

## Sullivan Geological Indicators

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(Property Visit)  
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CK

- **WORLD CLASS DEPOSITS** World class sedex deposits occur in clusters along regional structural lineaments. Additional world class sedex deposits should occur in the Sullivan district, southeastern B.C., Canada.

● NE Australia:	Broken Hill (BHP)	180mt	12%Zn, 13%Pb
	Dugal River	40mt	12%Zn, 2%Pb
	Mt. Isa	160mt	6%Zn, 7%Pb
	Lady Loretta	9mt	14%Zn, 8%Pb
	Hilton	40mt	10%Zn, 8%Pb
	Century	120mt	10%Zn, 1.5%Pb
	H.Y.C.	190mt	9.5%Zn, 4.1%Pb
	● Rep. of S. Africa:	Gamsberg	150mt
Broken Hill (BHP)		85mt	2%Zn, 4%Pb
Black Mountain		82mt	1%Zn, 3%Pb
Big Syn		101mt	2.5%Zn, 1%Pb
● SE B.C., Canada:	Sullivan	155mt	5.7%Zn, 6.6%Pb

- **SULLIVAN DEPOSIT CRITERIA**

- Structural intersection--provides plumbing and host for Zn-Pb-Ag ores.
- Vent system--provides conduit for Zn-Pb-Ag ores.
- Fragmental rocks--indicators of active structures and venting.
- Tourmalinite rocks--indicators of boron degassing and venting.
- Gabbro arch--indicator of active structures producing Zn-Pb-Ag ores.

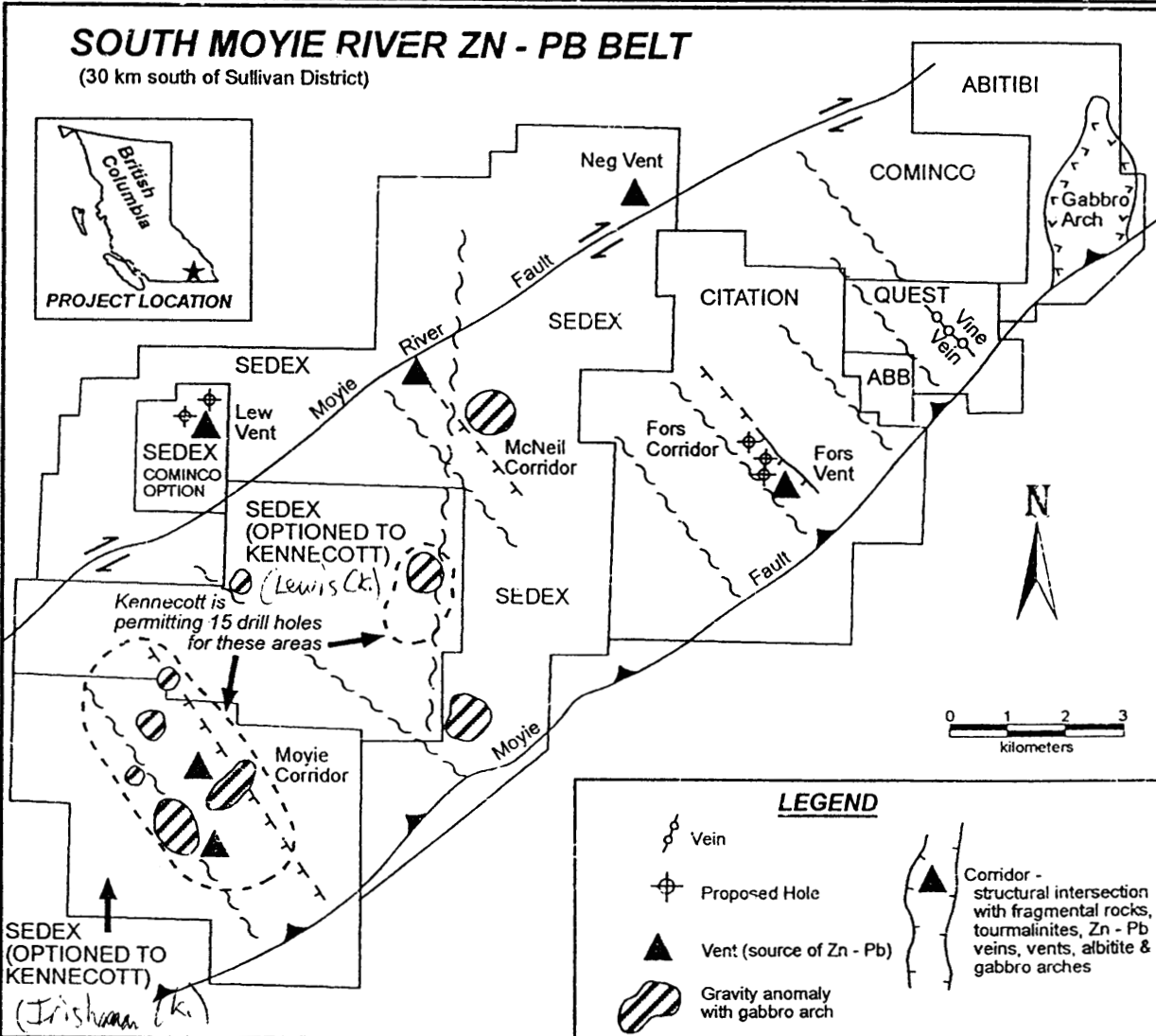
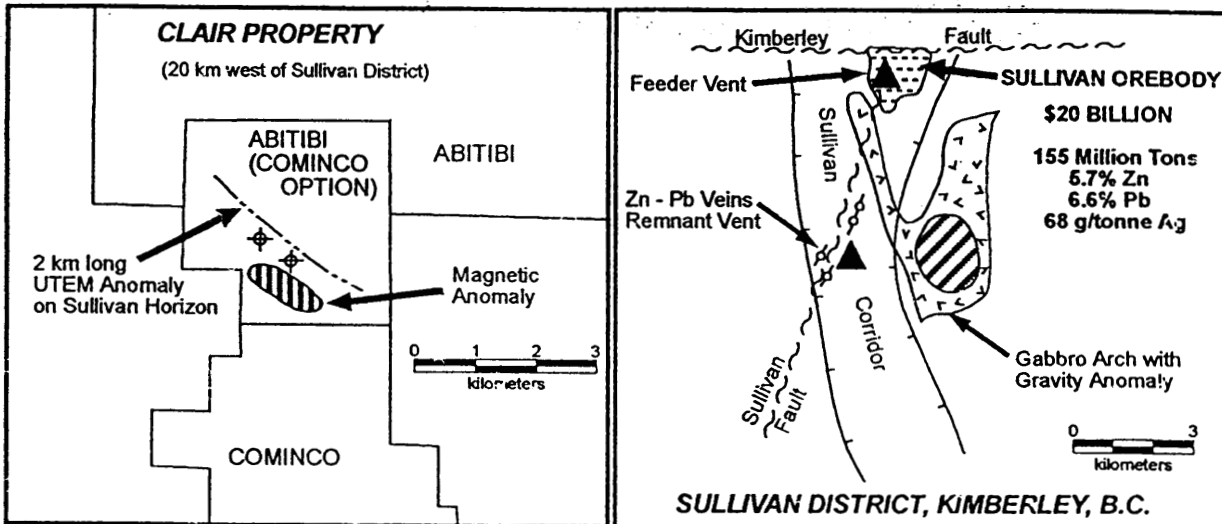
- **CRANBROOK AREA PROPERTIES**

<u>Property</u>	<u>Structure</u>	<u>Vent</u>	<u>Fragmentals</u>	<u>Tourmaline</u>	<u>Arch</u>
Sullivan Mine (Cominco)	yes	yes	yes	yes	yes
Irishman (Kennecott Option)	yes	yes	yes	yes	yes
Lewis (Kennecott Option)	yes	yes	yes	yes	yes
Lew (Cominco Option)	yes	yes	yes	yes	?
Clair (Cominco Option)	yes	?	?	yes	yes
Yak (Abitibi)	yes	yes	yes	yes	yes
Pyramid Peak (Abitibi)	yes	yes	yes	yes	?
McNeil Creek (Sedex)	yes	yes	yes	yes	yes
Fors (Citation Resources CUE/VSE & ASE)	yes	yes	yes	yes	yes

# ABITIBI MINING CORP. ABB. v SEDEX MINING CORP. SDN. v

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## SEDEX EXPLORATION IN THE SULLIVAN DISTRICT, B.C.



# Sullivan Geological Indicators

## Regional (tectono-stratigraphic) Criteria

These are the "regional" criteria that we look for in selecting an area before we go into the field. These criteria are based on our knowledge of world class SEDEX district around the World and the detailed data developed by the Sullivan/Aldridge Research Group during the last 10 years.

- **WORLD CLASS DISTRICTS** First, we look for world class deposits. We know that world class deposits occur in clusters constituting a world class mining district. An example of a world class base metal deposit would be a single deposit containing over 100 million tons of ore grading over 10% combined Pb and Zn. Examples of world class mining districts would be:

1.	Australia Zinc Belt:	Broken Hill	180 mt	12%Zn, 13%Pb
		Dugal River	40 mt	12%Zn, 2%Pb
		Mt. Isa	160 mt	6%Zn, 7%Pb
		Lady Loretta	9 mt	14%Zn, 8%Pb
		Hilton	40 mt	10%Zn, 8%Pb
	Century(Kennecott)	120 mt	10%Zn, 1.5%Pb	
2.	Rep of S. Africa:	Gamsberg	150 mt	7%Zn, 0.5%Pb
		Broken Hill	85 mt	2%Zn, 4%Pb
		Black Mountain	82 mt	1%Zn, 3%Pb
		Big Syn	101 mt	2.5%Zn, 1%Pb
3.	SE BC, Canada	Sullivan	160 mt	5.5%Zn, 5.8%Pb

As anyone can see, there should be more deposits in the Sullivan district.

- **STRUCTURAL INTERSECTIONS** All of the world class deposits occur where a regional structural lineament is cut by cross-structures. Not only does the structural intersection provide the conduit for the mineralizing fluids but the intersection defines the geometry of the host basin for the deposit (ie. half graben). Examples of these structural elements in the Sullivan area are:

1. Regional structural lineament. This is the axis of the rift basin that produced the Purcell basin for the Purcell/Belt sediments to form in. The central axis of the "rifting" basin also provided the heat and conduits for the base metals to be transported to the surface.

2. Cross-structures. The cross-structure for the Sullivan deposit is the Kimberley fault. These are the structures that form the intersection and develop the half graben geometry. The half graben that developed in conjunction with the Sullivan deposit contains a variety of rocks, alteration, mineralization, etc that is informally called a "corridor". I personally, do not like the term corridor because it is misleading and misused, but since it is commonly used in the Sullivan district we will live with it.

### Field Criteria

These are the geologic "indicators" that we look for in the field. They can be identified and mapped. If you find an "accumulation" of the indicators they constitute a "corridor". Following is a list and discussion of the major indicators and their significance:

- **FRAGMENTAL ROCKS.** Fragmental is a field mapping term applied to a family of rocks that range from fault breccias, vent breccias, and tectonic breccias from seismic or fault activity. The importance of finding and mapping fragmental rocks is that they identify **STRUCTURES** which may or may not be related to growth faults from which SEDEX mineralization originates.
- **VENT SYSTEMS.** Vents are believed to be the source for the SEDEX base metals. A large tourmalinized vent system occurs beneath the western part of the Sullivan deposit. In general vents are composed of fragmental rocks, altered rocks (tourmaline) and high-angle sulphide veining indicative of the source area for the SEDEX mineralization. We believe that vents can be stacked on top of one another throughout geologic time. In other words, a vent and SEDEX ore body could occur at the lower-middle Aldridge contact and an additional series of vents could occur along the same structure higher in the system. As an example, the FORS vent occurs at Hiawatha time approximately 400 meters above the LMC (LMC is the lower-middle Aldridge contact or Sullivan Time) in the Fors area. Recent drilling by Citation has found good Sullivan indicators (massive pyrrhotite veins, abundant disseminated sphalerite and galena, black and brown tourmalinite, bedded fragmental, albitite, cross-cutting fragmental and intensely disrupted sediments) at the LMC 400 meters below the FORS vent.
- **A GABBRO ARCH.** The presence of a gabbro arch is indicative that a major structure was active in the area when the gabbro sills were intruded into the sediments. This would allow the sills to move ("jump") up or down section along the active fault. The most active faults would "probably" be growth faults along which VENT SYSTEMS could develop which may produce SEDEX deposits. A gabbro arch occurs at Sullivan, at the Fors and we have 2 probable gabbro arches on the south end of our Moyie property near the Panda basin. The gabbro arches that we see on the Moyie property have the same relationship to the Moyie fault that the gabbro arch at the Fors does and all may (?) be part of the same system.

## Comparison of Sullivan District Properties

### Sullivan Mine

- Structural Intersection--Rift axis (N. Star-Sullivan corridor) and Kimberley fault.
- Vent System--Discordant vent system under the western part of the ore body contains tourmalinite and pyrrhotite alteration pipe, muscovite and albite-biotite-chlorite alteration.
- Gabbro Arch--"The" gabbro arch occurs along the Sullivan fault suggesting that the Sullivan fault was active after deposition of the Sullivan ore body.
- Fragmental Rocks--At the Sullivan deposit fragmental rocks occur (1) within the discordant western vent zone, (2) as chaotic breccia associated with the ore body, and (3) as intraformational conglomerate within the North Star-Sullivan graben outlining the structures which form the graben.
- Mineralization--Vein- and stratiform-type Pb-Zn mineralization occurs through the corridor. The vein-type mineralization at the Stemweinder constitutes a small ore body. The stratiform-type mineralization at the North Star constitutes a small ore body.

### Fors

- Structural Intersection--Rift axis and the Moyie fault.
- Vent System--A small dewatering vent, termed the Fors vent, occurs at Hiawatha time approximately 400 meters above the LMC. Both vein- and stratiform-type Pb-Zn-Ag-Au mineralization occurs with the Fors vent along with a suite of "epithermal-type" As-Hg-Sb minerals.
- Gabbro Arch--A gabbro arch has been defined by the latest Citation drilling and may extend from Hiawatha time down to the LMC.
- Fragmental Rocks--Both cross-cutting and bedded fragmental rocks along with intensely disrupted sediments have been found above and at the LMC by recent Citation drilling.
- Mineralization--Both vein- and stratiform-type Pb-Zn mineralization occur at the "Fors horizon" approximately 400 meters above the LMC. Recent Citation drilling has identified disseminated sphalerite and galena at "Sullivan Time" or the LMC.

### Moyie Property

- Structural Intersection--Rift axis and the Moyie faults (same as at the Fors).
- Vent System--Probable vent system on the south end of the property in the Panda basin. Kennecott has mapped cross-cutting fragmentals and believes a "Fors-type" system may occur at Hiawatha time. This will be drill tested this summer by Kennecott.
- Gabbro Arch--Kennecott has mapped two arches termed the Bear Dyke and the MK dyke on the south part of the property in the Panda basin. Another arch may have been identified in Sedex Mining Corp.'s SMC-95-1 drill hole along the western side of Active Ridge. The three 3-mgal gravity anomalies identified by Kennecott during the 1996 gravity survey are positioned over the gabbro arches and may be related to them.

- Fragmental Rocks--Kennecott mapped fragmental rocks in the Panda basin and the Lewis areas during 1996. Both of these may be related to a vent system.
- Mineralization--Disseminated Pb-Zn and arsenic mineralization has been mapped by Kennecott in the Panda basin and may be associated with a vent at Hiawatha time.

### Yak Property

- Structural Intersection--Rift axis and unknown fault.
- Vent System--Two tourmalinized vent systems at Sundown time were located during the 1996 reconnaissance mapping. Additional systems are probably present.
- Gabbro Arch--1996 airborne magnetic survey identified probable gabbro arch in the Ryan Creek area. Follow-up planned for 1996. Previous gravity survey by Chevron in 1985 may have identified a gabbro arch on the north part of the property.
- Fragmental Rocks--A large tourmalinized fragmental sheet has been mapped by Chevron around the Mt. Mahon area. Prospecting in 1996 discovered a large (1 km x 4 km) fragmental sheet below the Sundown marker which may be related to a long-lived structure extending north-south.
- Mineralization--None located to date.

### Pyramid Property

- Structural Intersection--Rift axis and the Kimberley faults (same as at Sullivan mine).
- Vent System--None detected to date but may occur along Alki Creek.
- Gabbro Arch--None detected to date but may occur along Alki Creek.
- Fragmental Rocks--Identified by Cominco in several areas, additional work needed.
- Mineralization--High-grade Pb-Zn-Ag veins mined along Pyramid creek in 1897. Abitibi Mining Corp. 1996 regional stream sediment sampling program identified several areas of high Pb and Zn plus Au in the area.

### Lew Vent (Cominco Option)

- Structural Intersection--Rift axis and unknown E-W-trending basement fault identified during Kennecott 1996 gravity survey. Locally, N-S-trending structures are outlined and intruded (?) by Moyie intrusives. The N-S-trending structures may produce a half-graben similar to the Sullivan corridor.
- Vent System--A tourmalinized vent, termed the Lew Vent, has been identified and drilled to a shallow depth by Cominco. The vent system may be at or above Hiawatha time similar to the Fors vent. The vent is probably positioned along one of the N-S-trending structures.
- Gabbro Arch--None detected to date.
- Fragmental Rocks--Vent breccias form the Lew vent. Additional fragmental rocks may be associated with the N-S-trending faulting.
- Mineralization--Pb soil anomaly down-dip to the vent system. A small (2-4 cm) high-grade (+5% Pb/Zn) stratiform occurrence at Hiawatha time within 1 km of vent.

### Clair Conglomerate (Cominco Option)

- Structural Intersection--Rift axis and unknown cross structure.
- Vent System--Some fragmental material within the conglomerate sheet may be from a vent but no vent identified to date.
- Gabbro Arch--No gabbro arch identified to date but gabbro material present in the sheet conglomerate.
- Fragmental Rocks--Fragmental rocks present within the conglomerate sheet but relation to structures undetermined to date.
- Mineralization--Extensive pyrrhotite and sparce Pb-Zn mineralization present in the conglomerate sheet.
- Geophysics--Coincident UTEM and magnetic anomaly over the Clair conglomerate which occurs at the lower-middle Aldridge contact. Detailed gravity survey planned for 1997.

## Exploration for World Class Pb-Zn-Ag Deposits

Sedex Mining Corp. and Abitibi Mining Corp. in a joint venture with Kennecott Canada Inc. are exploring in southeastern British Columbia for another world class base metal deposit such as the Sullivan mine containing 160 million tons of ore grading 6% Zn, 6% Pb and 67g/t Ag with a present worth of over \$20 billion dollars. We have assembled a team of experts, including ex-Cominco employees, who have developed a new exploration model based on their experience in the Sullivan district and the occurrence of similar type deposits around the World.

World class sedimentary exhalative (SEDEX) deposits such as the McArthur River, Century, Hilton and Mt. Isa deposits in Australia and the Big Syncline, Black Mountain, Broken Hill and Gamsberg in Africa occur in clusters along regional structural trends. The Sullivan deposit occurs at the intersection of the regional axis of the Purcell basin and a cross-structure, the Kimberley fault. By comparison to other major SEDEX districts in the world another Sullivan-size deposit should exist along trend.

The Sullivan deposit formed in an intracratonic rift setting within deep water turbidites close to a major structural intersection. The deposit comprises a discordant western vent zone and an eastern stratiform zone of bedded ores close to the lower-middle Aldridge contact. Deposit characteristics include footwall chaotic breccia, intraformational conglomerate, tourmalinite alteration pipe, muscovite and albite-biotite-chlorite-alteration, manganese-rich garnet-rich beds, a gabbro arch, and gently east-dipping stratiform massive and laminated sulphides.

Sedex Mining Corp. and Abitibi Mining Corp. control 25 properties containing 3900 claim units totaling over 240,000 acres in the district with similar deposit indicators such as favorable host horizons positioned at structural intersections with fragmental rocks, tourmalinite alteration and Pb-Zn mineral indicators. Recent drilling by Citation Resources Inc. just 3 km to the east of Sedex Mining Corp.'s Moyie property has encountered features analogous to the alteration and mineralization observed peripheral to the Sullivan Pb-Zn-Ag deposit including massive pyrrhotite veins, abundant disseminated sphalerite and galena at "Sullivan Time", black and brown tourmalinite, bedded fragmental, albitite, cross-cutting fragmental and intensely disrupted sediments.

During 1996 through a \$500,000 private placement to Sedex Mining Corp., Kennecott Canada Inc. examined 8 Sedex Mining Corp. properties with geologic mapping, stratigraphic drilling, geochemical sampling, gravity and airborne magnetic surveys and have optioned 2 of these properties for a future work commitment expenditures in 1997 of \$500,000 each. Currently, Kennecott is permitting 19 drill holes on the two optioned properties and plans an aggressive follow-up program of in-fill gravity stations, geochemical sampling and geologic mapping.



In 1997 through a \$500,000 private placement to Abitibi Mining Corp., Kennecott plans to evaluate 11 Abitibi Mining Corp. properties with geologic mapping, geochemical sampling and gravity surveys. Two of the properties have extensive mining and exploration histories. Starting in 1897 high-grade Pb-Zn-Ag veins were mined in the Pyramid Peak area just 14 km west of the Sullivan mine along the westward extension of the Kimberley fault by Rio Tinto Mining Co. from Spain the parent company of present day Kennecott a RTZ/CRA company. In the Yahk area approximately 60 km south of the Sullivan mine along the axis of the rift basin, since 1966 Noranda, Chevron, Falconbridge and Cominco have completed extensive geochemical sampling and stratigraphic drilling programs around the Mt. Mahon tourmalinite sheet to discover the source of a stratiform Pb-Zn-Ag occurrence in the area. Kennecott and Abitibi Mining Corp. will thoroughly evaluate these two areas in 1997.

Abitibi and Sedex Mining Corp. have optioned the Lew and Clair properties from Cominco Canada Ltd. and plan 10,000 ft of core drilling on these properties in 1997. Cominco is providing marker control for the proposed drilling along with their geophysical and geological data that they have generated.

The Clair property is located 25 km west of southwest of the Sullivan mine along the same mineralized horizon as at the Sullivan mine. A strong electrical and magnetic anomaly with an associated fragmental sheet are located along the lower-middle Aldridge contact. After completing a gridded gravity survey over the target area to determine the depth and extent of any massive sulfide, two drill holes are planned to test the anomalies.

The Lew property is located 40 km southwest of the Sullivan mine along the regional axis of the rift basin. A tourmalinized fragmental vent system above the Sullivan horizon suggests that a Sullivan-type massive sulfide could be at depth. Two drill holes are planned to test the Sullivan horizon after completing surface mapping, gravity and geochemical surveys.

Sedex Mining Corp. and Abitibi Mining Corp. control 4 out of 6 of the most prospective areas in the Sullivan district. Kennecott Canada Inc. in joint venture with Sedex Mining Corp. and Abitibi Mining Corp. will start the drill evaluation of the first area in 1997.

# Sullivan Mine

The Sullivan deposit, one of the largest massive sulphide base metal deposits in the world, is a stratiform sediment-hosted (sedex) deposit characterised by bedded iron, zinc and lead sulphides formed as hydrothermal sediments on the sea floor.

The Sullivan deposit has produced 137 million tonnes of ore (to September, 1993) from a deposit estimated to have originally contained more than 160 million tonnes of 6.5% lead, 5.6% zinc, 25.95 iron and 67 g/tonne silver. The Sullivan orebody comprises a broadly stratiform, upwardly convex lens and less bands covering an area of 1.6 x 2.0 km across composed mainly of pyrrhotite, sphalerite, galena and lesser pyrite. Contacts with enclosing sediments are sharp and conformable; the orebody is truncated on the north by the Kimberley fault. The deposit is divided by an irregular transition zone into two parts, western massive sulphides and an eastern zone of interbedded sulphides and silicate sedimentary rocks (Figure 1). Thus, the Sullivan deposit is a classic example of a stratiform deposit composed of a vent complex overlain and flanked by bedded sulphides\*.

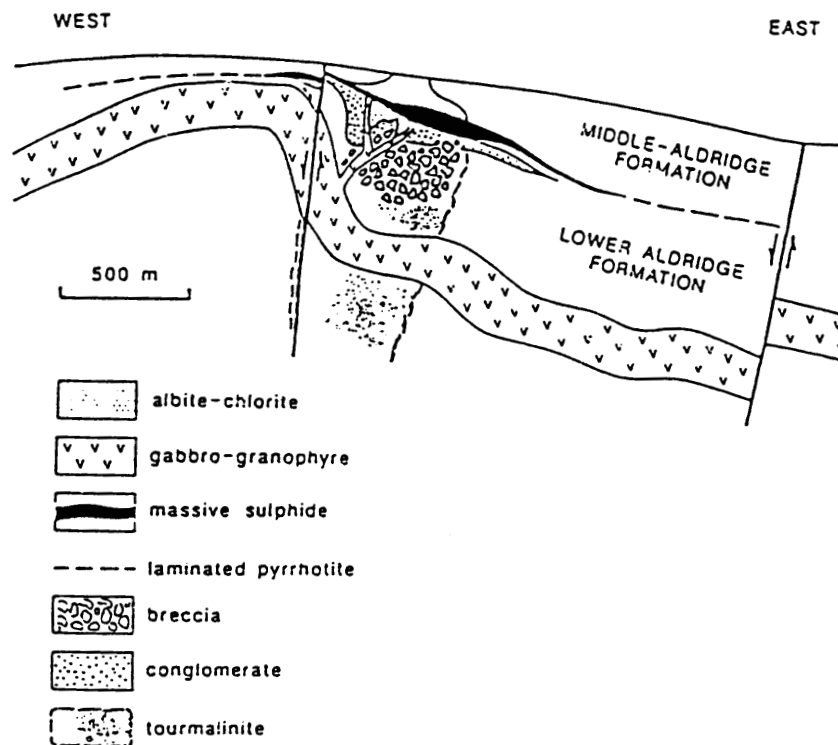


Figure 1. Schematic east-west geological cross-section.

\*Turner, R.J.W., Hoy, Trygve, Leitch, C.H.B. and Doug Anderson, 1992, Guide to the tectonic, stratigraphic and magmatic setting of the middle Proterozoic stratiform sediment-hosted Sullivan Zn-Pb deposit, southeastern British Columbia: Contribution No. 11, Sullivan-Aldridge Project, Information Circular 1992-23.