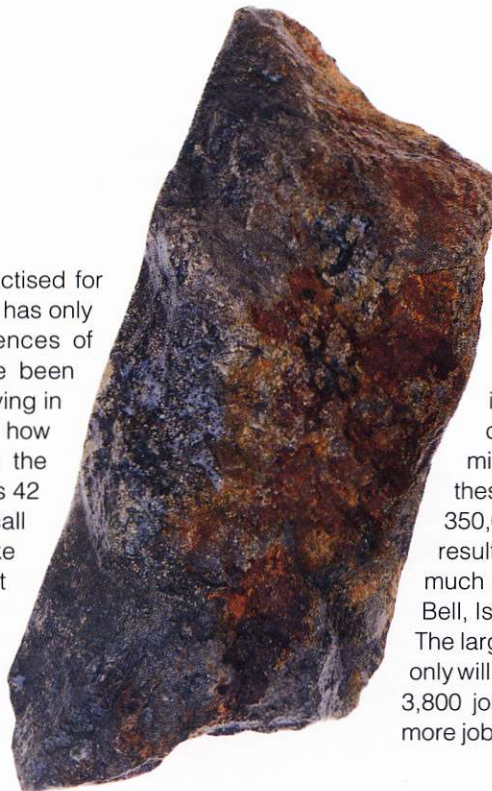


Three giant copper discoveries replace BC's dwindling reserves

Geophysics and geochemistry prove invaluable tools for finding hidden ore deposits

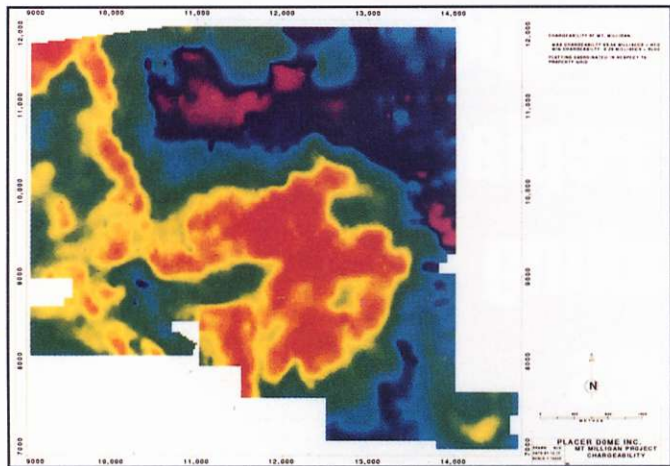
by Ellsworth E. Dickson

Although mining has been practised for several thousands of years, it has only been recently that the sciences of geophysics and geochemistry have been used to discover mineral deposits. Living in the city, we tend to take for granted how dependent we are on mining. Even the simple act of phoning for pizza utilizes 42 different minerals to make the phone call plus all the various metals used to make the delivery truck. The metals that make up these machines had to be discovered and developed into economically viable mines, no easy feat. The usual rule of thumb is that one property in a thousand worth ex-

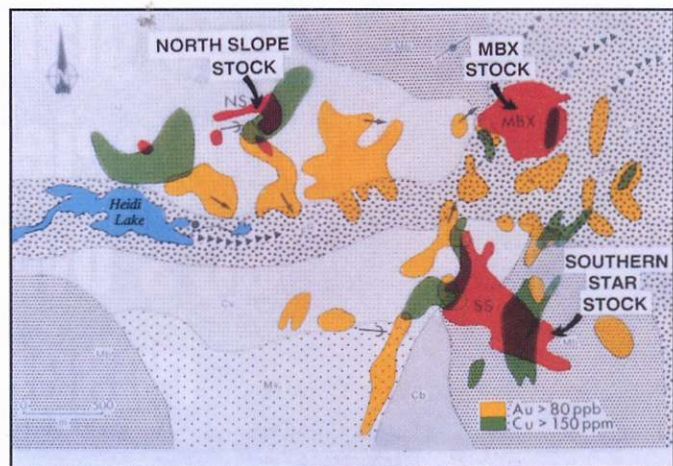


ploring ever becomes a mine.

Back in the 1960s and 70s, a number of large copper deposits were discovered in British Columbia that were developed into some of Canada's largest mines. In 1987, copper mining alone in BC contributed C\$837 million to the provincial economy. However, these deposits are being depleted at the rate of 350,000 tonnes of copper metal per year. As a result, copper production in BC could drop by as much as 45% by the year 2000 with the closing of Bell, Island Copper, Afton, Equity and other mines. The large Brenda operation has already closed. Not only will this result in a huge loss in revenue, but some 3,800 jobs will be gone forever. In addition, many more jobs will be lost in related industries that service



The red coloring on the induced polarization survey indicates a chargeability high over the orebodies.



The gold and green colors on the geochemical survey map indicate higher metal concentrations of gold and copper.

Geological graphics courtesy Placer Dome Inc.

the mining operations and depend on the wealth created by its employees.

Science and the Search for Minerals

As the more easily discovered orebodies were mined out, new prospecting techniques were developed such as geophysics and geochemistry, enabling geologists to "see" deep into the earth, increasing the chances of locating economic mineral deposits.

One of the most important pioneers in geophysics was the late Dr. Norman Keevil Senior, who went from college professor to running one of Canada's largest mining companies, Teck Corporation. Applying World War II airborne magnetic submarine detector technology, Dr. Keevil implemented vast aerial mapping programs using similar geophysical instruments to detect "anomalies" in the earth's magnetic field. These anomalies provide valuable clues to locate buried metal deposits.

Strictly speaking, an anomaly is an area different than that surrounding it. Dr. Keevil's geophysical surveys of the area near Temagami, Ontario indicated promising anomalies, which when diamond drilled, revealed drill core of almost pure chalcopyrite, a high grade ore of copper. The Temagami deposits were developed into one of the richest copper mines ever discovered in Canada. From this spectacular beginning, the use of geophysics has now become a valuable tool used in virtually every exploration program.

In addition to geophysics, geochemistry also became a widely used tool to search for mineral deposits. It was discovered that metals in bedrock slowly leach into the surrounding soil and plant life. Thus, it is possible to analyze soil, leaves and even pine cones to detect minute quantities of gold, copper and other metals, indicating metal concentrations in the bedrock below the surface. Dozens, sometimes hundreds of samples are taken along a grid pattern, analyzed for various elements and plotted on a map to indicate any anomalous values.

Hunting for Elephants

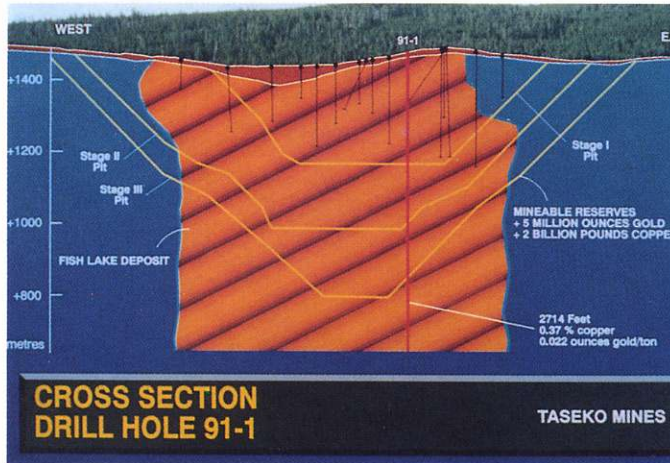
Against this backdrop of depleting copper reserves, an entrepreneurial group in Vancouver, BC had enough faith and

courage to take a shot at discovering a major copper/gold deposit in an area about 100 miles northwest of Prince George. The chosen area was along a trend of what are known as alkaline porphyry orebodies which begin in south-central BC and extend up to the Alaska Panhandle. Through the facilities of the Vancouver Stock Exchange, Continental Gold Corp. raised the necessary exploration funds to start work. Comprised of well known mine financier Robert Hunter and geologists Robert Dickinson, Jeff Franzen and Douglas Forster, the group proceeded with a preliminary exploration of the Mt. Milligan property.

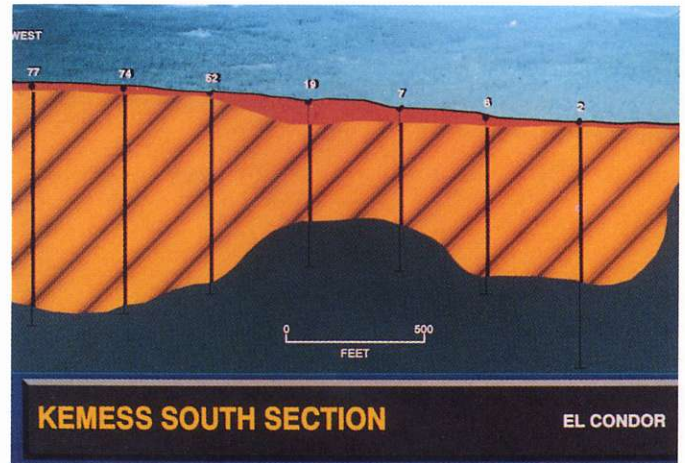
Not only did this group outline some 1.7 billion pounds of copper on the Mt. Milligan property, the two orebodies also contained 6.6 million ounces of gold in about 440 million tons of rock. Grading 0.20% copper and 0.015 ounces gold/ton, the Mt. Milligan deposits are among the largest in the world. Indeed, large enough to provide some 400 jobs for 20 years. However, the story does not end here. This same group went on to outline two more copper/gold deposits in northern BC, both of which also appear to be super giants.

Through their junior company El Condor Resources Ltd. (ECN-VSE), the Kemess South deposit, located about 250 miles northwest of Prince George in the southern Toodoggone region, now has reserves defined totalling 140 million tons containing 0.7 billion pounds of copper and 2.4 million ounces of gold. Another





The cross section of the Fish Lake copper/gold deposit, cylindrical in shape, indicates the three stages of mining.



A cross section of the Kemess South copper/gold deposit located in the Toodogone region of north-central BC.

Geological graphics courtesy El Condor/Taseko Mines

of the group's junior companies, Taseko Mines Ltd. (TKO-VSE), has outlined reserves of 600 million tons containing 3.8 million pounds of copper and 9.6 million ounces of gold in the Fish Lake deposit located about 50 miles southwest of Williams Lake.

As the development of an operating mine is a time consuming and expensive process, it won't be until the second quarter of 1995 that the Kemess and Fish Lake projects could start production. With more of BC's large copper producers closed down or nearing the end of their mine life in the next few years, one could say the three discoveries have arrived in the nick of time. BC needs the revenue, the current mine employees will need the work and the communities need the spending power that these large mines will generate.

How They Did It

As far as the discovery of the Mt. Milligan deposits was concerned, "It was the combination of different sciences that resulted in finding the orebodies", says one of the discoverers, Mark Rebagliati, consulting geological engineer. As can be seen from the accompanying cross sections, no bedrock protrudes above the overburden left behind when the last glacier retreated some 10,000 years ago, making for a hidden or "blind" deposit.

Continental Gold and joint venture partner BP Canada gave Mark some guidelines. They wanted to find a deposit with a very long mine life of at least 10

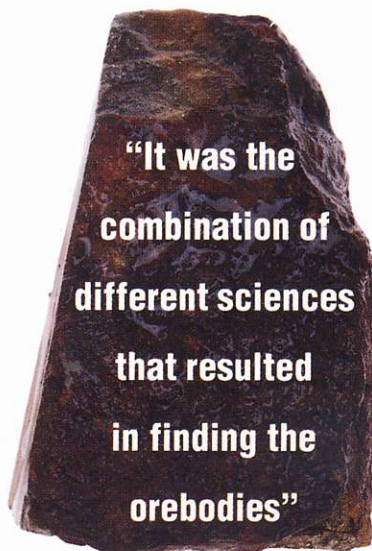
years, preferably 20 to 30 years. It was known that porphyry deposits in British Columbia offered that potential, specifically porphyry copper/gold deposits. These deposits were formed when concentrations of metal welled-up from deep in the earth carried by molten intrusive rocks. The metal values were then widely disseminated throughout the host intrusive as well as into the surrounding country rock. Today, these porphyry deposits are characterized by low grades and huge tonnages that can be mined by low cost, open pit methods.

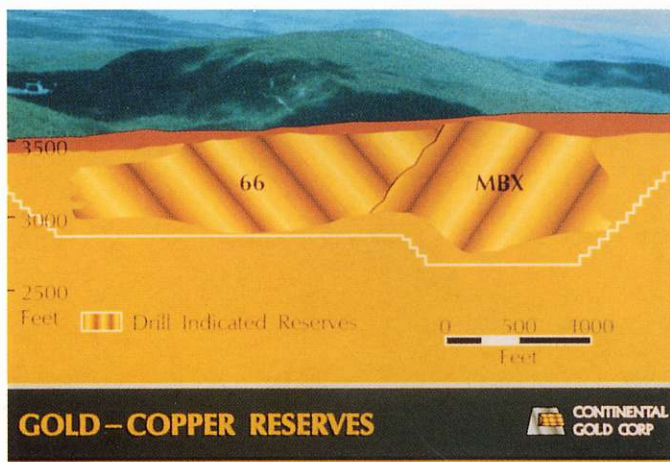
During the search of geologic literature, it was noted that rocks of the Nicola Group and Takla Group formed during the Upper Triassic and Lower Jurassic

ages (135 - 225 million years ago) already hosted large scale copper/gold deposits including the Copper Mountain deposit near Princeton, BC, the Afton deposit near Kamloops and the Bell deposit near Smithers, BC.

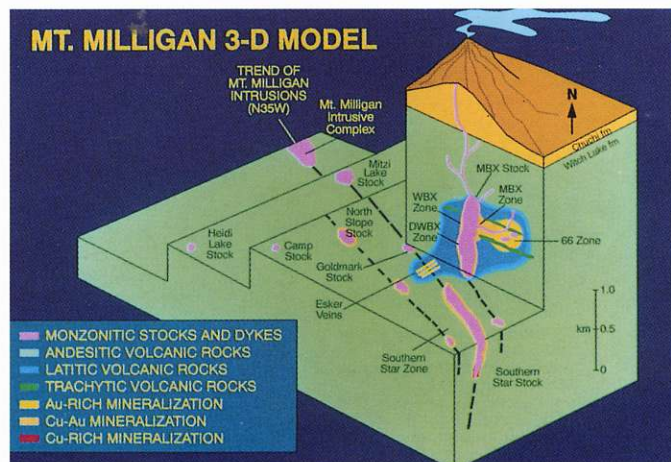
As the southern part of the belt had been explored, the region north of Prince George became a focus. From Geological Survey of Canada geological maps and airborne magnetic maps, some 20 targets areas were isolated, ranging in size from 3.7 to 12.5 square miles. The final ground selection was based on evidence from reconnaissance traverses, alteration assemblages, geochemistry, and known geology. The choices were now narrowed down to three areas. At this point thousands of soil samples were taken and analyzed for copper, gold and 30 other elements. It was discovered that one particular area about 2.7 square miles in size had anomalous values in gold and copper.

Unfortunately for the explorers, there were no outcrops of bedrock protruding above the glacial till. However, a valuable clue was provided by a prospector nearby who did find an outcrop with low copper and gold values. The explorers speculated the prospector's samples could be from a vein that might lead to a major mineral system, which eventually proved to be true. As the area of interest was so large, induced polarization surveys were completed to further define the target. This geophysical technique polarizes the specks of metal in the earth





A cross section showing how overburden masks the ore deposits at Mt. Milligan.



A three-dimensional geological model of Mt. Milligan.

Geological graphics courtesy Placer Dome Inc.

by sending an electrical current through the bedrock and measuring the time of decay when the current is shut off, indicating the presence of metal when the current "lingers".

Instead of pinpointing the mineral system, the IP surveys expanded the area of interest. The mineral system in question was going to be gigantic in size. Further geophysical surveys were completed, in particular, ground magnetics to pick up magnetite which is commonly associated with this type of deposit. Compiling all the information, it was discovered there were magnetic highs within a high concentration of metals (as indicated by the IP surveys), all within geochemical anomalies. Now there were three coincident anomalies which finally provided the initial drill targets. All the exhaustive efforts were about to pay off. The first three shallow drill holes intersected ore-grade mineralization.

It was only by the integration of geophysics, geochemistry and geology that these giant mineral deposits were discovered. There were other individuals that played important roles in the beginning of development at Mt. Milligan and Kemess South, including consulting geologist David Copeland, presently Project manager and director of El Condor, who recognized similar geological models from his work in the South Pacific. With the assays from many diamond drill cores, calculations were made to estimate the tonnage and grade of the Mt. Milligan deposits. By this time, five years

of exploration costing \$22 million had gone into the project which included 750 drill holes and over 110 miles of drill core.

As is the custom, senior resource companies usually buy out the junior companies when sufficient ore reserves have been defined to prepare for a sizeable mining operation. In the case of Continental Gold, one of Canada's largest mining companies, Placer Dome Inc., paid \$258 million for the project and is now engaged in engineering studies to investigate the feasibility of placing the property into commercial production.

Meanwhile, at the Kemess project, also a blind discovery, which turned out to be two deposits, the Kemess North and South, step-out drilling is continuing to expand reserves. El Condor has a 100% interest in the Kemess North and a 60% interest in the Kemess South. Assuming a positive feasibility study, it is expected the Kemess South mine would process 40,000 tons of ore per day averaging 0.23 per cent copper and 0.017 ounces gold per ton.

This translates to well over 65 million pounds of copper and almost 230,000 ounces of gold annually for at least 15 years. To place the mine into production, capital costs are projected at \$275 million with a project payback in 3.5 years.

At the Fish Lake deposit, a mine production model has also been developed indicating a four-year capital cost payback. Not bad if you consider the capital cost of the project is going to be about \$400 million. Actually, as yet no one knows just how large the Fish Lake deposit is as the

drills have not reached the bottom of the copper/gold ore. Geologists and investors alike were recently amazed with drill results that included hole after hole with grades such as 0.37 per cent copper and 0.022 ounces gold/ton over 2,700 feet, or over half a mile in depth from surface! Prefeasibility projections for the Fish Lake deposit indicate that at a production rate of 66,000 tons per day, average annual production would be some 270,000 ounces of gold and 125 million pounds of copper over a mine life exceeding 30 years.

As with Continental Gold's Mt. Milligan project, it is expected that major resource companies will take over and provide development funding to place the Kemess and the Fish Lake deposits into production.

It is hard to overstate the importance of these mineral discoveries for British Columbia and, of course the lucky shareholders, however, to give you some idea, the gross metal value in the Fish Lake deposit alone is worth about \$10 billion at current metal prices.

Three years ago, mining analysts were saying BC was in trouble. There was technical expertise, a stock exchange to raise money, miles of country to explore and government tax incentives. However, ore was running out and new discoveries were needed. While luck, faith and perseverance play a part in mineral exploration, it was science that unlocked the geological riddles at Mt. Milligan, Kemess and Fish Lake. **T**