

# A PROSPECTOR'S GUIDE TO VMS DEPOSITS IN NEWFOUNDLAND AND LABRADOR

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# A PROSPECTOR'S GUIDE TO VMS DEPOSITS IN NEWFOUNDLAND AND LABRADOR

## *What are VMS Deposits?*

Volcanogenic massive sulphide (VMS) deposits are one of the most common families of mineral deposits on earth. They consist of irregularly-shaped, tabular bodies of nearly 100% sulphides within volcanic host rocks. Pyrite is generally the most abundant sulphide, though many non-Newfoundland deposits contain significant pyrrhotite. The base metals zinc (from sphalerite) and copper (from chalcopyrite) are the two most important commodities produced from most VMS deposits; lead (from galena) is common, but less important economically. Many ores have important gold and silver credits which have a positive impact on the economics.

Canada may have the world's greatest endowment of VMS deposits with great districts like Noranda, Matagami, Bathurst and Flin Flon, rich deposits like Eskay Creek and Buchans and giant deposits like Kidd Creek and Manitouwadge.

A typical VMS system consists of two main ore types, (1) massive sulphide and (2) stringer or stockwork ore with its associated alteration system. The massive sulphide is a much smaller target than the alteration zone and tends to be aligned in conformity with the host volcanic strata. The stringer/stockwork zone forms beneath the massive sulphide and consists of

sulphide disseminations and veining in altered volcanic host rocks. This zone can be very irregular in shape. The alteration zone associated with most VMS deposits forms a much larger target than the massive sulphide and is therefore one of the most important features to identify when prospecting for VMS deposits. A massive sulphide district contains a cluster of VMS deposits associated with a single or multiple alteration systems.

There are several different classes of VMS deposits and each member of each family is different from the rest. Don't worry if your prospect doesn't look exactly like Buchans!

## *Is Newfoundland and Labrador a Significant VMS District?*

On a worldwide scale, the Appalachians in general, and Newfoundland in particular, are recognized as an important VMS belt. They contain two of the world's great VMS "camps", Bathurst and Buchans. Both of these districts contained clusters of economic deposits which could form the cornerstone of almost any company. There has been significant production from other VMS deposits in Newfoundland (Rambler, Tilt Cove, Whalesback, Little Bay, Pilley's Island, Gullbridge, to name a few) and

a host of subeconomic deposits are known. Prospectors should take heart in the fact that brand new VMS deposits are found in Newfoundland virtually every year. The Archean greenstone belts in Labrador should contain economic VMS deposits, but exploration to date has not been encouraging. From a technical standpoint, these belts should be fertile ground for prospectors.

Apart from the mineral potential, Newfoundland has a lot going for it which prospectors should be quick to point out to their clients. Newfoundland's road and power systems, abundant fresh water, proximity to tidewater, political stability (though this could be argued), eager labour force and historic association with resource industries are all positive factors in selling your VMS prospect.

### *How do VMS Deposits Form?*

**VMS** deposits are a natural product of hydrothermal activity associated with submarine (underwater) volcanic activity worldwide. Seawater circulates through active volcanic rocks and becomes heated and picks up small quantities of metals from the rocks. The heated, "pregnant" seawater is spewed onto the sea floor as underwater geysers termed "black smokers" from which the sulphide minerals precipitate. As you are reading this, black smokers are creating new VMS deposits at thousands of sites throughout the world.

### *Are VMS Deposits an Attractive Exploration Target?*

The short answer is YES! They're attractive to the prospector because there are plenty of showings and new deposits are being found all the time. They're attractive to companies because the deposit type is well known and has an attractive economic profile. The combination of base and precious metals keeps these deposits in vogue through the wild market swings that tend to knock the wind out of other deposits (gold being a good recent example).

### *What to Look for in the Field?*

*Boulders:* Look for boulders of massive sulphide or of altered and mineralized rock. Find out the ice directions in the area and trace them back to source.

*Gossan:* Pyrite is usually the most abundant sulphide in VMS deposits. Look for the telltale, yellowish rusty "burn" (weathering) on pyritic outcrops; learn to distinguish between this and the more ochre-coloured carbonate alteration. But be on the lookout – some of the richest deposits, like Buchans, are pyrite-poor and high grade boulders from these are not gossanous. Hammer everything!

*Alteration:* If the alteration system is the haystack, the orebody is the needle. Chloritization, sericitization and pyritization are common and important. Silicification in small doses is a very

good sign. Visit Noranda (or closer yet, Gull-bridge) and get to know what “dalmatianite” looks like.

*Rock Types:* Volcanic rocks somewhere in the vicinity of your showing are a must for VMS deposits. VMS deposits form in a submarine environment, on or below the ocean floor. Clearly then, it is important that the volcanic rocks which you are prospecting were deposited in a submarine environment. Pillow lavas are a sure sign of submarine extrusion and any volcanic belt containing both pillow lavas and felsic volcanics is a good bet for VMS deposits.

*Sulphide Clasts:* Carefully examine any outcrops of breccia for clasts which may be altered and mineralized, or better yet, for massive sulphide clasts.

*Evidence of Faults:* We all have our faults and so do VMS deposits. Faults containing ground-up mineralized material are a very good sign.

*Specific Features:* Every VMS district is different and in each there’s one or two rock types of extraordinary importance. At Matagami it’s the “Key Tuffite”; at Buchans it’s the “Granite Conglomerate”. Get to know the important rocks in your area on an intimate basis!

## *Who Would be Interested in a VMS Showing?*

Almost any small to mid-sized minerals company with a base metals focus will be glad to examine your VMS property. Very large companies need very large deposits to sustain them in the long run. Because there are only a few “giant” VMS deposits in the world (for example Kidd Creek at Timmins), some of the largest companies prefer to look for porphyry copper and other types of deposits which offer

a greater probability of world-class size.

## *What Does a Buyer Want to See?*

*Regional Geology:* Are there other VMS deposits or mines in your belt? Felsic volcanics? Subvolcanic intrusions?

*Volcanic Rocks:* Are a “dime a dozen” but some textures are important. After you’ve shown him some mineralization, make sure you also show any good exposures of volcanic rocks. A variety of volcanic rock types is more promising than mountains of boring pillow lavas.

*Structural Complexity:* It’s a simple fact that VMS deposits occur in structurally complex settings.

*Alteration:* The stronger, the better. Chloritization, sericitization and silicification are the best signs. Chloritized felsic volcanics are better than chloritized mafics. Areas of K-feldspar, carbonate and epidote alteration will raise some geologist’s eyebrows.

*Mineralization:* Disseminations of pyrite or pyrrhotite in altered rock are the first step. Stringers (irregular veinlets, preferably with alteration selvages) of pyrite with base metal sulphide are better than those without. Barite is a common gangue mineral in some VMS deposits and is a good sign – learn to identify it.

*Grade:* The visitor is going to want to see that there’s some indication of ore grades on the property. Unfortunately, there are a large number of “barren” or low grade VMS deposits in Newfoundland (for example, big ones at Point Leamington, Pilley’s Island and in the Tulks Belt). You’ll have a harder sell if all you



can show is pyrite. On the other hand, large zones of massive barren pyrite characterize significant parts of some of the world's great VMS deposits. In Newfoundland, the Duck Pond deposit is dominantly massive pyrite but contains an ore grade core. Due to the realities of the market and smelting considerations, deposits which contain higher proportions of copper and precious metals (gold and silver) will be valued more highly than those which do not.

*Previous Work:* A new prospect will hold more mystery than a property that has been “killed” with hundreds of drill holes.

*Value added features:* Geochemical or geophysical anomalies will make your property more interesting.

*Geochemical Anomalies:* Soil geochemistry is generally a very effective VMS exploration technique in Newfoundland. If you can't sell your prospect as it is, consider doing a small soil geochemical survey to demonstrate untested potential.

*Geophysical Anomalies:* EM, IP, magnetic and gravity surveys are the most common geophysical methods used in the search for VMS deposits. Chalcopyrite and pyrrhotite are the two most conductive VMS minerals and deposits containing appreciable amounts of these are excellent EM conductors. On the other hand, deposits with lots of sphalerite and barite are may only be weak conductors. VMS deposits and their mineralized alteration zones produce strong Induced Polarization anomalies. Some VMS deposits contain abundant magnetite and are strongly magnetic. Be aware that strong EM, IP, magnetic and gravity responses can be produced (and indeed are most commonly produced) by sources which are not of economic interest.

*Litho geochemistry:* Whole rock geochemistry (or “litho geochemistry”) has become a standard

tool used by geologists to help quantify alteration. VMS alteration is a complex topic but the simplified bottom line is that soda ( $\text{Na}_2\text{O}$ ) depletion is an important characteristic of the alteration zones at all VMS mines.  $\text{Na}_2\text{O}$  contents in volcanic rocks of less than 1% will arouse interest and less than 0.1% will have some geologists turning cartwheels. Most geologists visiting your property will want to take a sample or two; copies of their results will be of interest to the next visitors.

## *General Advice*

- ⇒ *Size is not everything* at the prospecting stage. Your showing may only be small, but many important VMS deposits do not even come to surface and are completely covered by “dead-looking” rocks (these are called “blind” deposits). Because most of the obvious outcropping deposits have already been found, blind deposits, or those showing just a small area of altered rocks at surface are where the next generation of VMS deposits will be found.
- ⇒ Get out and visit as many VMS deposits, prospects and mines as you can. You'll see lots of important things that can't be crammed into a short write-up.
- ⇒ Be assured that there really are plenty of undiscovered VMS deposits in Newfoundland and Labrador. There's one out there waiting for you. Good luck!

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