can also produce precious metals such as **gold and silver.**

% WORLD METAL PRODUCTION FROM VMS DEPOSITS:

ZINC	22%
COPPER	6%
LEAD	9.7%
SILVER	8.7%
GOLD	2.2%

There are more than 900 VMS deposits globally, averaging ~17Mt grading, with 1.7% copper, 3.1% zinc, and 0.7% lead.*

New deposits are still being formed today, but some are as old as 3.4 billion years

Source: Cornwall

**A compilation of current resource and historical production figures sourced from academic data from 904 VMS around the world suggests the deposit type averages ~17 Mt grading 1.7% copper, 3.1% zinc, and 0.7% lead– signalled that this data set average is skewed by a subset of 'giants' (>20 Mt; e.g., Brunswick No. 12 [230 Mt], Kidd Creek [138 Mt], and Windy Craggy [500 Mt]) and is inclusive of copper-rich and zinc-rich 'end-members' (median tonnage of ~2 Mt).*

WHERE ARE VMS DEPOSITS FOUND?

VMS deposits are found worldwide, and often form in clusters, following the tectonic plate boundaries in areas of ancient underwater volcanic activity.

Tomorrow's VMS deposits are being formed today.

Several major VMS camps are known in Canada, including the **Flin Flon, Bathurst, and Noranda** camps. High-grade deposits within these camps are often in the range of 5 to 20 million tonnes, but can be considerably larger.

The **Iberian Pyrite Belt**, which runs through Portugal and Spain, is home to about 90 VMS deposits, of which several are larger than 100 Mt.

MINERALIZATION

VMS deposits form originally on, or below, the ocean floor and are typically associated with volcanic and/or sedimentary rocks.

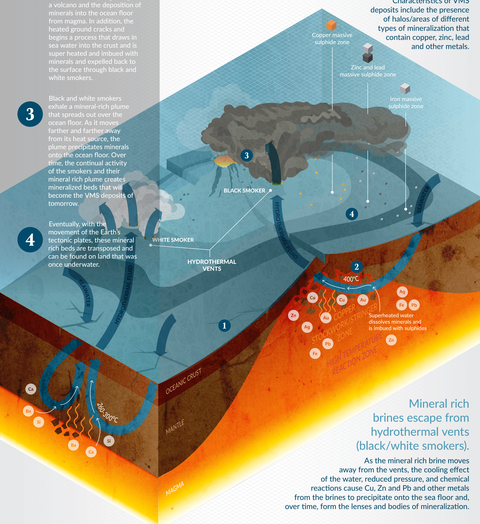
1 At sections where the Earth's crust is thin due to faulting or separation of tectonic plates, the magma heats up the ocean floor.

2 As the Earth's crust warms up, the ground softens and allows heated magma to escape towards the ocean/crust contact, the early beginning of a volcano and the deposition of minerals into the ocean floor from magma. In addition, the heated ground cracks and begins a process that draws in sea water into the crust and is super heated and imbued with minerals and expelled back to the surface through black and white smokers.

3 Black and white smokers exhale a mineral-rich plume that spreads out over the ocean floor. As it moves farther and farther away from its heat source, the plume gradually precipitates minerals onto the ocean floor. Over time, the continual activity of the smokers and their mineral rich plume creates mineralized beds that will become the VMS deposits of tomorrow.

4 Eventually, with the movement of the Earth's tectonic plates, these mineral rich beds are transposed and can be found on land that was once underwater.

Characteristics of VMS deposits include the presence of halos/areas of different types of mineralization that contain copper, zinc, lead and other metals.



Mineral rich brines escape from hydrothermal vents (black/white smokers).

As the mineral rich brine moves away from the vents, the cooling effect of the water, reduced pressure, and chemical reactions cause Cu, Zn and Pb and other metals from the brines to precipitate onto the sea floor and, over time, form the lenses and bodies of mineralization.

ENORMOUS POTENTIAL

A shining example of VMS deposits is Kidd Mine, which has been in production since 1966 and has produced a whopping:

9 MILLION TONNES OF ZINC

3.4 MILLION TONNES OF COPPER

12,000 TONNES OF SILVER

VMS deposits have the potential for long term production due to the formation of clusters of deposits or ore lenses in close proximity, and the polymetallic nature of the ore.

Typically, several deposits feed a central mill, creating economies of scale. By-product credits generated from production of different metals enhance the cash cost profile for the mining companies and thus benefit their investors.