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The Keno Hill silver mining district

Field trip leader:
Al McOnie

June 4-6, 2016

Margins Through Time
Whitehorse, YT
GAC®-MAC 2016

The Keno Hill Silver Mining District

View west from Sourdough Hill across Keno City to Galena Hill

Canada's largest silver producing district.
Historic production 213 Moz silver at 44 oz/t from 1913 – 1989.
Current Silver Resources 55.5 Moz Indicated, 12.0 Moz Inferred.

1950's

2011

GAC – MAC Conference Field Trip 2016

Prepared by Al McOnie February 2016

FOREWORD

A day will be spent at Keno Hill, located 330 kilometers north of Whitehorse in one of the world's highest-grade silver mineralized districts. To the extent that will be possible due to remaining snow cover in early June, field stops will examine host rock stratigraphy and mine sites in the district, view mineralized drill core samples and visit the historic community of Keno City.

District wide, the mineralization is developed in dominantly steep southeasterly dipping vein-filled faults in Devono-Mississippian quartzite of the Keno Hill Quartzite. Prior to development of the vein-faults, at least one and possibly two phases of isoclinal folding produced dismembered macroscopic isoclines that accompanied a period of chlorite zone regional metamorphism. The veins are offset by post-mineralization deformation including northwest striking high angle cross faults, low angle faults and bedding faults.

Between 1913 and 1989 the Keno Hill Silver District produced more than 214 million ounces of silver from over 4.8 million tonnes of ore from over than 35 mine sites containing some of the richest Ag-Pb-Zn vein deposits in the world, at an average grade of 44 ounces per tonne (oz/t) silver, 6.7% lead and 4.1% zinc, making it the second-largest historical silver producer in Canada and producing more wealth than the Klondike Goldfields. It provided the backbone of the Yukon economy from the 1920's until the 1960's and at one time supported up to 15% of the Territories' population. Although the historic mines are not generally accessible, there will be opportunities to review the historic mining locations and activities.

The Bellekeno Mine that commenced production at the beginning of 2011 was Canada's only operating primary silver mine and until 2013 produced 5.2 Moz silver at average grade of 25 oz/t. The mining operation is currently in interim suspension, but meanwhile, two new important exploration discoveries at Flame & Moth and Bermingham, as well as three other mines located near the existing mill that are well into development, will provide the basis for renewed production as economic conditions improve.

LOCATION

The Keno Hill Silver District is located at approximately 63.95° latitude north, 135.25° longitude west, in central Yukon, some 450 km by road access north of Whitehorse. The nearest settlement is Keno City located at the head of the Silver Trail Highway that connects to Stewart Crossing on the Klondike Highway (Figure 1). The exploration base for Alexco Resource Corp is in the historic mining town of Elsa on the Silver Trail Highway approximately 40 km north of the town of Mayo.

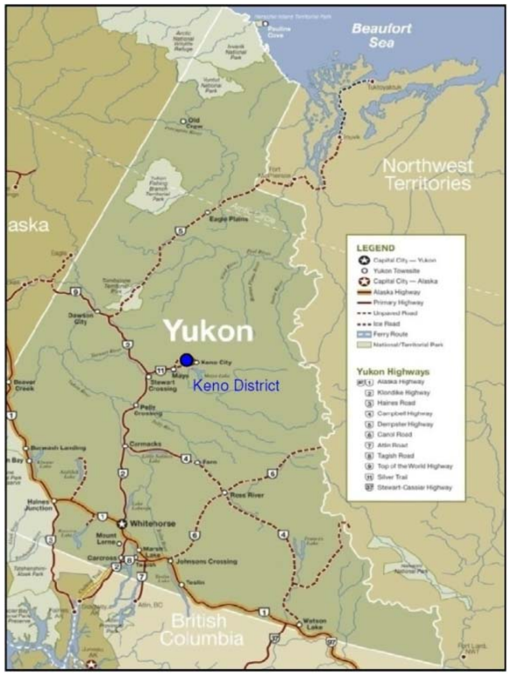


Figure 1. Keno Hill Silver District location map.

The central Yukon is characterized by a subarctic continental climate with cold winters and warm summers. Average temperatures in the winter are between -15 and -20 °C but lows can reach -60°C. The summers are moderately warm with average temperatures in July around 15°C. Annual precipitation averages 28 cm, half of which falls as snow.

The ground is variably covered by permafrost that may extend to depths of ~80 m on north facing slopes.

Exploration work is essentially confined to the period between late March if advantage is to be taken of accessing sites on frozen ground, or late May when most snow has cleared, and late October - November when snow starts to accumulate.

The landscape is characterized by generally gentle rolling hills and mountains with a relief of between 525 m in the South McQuesten valley and 1,975 m on Keno Hill.

Alexco currently controls over 244 km^2 of mineral tenure in the district.

MINING HISTORY

Robert Cathro (2006) described Keno Hill as "… *one of The Great Mining Camps of Canada; it was not only Canada's second largest primary silver producer and one of the richest Ag-Pb-Zn vein deposits ever mined in the world, it was also one of the mainstays of the Yukon economy from the 1920s, after the rapid decline of the Klondike Goldfield, until the early 1960s. At its peak in the 1950s and early 1960s, it supported about 15% of the territorial population. It also produced more wealth than the Klondike, one of the richest placer gold districts in the world. Following a small amount of hand mining between 1913 and 1917, larger scale production was almost continuous from 1919 to 1989, except during the war from 1942 to 1945. Two companies produced most of the ore, Treadwell Yukon Corp. Ltd. from 1925 to 1941, and United Keno Hill Mines Ltd. between 1947 and 1989. Both companies went bankrupt when silver prices failed to increase as quickly as mining costs. About three years of uneconomic 'reserves' remained at closure."*

Silver production is recorded from 35 mines with seven producing over 10 million ounces each, with the largest being Hector-Calumet (96 Moz) and Elsa (30 Moz) (Table 1).

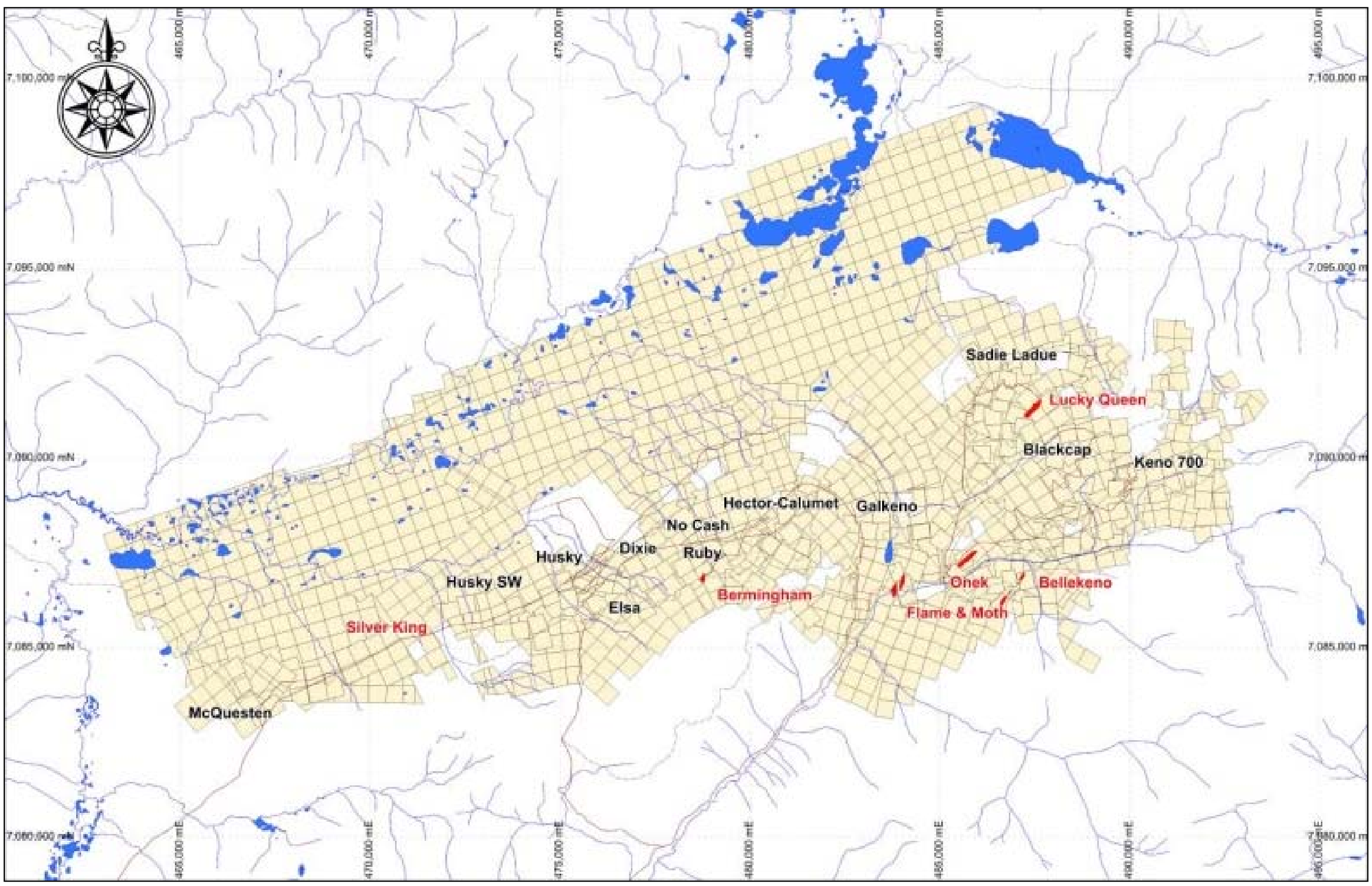


Figure 2. Alexco claim and lease holdings in the Keno Hill Silver District showing location main deposits.

	Mined	Recovered Grades				Production				
Mine	**Tonne (t)**	**Ag (oz/t)**	**Ag (g/t)**	**Pb (%)**	**Zn (%)**	**Ag (oz)**	**Pb (lbs)**	**Pb (t)**	**Zn (lbs)**	**Zn (t)**
Hector-Calumet	2,468,712	39.0	1,214	7.5	6.1	96,333,610	406,912,502	184,573	334,570,797	151,759
Elsa	445,436	67.7	2,105	4.9	1.4	30,147,957	47,708,019	21,640	13,484,869	6,117
Husky	389,515	46.0	1,430	3.9	0.4	17,904,607	33,290,002	15,100	3,309,284	1,501
Sadie-Ladue	203,509	57.4	1,786	6.5	4.5	11,687,595	31,923,607	14,480	22,029,310	9,992
Keno & Keno 6	257,425	48.9	1,522	10.7	3.7	12,599,035	60,549,038	27,465	21,189,428	9,611
Lucky Queen	112,119	98.3	3,058	7.0	2.7	11,024,230	17,223,250	7,812	6,653,462	3,018
Silver King	188,348	58.4	1,817	7.7	0.8	11,003,756	31,917,957	14,478	3,510,383	1,592
No Cash	151,074	32.8	1,022	3.6	1.9	4,962,595	11,912,346	5,403	6,188,199	2,807
Galkeno	151,557	30.0	933	5.2	2.7	4,544,114	17,437,410	7,909	8,999,204	4,082
Bermingham	168,978	22.4	696	4.2	0.6	3,781,200	15,575,525	7,065	2,157,714	979
Bellekeno	36,743	47.0	1,461	9.8	2.3	1,725,385	7,966,619	3,614	1,828,776	830
Black Cap	44,067	30.2	939	1.6	0.3	1,330,983	1,560,359	708	269,402	122
Onek	86,446	15.0	466	5.5	3.4	1,295,944	10,456,254	4,743	6,452,107	2,927
Ruby	36,879	27.8	864	3.0	1.3	1,024,431	2,420,577	1,098	1,022,818	464
Shamrock	4,841	198.7	6,182	37.6	0.3	962,081	4,013,179	1,820	36,523	17
Comstock & Porcupine	20,741	43.8	1,361	10.7	3.8	907,661	4,891,434	2,219	1,719,131	780
Dixie	21,656	22.3	693	3.8	5.1	482,214	1,813,155	822	2,455,694	1,114
Husky SW	9,490	43.7	1,358	0.3	0.1	414,256	56,193	25	17,300	8
Townsite	16,846	18.1	562	4.3	2.0	304,548	1,583,393	718	730,014	331
Mt Keno (Runer)	1,441	153.6	4,776	17.7		221,208	561,770	255		
Miller (UN & Dragon)	8,518	16.6	518	2.2	0.7	141,789	419,702	190	139,638	63
Ram	384	248.0	7,714	45.0		95,175	380,700	173		
Yukeno	308	164.1	5,105	11.1		50,626	75,365	34		
Gambler	223	209.5	6,518	56.2		46,765	276,265	125		
Flame & Moth	1,442	20.2	627	1.1	0.9	29,097	35,363	16	28,895	13
Elsa Mill Tailings - 1950's	1,709	15.9	494	3.0	0.8	27,130	112,462	51	29,423	13
Stone	135	138.9	4,320	30.3		18,774	90,495	41		
Caribou Hill	79	195.2	6,072	71.6	0.3	15,408	124,524	56	522	0
Vanguard	44	337.1	10,485	55.3	0.4	14,678	52,976	24	360	0
Duncan	14	820.5	25,519	22.4		11,165	6,500	3		
Croesus	9	263.3	8,191			2,389		0		
Silver Basin	11	185.0	5,753	41.1		2,014	10,227	5		
Coral & Wigwam	7	284.4	8,846	61.0		2,064	9,150	4		
Silver Basin 2	224	7.5	233	2.1	0.7	1,680	10,374	5	3,458	2
Wayne	5	147.7	4,594	56.0		804	6,720	3		
Klondyke-Keno	5	137.6	4,279	49.7		749	5,680	3		
Total / Average	**4,828,940**	**44**	**1,373**	**6.7**	**4.1**	**213,117,715**	**711,389,092**	**322,681**	**436,826,711**	**198,141**

Table 1. District production through to 1989 (after Cathro, 2006).

The Keno Hill Mining Companies

- 1898 Placer gold discovery in Duncan Creek brought prospectors from the Klondike goldfields.
- 1902 Mayo township established.
- 1903 Galena discovered at Silver King and mined 1913-1917.
- 1918 Galena discovered on Keno Hill.
- 1919 Keno Hill Ltd staked claims on Keno Hill.
- 1920 Keno City established.
- Mining grades had to be more than 125 oz/t to be economic, cost of horse transport to Mayo the same as to smelters in US.
- 1921 Treadwell Yukon Company acquired claims at Sadie Ladue on Keno Hill.
- 1925 Treadwell established mill at Sadie Ladue. Bulldozers significantly reduced the cost of ore haulage.
- 1927 Treadwell acquired Lucky Queen high grade mine.
- All operations suspended in 1932 during Depression.
- 1934 Treadwell Yukon acquired all the Keno Hill Ltd properties.
- 1924 Elsa vein discovered on Galena Hill, re-opening of Silver King and discovery of Hector–Calumet, and optioned by Treadwell Yukon.
- 1935 Mill moved to Elsa and mining continued until 1941 when all work ceased and equipment was sold to US Army for construction of Alaska Highway during World War II.
- Livingstone Wernecke had led Yukon Treadwell and produced 44 Moz silver with 80% milled at 60 oz/t and 20% hand sorted at 340 oz/t. 60% of production came from Keno Hill.
- 1946 Treadwell Yukon assets purchased by Keno Hill Mining Company, later named United Keno Hill Mines (UKHM), and mill began re-operating. Power was generated from coal mine purchased in Carmacks, and transport was improved by the government building the Whitehorse – Mayo road.
- 1951 New discoveries at Hector-Calumet led to construction of a town and a new mill built at Elsa, and power was supplied from a new hydro plant in Mayo.
- UKHM's success bought new companies to the district and another mill was built at Mackeno near Christal Lake.
- 1950 Zinc recovery became economic.
- New exploration from 1963 led to the discovery of the Husky deposit in 1970 just as the Hector-Calumet was closing.
- At peak in 1960's UKHM had 600 employees, and with families, supported about 20% of the Yukon population. The operation also kept the White Pass Railway going and was responsible for the development of the Mayo airport.
- 1972 Husky Mine commenced production.
- 1977 Economics became uncertain due to fluctuations in silver price, open pit mining commenced unsuccessfully.
- 1982 - 1989 Small scale tribute mining continued until UKHM closed.
- 1990 - 1998 Dominion Mineral Resources and Sterling Frontier Properties after acquiring 32% of UKHM, conducted exploration but were unsuccessful in reopening mines; rights reverted to UKHM but environmental liabilities and site maintenance drove UKHM bankrupt. Federal government inherited assets.
- 2006 Alexco Resource Corp purchased the property.

ALEXCO RESOURCE CORP.

TSX: AXR **NYSE-AMEX: AXU**

- 2005 Alexco established with an unique business model combining exploration, mine operations and environmental remediation expertise.
- 2006 Acquired UKHM's Keno Hill Property - indemnified against all historical liability.
  Received clear title to surface and subsurface claims, leases, freehold land, buildings, and equipment.
  Partnership with Canada -Yukon Governments for a District Closure Plan.
  Assumed responsibility for ongoing environmental care and maintenance of the site.
  Commenced exploration.
- 2009 Commenced construction of Bellekeno Mine and mill.
- 2010 Comprehensive Cooperation Agreement with Nacho Nyak Dun First Nation.
  Discovered Flame & Moth deposit.
- 2012 Developed access to Onek and Lucky Queen mines.
- 2011-13 Canada's only primary silver producer, producing 5.6 Moz Ag at grade of 725 g/t, 9.5% Pb, 5.1% Zn.
- 2013 Announced interim winter shutdown of Bellekeno operations to optimize costs.
- 2014 Completed surface exploration at Flame & Moth and published new PEA for Keno Hill Silver District.
- 2015 Discovered high grade mineral shoot at Bermingham.
  Continuing care and maintenance and environmental closure planning.

Alexco Mineral Resources

Category[1,2,11]	Property	Tonnes	Ag (g/t)	Au (g/t)	Pb (%)	Zn (%)	Contained Ag (oz)
Indicated	Bellekeno Deposit[3&4]	262,000	585	*n/a*	3.5%	5.3%	4,927,000
	Lucky Queen Deposit[3&5]	124,000	1,227	0.2	2.6%	1.7%	4,892,000
	Flame & Moth Deposit[3&6]	1,638,000	506	0.4	1.9%	5.4%	26,650,000
	Onek[3&7]	654,000	200	0.6	1.3%	12.3%	4,205,000
	Bermingham[3&8]	377,000	430	0.1	1.6%	1.7%	5,212,000
	Total Indicated – Sub-Surface	**3,055,000**	**467**	***n/a***	**1.9%**	**6.3%**	**45,886,000**
	Elsa Tailings[9]	2,490,000	119	0.1	1.0%	0.7%	9,527,000
	Total Indicated – All Deposits	**5,545,000**	**311**	***n/a***	**1.5%**	**3.8%**	**55,413,000**
Inferred	Bellekeno Deposit[3&4]	243,000	428	*n/a*	4.1%	5.1%	3,344,000
	Lucky Queen Deposit[3&5]	150,000	571	0.2	1.4%	0.9%	2,754,000
	Flame & Moth Deposit[3&6]	348,000	366	0.3	0.5%	4.4%	4,095,000
	Onek[3&7]	234,000	134	0.4	1.2%	8.9%	1,008,000
	Bermingham[3&8]	52,000	477	0.1	1.2%	1.9%	797,000
	Total Inferred	**1,027,000**	**363**	***n/a***	**1.7%**	**4.9%**	**11,998,000**
Historical	Silver King[10]						
Resources	- Proven, probable and indicated	**98,998**	**1,354**	***n/a***	**1.6%**	**0.1%**	**4,310,000**
	- Inferred	**22,581**	**1,456**	***n/a***	**0.1%**	***n/a***	**1,057,000**

1. All mineral resources are classified following the CIM Definition Standards for Mineral Resources and Mineral Reserves (May 2014), in accordance with the CIM Estimation of Mineral Resources and Mineral Reserves Best Practice Guidelines and the guidelines of NI 43-101.
2. Mineral resources are not mineral reserves and do not have demonstrated economic viability. All numbers have been rounded to reflect the relative accuracy of the estimates.
3. The Keno Hill Silver District comprises five deposits: Bellekeno, Lucky Queen and Flame & Moth, Onek and Bermingham, of which Bellekeno, Lucky Queen and Flame & Moth are incorporated into the current mine plan outlined in the technical report filed on SEDAR dated December 10, 2014 entitled "Updated Preliminary Economic Assessment for the Keno Hill Silver District Project – Phase 2, Yukon, Canada". The mineral resource estimates for the project are supported by (a) disclosure in the news release dated December 23, 2014 entitled "Alexco Updates Positive Preliminary Economic Assessment for Expanded Silver Production from Keno Hill Silver District, Yukon"; and (b) a technical report filed on SEDAR dated December 10, 2014 entitled "Updated Preliminary Economic Assessment for the Keno Hill Silver District Project – Phase 2, Yukon, Canada". The mineral resource estimates for the Flame & Moth and Bermingham deposits are further supported by disclosure in the news release dated April 30, 2015 entitled "Alexco Announces Indicated Silver Resource Estimate Increases of 17% at Flame & Moth and 26% at Bermingham, Resulting in a 10% Increase Overall for Keno Hill Silver District".
4. The resource estimates for the Bellekeno deposit are based on a geologic resource estimate having an effective date of September 30, 2012. The Bellekeno indicated resources are as at September 30, 2013, and reflect the geologic resource less estimated subsequent depletion from mine production.
5. The mineral resource estimates for the Lucky Queen deposit have an effective date of July 27, 2011.
6. The mineral resource estimates for the Flame & Moth deposit have an effective date of April 28, 2015.
7. The mineral resource estimates for Onek have an effective date of October 15, 2014.
8. The mineral resource estimates for Bermingham have an effective date of April 28, 2015.
9. The mineral resource estimate for the Elsa Tailings has an effective date of April 22, 2010, and is supported by the technical report dated June 16, 2010 entitled "Mineral Resource Estimation, Elsa Tailings Project, Yukon, Canada".
10. Historical mineral resources for Silver King are supported by disclosure in the news release dated December 23, 2014 entitled "Alexco Updates Positive Preliminary Economic Assessment for Expanded Silver Production from Keno Hill Silver District, Yukon"
11. The disclosure regarding the summary of estimated mineral resources for Alexco's mineral properties within the Keno Hill District has been reviewed and approved by Scott Smith, P.Eng., former Bellekeno Mine Manager and a Qualified Person as defined by NI 43-101.

REGIONAL GEOLOGY

The Keno Hill mining district is underlain by an Upper Proterozoic to Mississippian sedimentary sequence of basinal clastic and carbonaceous sediments that were deposited in the northwestern part of the Selwyn basin off the western margin of the ancestral North American continent (Figure 3).

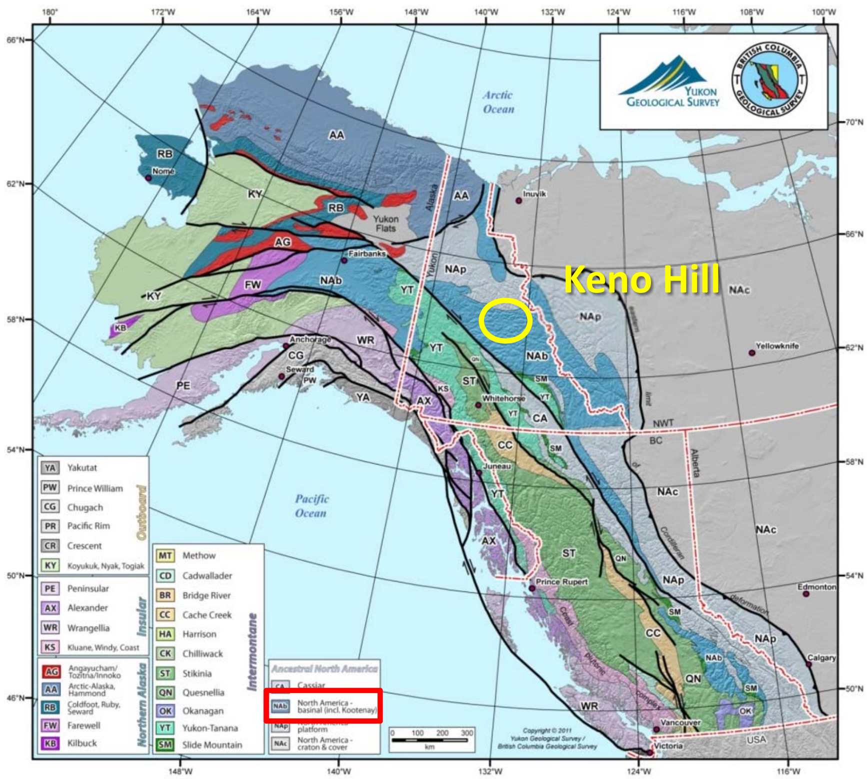


Figure 3. Regional geologic setting of the Keno Hill Silver District (from YGS).

The main stratigraphic units at Keno Hill include:

- In the north, the Devonian Earn Group comprising predominantly phyllitic grey graphitic metasediment, with an upper band of greenish chlorite-sericite meta-felsic volcanic rocks. Minor interbedded quartzite occurs close to the conformable transition to the overlying Keno Hill Quartzite.

- Mississippian Keno Hill Quartzite Formation, the dominant host to the silver-lead-zinc mineralization, with a total estimated structural thickness of about 1,900 m, comprises a prominent lower massive blocky Basal Quartzite Member (structural thickness about 1,100 m) with thin to thick interbeds of quartzite and graphitic schist, and the overlying Sourdough Hill Member (structural thickness about 800 m) which has distinctive basal marker horizons of sericitic meta-rhyolite and graphitic schist, intermediate units of an Upper Quartzite, quartz eye grits or metavolcanic and chloritic schist that pass into an overlying section that is carbonate rich with some well-defined black limestone beds.

- To the south the sequence is structurally overlain across the Robert Service Thrust Fault by the Yusezyu Formation comprising greenish quartz-rich chlorite-muscovite schist with locally clear and blue quartz-grain gritty schist, of the Upper Proterozoic Hyland Group within the Robert Service Thrust Sheet.

- The Keno Hill sequence contains numerous Mid-Triassic greenstone sills, locally up to 100 m thick, intruded only up to the top of the Basal Quartzite Member.

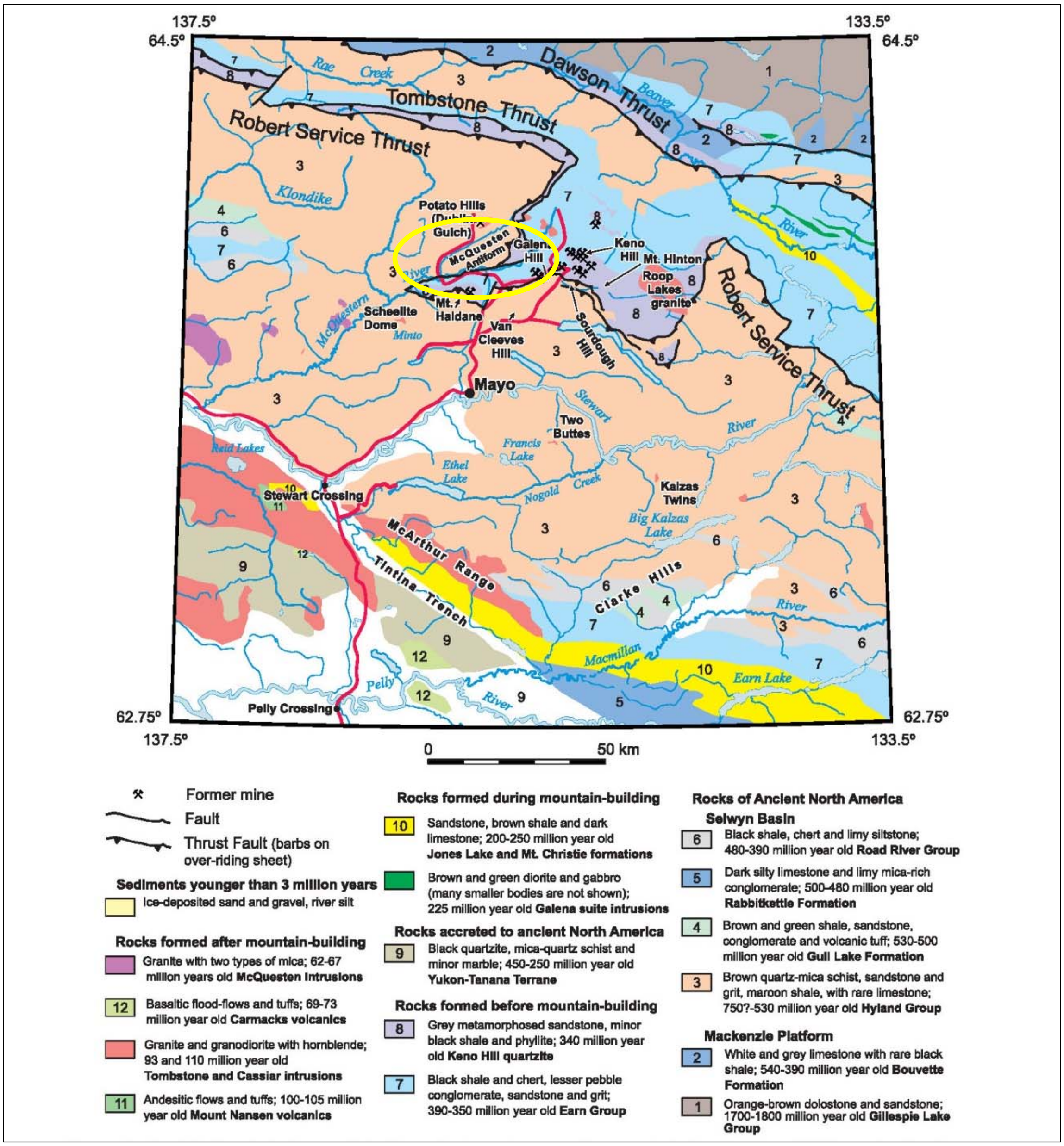


Figure 4. Simplified geological map of the Mayo area (from Cathro, 2006).

Structurally, the area lies within the highly deformed Tombstone Thrust Sheet (Figure 4) where at least one and possibly two phases of deformation (about 100-110 My), accompanied by chlorite grade regional metamorphism and isoclinal folding, produced dismembered district scale overturned isoclines (with local structural thickening and thrusting) of Keno Hill Quartzite Basal Member overlying the Earn Group. A post-metamorphic, upright mesoscopic phase of folding followed. The dominant structural foliation is essentially axial planar to the early folding and to subparallel to primary bedding.

Up to four periods of faulting, including the Robert Service Thrust, largely related to the main periods of deformation are recognized. The mineralization developed in a series of north-northeast to northeast striking, southeasterly dipping, faults that display apparent left-lateral oblique normal movement. Post-mineral northwesterly striking southwesterly dipping cross faults, low angle faults, and bedding faults offset veins and show apparent right-lateral oblique normal displacement.

Intrusive rock suites include:

- Mid-Cretaceous Tombstone aplite (~ 92 My) occurs locally as dikes and sills;
- Late Cretaceous fine-grained lamprophyre (dated at 89 My) occurs as metre-scale dikes and sills; and
- The Upper Cretaceous McQuesten granitoid (~ 65 My) is not yet recognized at Keno Hill).

DISTRICT GEOLOGY

During 2007 the UKHM exploration geology maps were digitized and followed with field checking that formed the basis for a program of re-mapping between 2008 and 2010 (McOnie, 2007, 2008; McOnie and Read, 2009; Read, 2010).

A simplified version of the basement geology is shown in Figure 5.

STRATIGRAPHY

Early mapping of the Keno Hill district portrayed the area as underlain by a regionally extensive tripartite succession of deformed metasedimentary and meta-igneous rocks.

Tempelman-Kluit (1966) *[see Box: Stratigraphic Correlation between Keno Hill and Tombstone and Klondike River Areas]* described the type section of a 550 m thick sequence of the Keno Hill Quartzite in the Tombstone area, located some 130 km to the northwest of Keno Hill, that McOnie (2007), McOnie and Read (2009), and Read (2010) compared with and correlated the Keno Hill sequence. The main stratigraphic elements for this are from bottom to top:

- A 120 m thick basal blocky quartzite ranging in colour from cream through buff to light grey. Medially it contains a thin black slate and argillaceous chert with recrystallized radiolarian. Locally this is manganiferous with nodules of rhodochrosite;
- Black slate and interbedded calcareous siltstone up 100 m thick form a slate marker member;
- 165 m thickness of interbedded black slate and quartzite;
- A 25 m marker unit of thick buff weathering sandy limestone with granule-sized quartz particles and chert grains; interbedded slate; and
- 130 m thickness of black slate with occasional fetid black limestone.

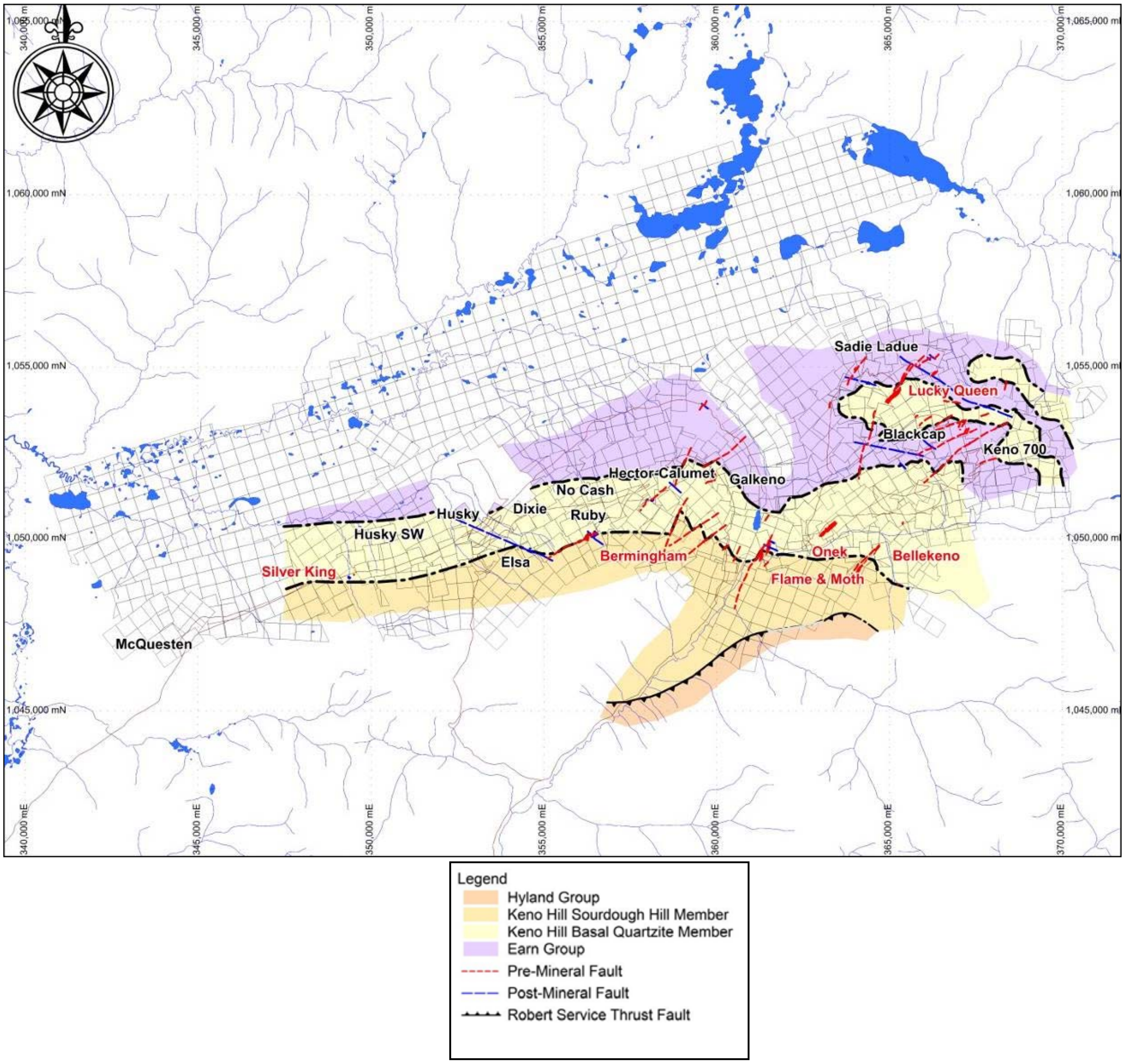


Figure 5. Simplified map of the basement geology at Keno Hill showing main prospect areas. Prospects with resources shown in red.

Boyle (1965) is generally accepted as the primary geologic reference on the Keno Hill area. He draws on the previous work by Cockfield (1920), Stockwell (1952), McTaggart (1950, 1960) and Kindle (1962).

The formations identified by Boyle (1965) include a lower sequence consisting of carbonaceous schist with a quartzite unit (Lower Schist), a massive quartzite (Central Quartzite) both intruded by mafic intrusions, and an upper schist, quartzite and rare limestone (Upper Schist) that he correlated with the Precambrian Yukon Group. Because of the simple stacking order over a large area, it was considered an upright homoclinal stratigraphic sequence, although he did recognize that *"there are many inconsistencies in the simple (stratigraphic) picture suggested …… and that further detailed work may well show that the rocks in the Keno Hill – Galena Hill area are thrown into a series of complex recumbent isoclinal folds."*.

The earlier work of McTaggart (1960) and Green and McTaggart (1960) had presented the evidence for isoclinal folding and low-angle faulting of the rocks. On the basis of fossil discoveries, Green and Roddick (1962) suggested a late Paleozoic age for the Lower Schist and a late Paleozoic or Mesozoic age for the Central Quartzite. It remained for Orchard (1991, p. 9) to establish an upper Mississippian age based on conodonts for limestone in the Upper Schist above the massive quartzite, and for Mortensen and Thompson (1990) to determine a late Middle Triassic age for the basic intrusions. At the same time, Abbott (1990a, b) correlated the Lower Schist with the Devono-Mississippian Earn Group.

Murphy *et al.*'s (1997) regional mapping and description of the Keno Hill Quartzite included a thick basal quartzite and overlying graphitic and sericitic phyllite, chloritic quartz augen phyllite and thin limestone.

In conjunction with a project to capture all the existing UKHM data to a digital platform, Alexco initiated district scale mapping in 2007. In the Keno Hill map area, the basal quartzite and overlying rocks described by Murphy *et al.* (1997) were recognized and the sequence was correlated with the Tombstone section described by Tempelman-Kluit (1966). The subdivision of the Keno Hill Quartzite formation into the Basal Quartzite Member and the Sourdough Hill Member reflects both the importance of the role of the competent Basal Quartzite in vein formation and lays to rest the stratigraphic uncertainties surrounding the "Upper Schist formation".

The area that has been remapped between Caribou Hill in the east and the South McQuesten road in the west, spans the stratigraphy from the upper part of the Devono-Mississippian Earn Group through the massive quartzite and overlying schist, limestone and rhyolite meta-tuff succession composing the Mississippian Keno Hill Quartzite to its truncation in the footwall of the Robert Service Thrust. The schist and grit of the upper Proterozoic Hyland Group form the hangingwall of the thrust and limit of mapping. Outcrop is generally limited particularly in the west and overall averages less than 1% of the area.

In keeping with the nearly eighty-year old mine terminology, the metapelitic rocks are referred to as "schist" even though their fine grain size is characteristic of "phyllite".

The Keno Hill area contains extensive glacial and Recent alluvial deposits (Bond, 1998) in the lowland areas. Predominantly glaciofluvial channel deposits associated with lateral and interfluve meltwater channels associated with the Late Pleistocene (20,000 year) McConnell Glaciation from a major glacier that flowed west from the Ladue valley down the South McQuesten valley, with a secondary arm in Christal Creek where it joined drainage from a smaller glacier that flowed south down the Lightning Creek drainage from the Mt. Hinton area, occur up to about 1,100 m elevation.

Up to about 1,500 m elevation, deposits associated with the Middle Pleistocene (200,000 year) Reid glaciation are also located on Keno and Galena hills.

Period or EPOCH	Rock Unit			Structural Thickness	Lithology
Middle to Upper Mississippian	**Keno Hill Quartzite**	Sourdough Hill Member	**Msls3/Msg3**	106 m	Upper Grey Limestone and Grey Schist: medium to dark grey crystalline limestone beds up to 10 m thick interbedded with medium to dark grey siliceous schist
			Msvr2/Msc2/ Msc1	180 m	Upper Meta-rhyolite, Chlorite-Sericite and Grey-Green Schists: clear quartz grain meta-rhyolite schist between chlorite-sericite and grey-green schist; minor crystalline limestone
			Msls1/Msg1	62 m	Middle Grey Limestone and Grey Schist: grey schistose crystalline limestone lenses in grey schist
			Msvr1	200 m	Middle Meta-rhyolite Marker: clear quartz grain, chlorite-sericite meta-tuff schist and meta-rhyolite flows; minor interbedded crystalline limestone
			Msq	240 m	Upper Quartzite Marker: medium to dark grey graphitic schist interbedded with medium to dark grey thinly laminated to platy quartzite
			Mss	12-100 m	Sericite Schist Marker: sericite±chlorite schist locally with sandy crystalline lime-stone, clear quartz grain meta-tuff and schistose meta-tuff
			Msg	0-150 m	Grey Schist Marker: medium grey to black graphitic schist
		Basal Quartzite Member	**MKq**	~1100 m	cream, buff, light green and light to medium grey quartzite blocky to platy with common grey schist and rare sericite schist partings locally up to 15 m thick; locally calcareous
Devonian to Lower Mississippian	**EARN GROUP**		**DEc**	0-50 m	Chlorite±Sericite Schist: silvery green chlorite-sericite schist with quartz segregations
			DEg	>500 m	Grey Schist: grey graphitic schist locally calcareous, minor thinly laminated grey to light green quartzite; rare grey siltstone
UPPER PROTEROZOIC	**HYLAND GROUP**	**Yusezyu Formation**	**PY**	> 500 m	Schist: cream to pale green muscovite±chlorite quartz schist, clear and blue quartz grain gritty schist and meta-grit; rare marble

Table 2. Table of rock units,(from McOnie and Read (2009) and Read (2010)).

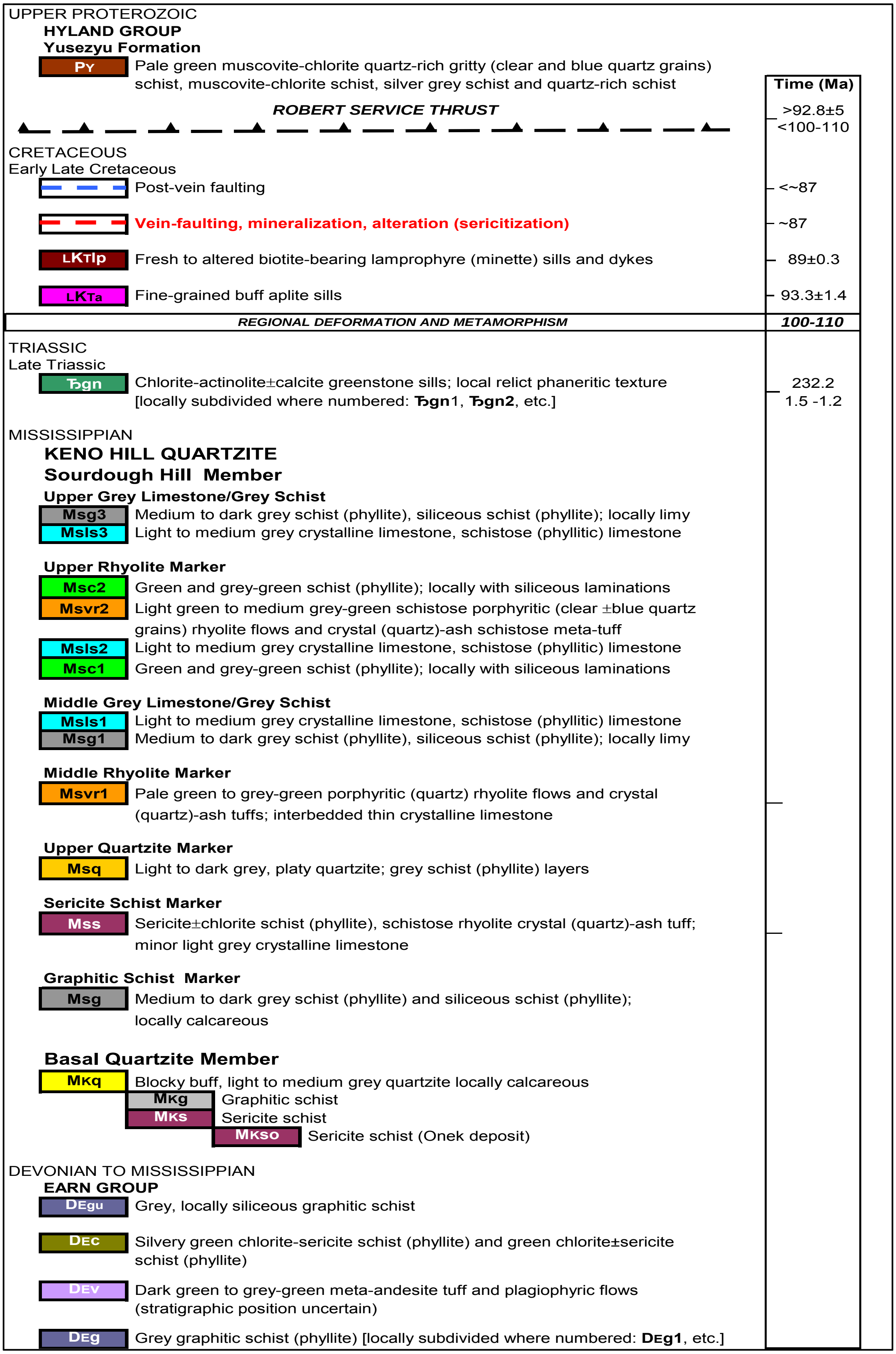


Figure 6. Keno Hill Silver Mining District stratigraphy and geochronology (from McOnie and Read (2009) and Read (2010)).

EARN GROUP *- from McOnie and Read (2009) and Read (2010)*

These rocks, formerly mapped by Boyle (1965) as the "Lower Schist Formation", underlie the lower parts of the north-facing slopes of Galena and Keno hills and form a septum passing eastward through Erickson Gulch and under the summits of Keno and Monument hills. The rocks of the Earn Group form the following three map units.

Grey Schist (unit DEg)

Typical exposures of this recessive unit exist as scattered road cuts along the Elsa-Keno City highway, a few road ditch outcrops immediately west of the UN adit and rock cuts along the road leading down to the Keno 700 adit from Signpost Hill. Dark non-limy to locally limy, grey graphitic schist with quartz segregations forms a majority of the unit. With increased calcite content scattered grey phyllitic limestone lenses develop. With increased quartz content the graphitic schist first develops thin white quartz laminae and with more quartz either siltstone or thinly laminated grey to light green quartzite forms. Quartz grain gritty rocks are absent.

On the lower, northern slopes of Galena Hill, continuous greenstone sills subdivide the grey schist into subunits based on their position among the sills. The road cuts along Elsa-Keno City highway best expose these lithologically similar subunits labelled **DEg1** to **DEg4** with thicknesses that range from 60 to 200 m.

Chlorite ± Sericite Schist (unit DEc)

Road ditch outcrops east of the UN adit, exposures in the Keno 300 to 900 trenches at the top of Signpost Hill and a rock cut in Erickson Gulch on the Keno City - Wernecke road provide typical exposures of this recessive unit. Green to silvery green chlorite ± sericite schist with quartz segregations forms the unit. The dominance of chlorite results in a green cast to the rock and the lack of crystalline limestone and gritty rocks distinguish this unit from the sericite schist marker (**Mss**) of the Keno Hill Quartzite. Other than the area where unit **DEgu** exists, **DEc** directly underlies Keno Hill Quartzite except in one poorly exposed area on the south side of Erickson Gulch on the Dorothy property where Boyle (1965, Figure 2) shows a sliver of quartzite beneath the chlorite ± sericite schist of **DEc**. Although Boyle solved this apparent inversion by putting a vein-fault along this contact, an excellent exposure in a bulldozer-scraped area indicates no intervening fault. Whether this area represents a stratigraphic or structural complexity is uncertain.

Upper Siliceous Grey Schist (DEgu)

On the south side of Erickson Gulch and straddling the road to Signpost Hill around 1500 m elevation are exposures of a medium grey, locally siliceous graphitic schist of unit **DEgu** that extends into Charity Gulch and locally lies only on the lower limb of Galena Hill Syncline. East and west of Signport Hill road, low cliffs expose an apparently conformable contact with the underlying chlorite ± sericite schist of **DEc**. Two trenches expose apparently conformable contacts with the overlying Basal Quartzite. Assignment of unit **DEgu** to the Earn Group depends upon the regional recognition of the base of the first quartzite beds as the base of the Keno Hill Quartzite.

Correlation

The proposed age for rocks mapped by Boyle (1965) as "Lower Schist Formation" has ranged from Precambrian (Bostock, 1948) to Jurassic (Green, 1972). It was not until the dating of the greenstone sills as late Middle Triassic by Mortensen and Thompson (1990) and mapping and stratigraphic correlations by Abbott (1990a, b) in the Mount Westerman area 50 km to the east, that a Devono-Mississippian age was proposed. A U/Pb zircon date corresponding to Early Mississippian from felsic metavolcanic rocks of the Marg deposit confirmed the proposed age (Turner and Abbott 1990a or b?, p. 35) and correlation of the chlorite ± sericite schist (unit **DEc**) and underlying grey schist (unit **DEg**) with the Earn Group.

Keno Hill Quartzite - *from McOnie and Read (2009) and Read (2010)*

Basal Quartzite Member (units MKq, MKg, MKs and MKso)

Although mapped for over a distance of 30 km and a maximum width of 6 km in the Keno Hill area, the member extends regionally for more than 250 km. On Galena Hill, numerous open pits yield the best and most complete exposures of the member. Outside the pits, the blocky weathering quartzite usually forms talus slopes and outcrops are rare.

The open pits and drill core show that grey graphitic and localized sericite schist form layers up to a few metres in thickness and in places up to 10 to 15 m. However, because of strong deformation, exposures in the open pits show that the thin schist layers lack continuity. In the Bellekeno Mine a detailed stratigraphy of the Basal Quartzite was developed (Otto, 2009) however the scarcity of outcrop and extensive development of quartzite felsenmeer precludes the recognition of most of the detailed stratigraphic units at surface. At Onek, sericite schist forms a marker horizon and is designated as **MKso**. The sericite schist horizons may represent waterlain rhyolite ash, but to date no quartz crystals have been found.

In the upper part of the member, carbonaceous schist may compose up to 30% of the unit and the quartzite tends to be more calcareous than deeper in the member.

Drilled thicknesses to as much as 295 m and an estimated thickness of 1100 m in cross section where rocks are known to be on a limb of an isoclinal fold, imply that not only deformation may have increased the thickness of the member, but that it probably was originally thicker than the 150 metre-thickness measured for the unit in the Tombstone area (Tempelman-Kluit, 1970).

In the less deformed rocks of the Tombstone area, Tempelman-Kluit (1970, p. 29-32) concluded that deposition of the Keno Hill Quartzite proceeded in a shallow marine to locally non-marine environment under conditions of moderate agitation such as prevail in neritic or littoral zones. He thought that the homogeneity of the thick quartzite intervals may reflect constant conditions of deposition and uniformly sized source material deposited on a gently dipping paleoslope.

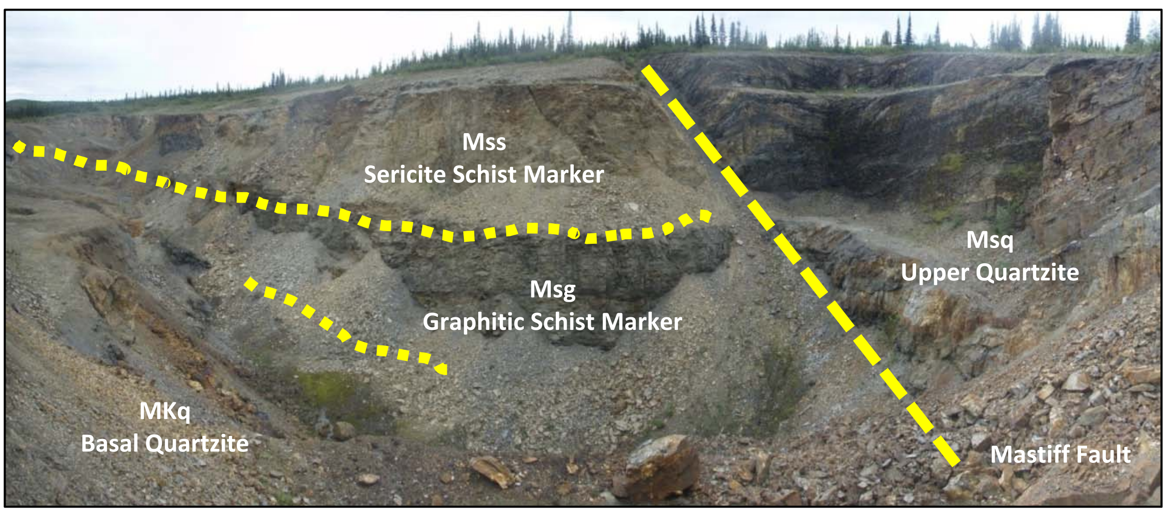


Figure 7. Keno Hill Quartzite stratigraphy view south in the Bermingham Open Pit.

Keno Hill Quartzite - *from McOnie and Read (2009) and Read (2010)*

Sourdough Hill Member

This member encompasses all the rock units lying stratigraphically above the Basal Quartzite and beneath the Robert Service Thrust. Historically these rocks are a part of the "Upper Schist formation", which include some of the rocks that Murphy *et al*. (1997) place in the Precambrian Hyland Group. The member consists mainly of platy quartzite with grey schist intercalations, graphite schist, limy schist and schistose limestone all of medium to dark grey tones. To a lesser extent sericite schist, sericite-chlorite schist, schistose clear and rare blue quartz meta-tuff all of cream to light green shades are present. The mainly grey colour of the Sourdough Hill Member distinguishes it from the cream to light green schist of the Hyland Group. Because meta-grit, or rocks of similar appearance, are present in both units, this is not a distinctive characteristic.

Grey Schist Marker (unit Msg)

The grey schist unit has few natural exposures but is best found forming the walls of Lightning Canyon. On the Mount Hinton Road, rock cuts expose most of the upper part of the unit 1.9 km up the road from the sand and gravel quarry. It ranges from medium grey to black depending upon its graphite content. Typically strongly deformed and contorted quartz segregations or "sweats" are present. Where the original sediment consisted of silica-rich laminations, these now exist as rootless fold hinges up to several millimetres across. Scattered, thin (2 cm) medium to dark grey quartzite beds may form up to a few per cent of the unit, and locally the unit is weakly calcareous. Because of the intense deformation and faulting, the thickness of the unit is highly variable ranging from nearly 150 m in Lightning Creek canyon to a few tens of metres at the Flame and Moth only one kilometre away, to complete absence at the surface east of the Eagle Vein. West of the Eagle Vein it is only locally present to and beyond the Silver King Mine. At the Bellekeno Mine, drilling gives an average thickness of 42.5 m.

Sericite Schist Marker (unit Mss)

The sericite schist portion of the member forms few natural exposures with the left bank of the middle portion of Lightning Canyon yielding complete exposures of the lower part of the unit. Part of the southeast wall of Bermingham Pit yields a complete exposure of the unit. On Sourdough Hill only the quartz-rich meta-tuff form scattered exposures on the bushy slopes below the paste fill landing. Elsewhere, scattered exposures are usually man-made. All of the rocks forming the unit range from cream through pale to medium green dependent upon an increasing chlorite content. With the addition of quartz, the rock becomes quartz-rich schist to schistose quartzite. Here and there the schist contains clear quartz augen indicating the schist probably developed from a quartz crystal tuff. With the addition of calcite, cream coloured sandy limestone to crystalline limestone develops as lenses up to a few tens of centimetres thick and beds up to several metres thick, but of unknown continuity. Because of the strong deformation, the thickness of the unit is highly variable ranging from over 100 m in Lightning Canyon, where the top of the unit is unexposed to an average thickness of 47 m in the drill holes at Bellekeno Mine. In the Bermingham Pit, it thins to 14 m and immediately west of the pit disappears at surface as a result of faulting. Drilling demonstrates that the simple succession of sericite schist overlying graphite schist, observed at Bellekeno becomes much more complicated with sericite and graphite schist probably originally intercalated and later tectonically interleaved.

Upper Quartzite Marker (unit Msq)

Rock cuts along the Mount Hinton Road starting at the switchback above the Ram and Eureka shafts expose a grey quartzite-rich portion of the unit and at the paste fill landing, a grey schist-rich variant. The best natural exposures are on the right bank of Lightning Creek 800 m above its confluence with Duncan Creek and in Galena Creek above the first waterfall above the Mayo-Elsa highway where the creek has eroded an almost continuous exposure of the unit for 650 m. Although the base and top of the unit are not exposed, the southwest end of the Bermingham pit exposes a continuous section of the lower part of the marker. In most outcrops, the unit is characterized by platy weathering medium to dark grey quartzite. The unit consists of medium to dark grey graphitic schist interbedded with medium to dark grey quartzite beds averaging 10 cm or less in thickness. However, in the Bermingham Pit, the lower part of the unit is quartzite-rich and the beds are blocky. In drill core, grey schist exceeds quartzite, but in outcrops, the grey schist usually does not outcrop and the platy grey quartzite dominates. The rocks are not gritty or calcareous. Sourdough Hill and the southeast-facing slopes at the northeast end of Galena Hill yield scattered exposures of the grey schist-rich, quartzite-poor upper part of the unit. On Sourdough and Galena hills, the top of the unit lies at the base of a sericite-chlorite schistose meta-tuff composed of clear quartz grains.

# #

Sourdough Hill Member (continued)

Middle Meta-tuff Marker (unit Msvr1)

On the top of Sourdough Hill, dominantly chlorite-sericite clear quartz grain schist and schistose meta-tuff and meta-rhyolite flows and minor interbedded crystalline limestone compose the unit, which extends southwesterly towards the junction of Lightning and Duncan creeks. The unit has an apparent thickness of 200 m as estimated on the top of Sourdough Hill. On Galena Hill, the thickness has diminished top only a few tens of metres.

Middle Grey Limestone/Grey Schist (units Msls1 and Msg1)

This is a very poorly exposed unit of grey crystalline limestone (**Msls1**) and grey schist (**Msg1**) on the top of Sourdough Hill that extends to Duncan Creek upstream of its junction with Lightning Creek. On the top of the Sourdough Hill the apparent thickness of the unit is 62 m. It also outcrops on Galena Hill south of the West Eagle vein-fault in several old trenches, which expose thin grey phyllitic limestone lenses in grey phyllite.

Upper Meta-tuff (unit Msvr2) and Chlorite-Sericite and Grey-Green Schist (units Msc1 and Msc2)

The upper meta-tuff sequence is best exposed on the ridge at the top of Sourdough Hill where the clear quartz grains are locally coarse (up to 3 mm) in a 5-10 m thick schistose quartz crystal meta-tuff. The unit has a light cream to green colour in distinction to the grey underlying and overlying units. The schistose meta-tuff thickens towards Thunder Gulch. Chlorite-muscovite schist and grey-green schist both underlie and overlie the meta-tuff. An extensive crystalline limestone up to 10 m thick underlies the quartz augen rocks beneath which are chlorite-sericite schist. The sequence totals an apparent thickness of 180 m. The lower boundary of the unit is set at the top of the last significant grey schist of **Msg1**. Above this level, the rocks are light green chlorite sericite schist which is locally quartz crystal-bearing. The upper boundary lies at the top of the quartz augen-bearing schist and meta-tuff.

Upper Grey Limestone/Grey Schist (units Msls3 and Msg3)

A trench on the top of Sourdough Hill once exposed interbedded medium to dark grey crystalline limestone beds up to 10 m thick interbedded with medium to dark grey siliceous and graphitic schist with contorted quartz segregations. Southwards towards the top of the unit only grey graphitic and siliceous schist are present. The top of the unit does not outcrop, but shows as dark grey to black chips in frost boils across an outcrop gap of 15 m to the first outcrops of the Precambrian Yusezyu Formation. On Sourdough Hill, the unit has an apparent thickness of 106 m below the Robert Service Thrust.

INTRUSIVE ROCKS - *from McOnie and Read (2009) and Read (2010)*

Intrusive rocks are volumetrically minor, but are important as a vein host, form pseudo-stratigraphic marker horizons and provide a maximum age for mineralization.

GREENSTONE SILLS (unit Ѣgn)

The greenstone sills crop out best of all the map units selectively forming cliffs in the Basal Quartzite member and cliffy hummocks in the schist of the Earn Group. They are especially abundant on the lower slopes of Keno and Galena hills. At Bellekeno, they range in thickness from less than a metre to more than 100 m and regional mapping near Sadie-Ladue implies even thicker sills. Usually the outcrops are surrounded by extensive talus slopes composed of slabs and blocks.

Most sills are aphyric with thin sills foliated throughout and thick sills marginally foliated with a blocky core. They consist of chlorite-actinolite-epidote (zoisite)-albite and where the rock has a brownish cast, stilpnomelane is present. The core of thick sills commonly ranges from medium-grained, equigranular metadiorite and metagabbro to plagiophyric and/or hornblende-phyric variants. The hornblende phenocrysts are marginally altered to totally pseudomorphed by actinolite. The lack of primary volcanic textures, such as amygdules and lapilli or breccia fragments favours an intrusive rather than an extrusive origin for the greenstone (McTaggart, 1960).

Although much discussion has centred on whether the greenstone forms separate lenticular bodies resulting from boudinage or flattened pipe-like bodies resulting from tectonic slicing, deformation certainly has modified their original form. In the Tombstone-Klondike River area, Tempelman-Kluit (1970) noted that what had been considered previously as a dozen or more separate, subparallel diabase sills, were in fact a single sill ranging from 120 to 245 m in thickness lying in the Shale Marker horizon over an area of 1,300 square kilometres. One or two additional thin sills occur stratigraphically above the thick sill, but they are laterally discontinuous. As in the present map-area, no feeder system was discovered for the sills. In the Galena-Keno hill area, the greenstone sills develop throughout the schist of the Earn Group and in the Basal Quartzite member of the Keno Hill Quartzite to as high as its contact with the overlying Graphite/Sericite schist markers.

Because of the scarcity of outcrop in the present area, isolated areas of greenstone outcrop have been mapped in the past as separate bodies resulting in an emphasis of their apparently boudinaged nature. As a result of surface geological mapping on a more detailed scale, the development of a detailed stratigraphy of the Keno Hill Quartzite, additional drilling and the demonstrated continuity of sills in the Tombstone-Klondike River area, greenstone sills in the Galena-Keno Hill area may have more continuity than previously considered. For example, in the Bellekeno area, a thick greenstone sill 255 m below the top of the Basal Quartzite extends at least three kilometres from the limit of mapping east of Bellekeno to west of the Flame and Moth where it disappears beneath overburden. This is one of a number of mappable greenstone sills in the area, but the others usually are <15 m thick and are discontinuous in both drill core and particularly on surface as a result of the sparsity of outcrop. The greenstone sills, particularly the thicker ones, act as “pseudo-stratigraphic marker” horizons within the Basal Quartzite.

In the Tombstone-Klondike River area, using zircon and baddeleyite, Mortensen and Thompson (1990) determined a U-Pb radiometric age of 232.2 +1.5/-1.2 My (late Middle Triassic) from a quartz-bearing hornblende clinopyroxene gabbro portion of a diabase sill. The lack of feeder dikes in this area and the Galena-Keno Hill area probably results from intrusion of the sills under a thin sedimentary cover where deviatoric stresses favour flat-lying rather than dike-like magma chambers (Mortensen and Thompson 1990, p. 27). In the Keno Hill area, the fact that sills only reach the top of the Basal Quartzite may reflect the fact that magmatic pressure at the time of intrusion was insufficient for the magma to reach higher stratigraphic levels.

RHYOLITE SILLS (unit LKTg)

A buff-weathering rhyolite sill outcrops in Galena Creek between 860 and 875 m elevation where an old mining road crosses the creek, on both sides of Brefalt Creek at 1100 m elevation and at two intervening outcrops on and northeast of Flat Creek. Both McTaggart (1960, Fig. 13) and Boyle (1965, Fig. 2) showed these outcrops as parts of a five kilometre long sill outcropping near the top of the Upper Quartzite marker. In addition, McTaggart showed the rhyolite sill offset 1500 m to the northeast to an area of float, but no outcrop, on the northwest side of Brefalt Creek Fault. Work with a bulldozer in this area uncovered two subcrops of the sill, one with the exposed base of the sill against dark grey siliceous phyllite of the Upper Quartzite. Both of these subcrops lie at the contact between the top of the Upper Quartzite (**MKq**) and the overlying quartz crystal meta-tuff (**Msvr1**). However, 2000 m eastward on the Eagle Property, the rhyolite sill has ended and does not appear in exposures at or near this contact.

Zircon dating by Tupper and Bennett (2009) of similar rhyolite (aplite) sills on the east bank of Duncan Creek downstream from its confluence with Lightning Creek yield dates of 93.3±1.4 My and 93.5±1.2 My respectively. The zircon U/Pb ages indicate that the rhyolite (aplite) sills are contemporaneous with the Tombstone intrusions U/Pb dated at 90 to 94 My. McTaggart (1960, p. 18) reported that the rhyolite sills are cut by mineralized veins.

LAMPROPHYRE SILLS (unit LKTlp)

At the Formo (Yukeno) property on the north side of Galena Hill, 100 m above the Elsa-Keno City road and 100 m east of the open pit, are a series of outcrops of a biotite-bearing lamprophyre also known as a minette. The outcrops indicate about a 5 to 10 m thick sill with one or other of the boundaries exposed.

The minette has a fine-grained (<1 mm) matrix of biotite (15%), diopside (18%), hornblende (0.5%) sanidine (55%) and quartz (5%), which hosts a few per cent of poikilitic biotite phenocrysts (10-15 mm). The biotite to phlogopite is fresh, dark to medium brown. The biotite flakes are locally altered to chlorite, and the diopside and hornblende are marginally altered to tremolite.

Mapping by Boyle (1965) indicated that the dike is left-laterally offset along a vein-fault which hosts the Formo Ag-Pb-Zn vein. The lamprophyre dikes intruded after the low grade regional metamorphism which affected the greenstone sills. In the underground workings, siderite-sphalerite-galena veins cut and alter the lamprophyre (Boyle 1965). Outside the map area, a biotite lamprophyre dike intruded a stock belonging to the Tombstone intrusions near the Pukelman stock (Murphy *et al*., 1997) indicating that the dike is younger than the Tombstone Intrusions.

Stratigraphic Correlation between Keno Hill and Tombstone and Klondike River Areas

Regional mapping shows that the Keno Hill Quartzite is continuous between Keno Hill and the Tombstone and Klondike River areas where it is much better exposed and less deformed and metamorphosed (Tempelman-Kluit, 1970). In the latter area, Tempelman-Kluit (1970) gave a detailed stratigraphy, which included two regionally extensive members together with the thicknesses of the formation and members (Fig. 1). In the Keno area, the best exposed section of the Keno Hill Quartzite underlies Sourdough Hill. Here the south-dipping Basal Quartzite Member underlies the lower part of the north-facing slope. In the past, rocks above the quartzite belonged to the Upper Schist formation (Boyle 1965), but Murphy *et al*. (1997) placed them into the Keno Hill Quartzite. A detailed correlation among the rock units exposed on Sourdough Hill and those of the Tombstone-Klondike river areas corroborates this placement.

The 150 m thickness of blocky quartzite at the base of the formation in the Tombstone-Klondike area correlates to the apparently considerably thicker blocky, cream through buff to grey Basal Quartzite Member of the Keno area. In the Tombstone-Klondike area, Tempelman-Kluit (1970) designated two members in the formation. The lower is a “Shale Marker” (unit 13a) consisting of 75 m of dark grey shale and the upper is a “Sandy Limestone” (unit 13b) composed of 20 m of sandy limestone with quartz grains and chert granules to 3 mm in diameter. The Shale Marker lies immediately above the basal quartzite, extends throughout the Tombstone-Klondike area and hosts a major diabase sill. In the Bellekeno area, the continuous Graphitic Schist Marker (unit **Msg**)**,** a medium to dark grey graphitic phyllite ranging in thickness from a few metres to over a hundred metres, immediately overlies the Basal Quartzite Member. Here, a thin, locally bifurcating greenstone sill (unit **Ъgn**) lies at or near the base of the Graphitic Schist Marker. Elsewhere in the Galena-Keno Hill area, sericite schist (unit **Mss**) overlies or is interbedded or tectonically interleaved with the Graphitic Schist Marker that is the correlative of the Shale Marker of the Tombstone-Klondike area. In the Keno area, the equivalent of the “Sandy Limestone” (unit 13b) is the Middle Meta-rhyolite Marker (unit **Msvr1**) which consists of clear quartz grain meta-rhyolite flows, quartz crystal and ashy chlorite-muscovite schist and light grey crystalline limestone to sandy limestone.

In the Keno area, a rock unit intervenes between the members recognized in the Tombstone-Klondike area. It is a platy grey quartzite and interbedded grey schist of the Upper Quartzite Marker (unit **Msq**) with an apparent thickness of 240 m, which corresponds to the 165 m thick interbedded shale and quartzite package between members 13a and 13b in the Tombstone-Klondike area.

In the Tombstone-Klondike area above the “Sandy Limestone”, a 135 m thick, grey shale-rich succession includes quartzite and locally dark grey fetid limestone. In the Keno area, rocks in the equivalent position are sequences of grey schist and dark grey crystalline limestone with a medial light green clear quartz grain meta-tuff and schist unit with a total apparent thickness of 550 m. In both areas, the Robert Service Thrust terminates and forms the top of the Keno Hill Quartzite.

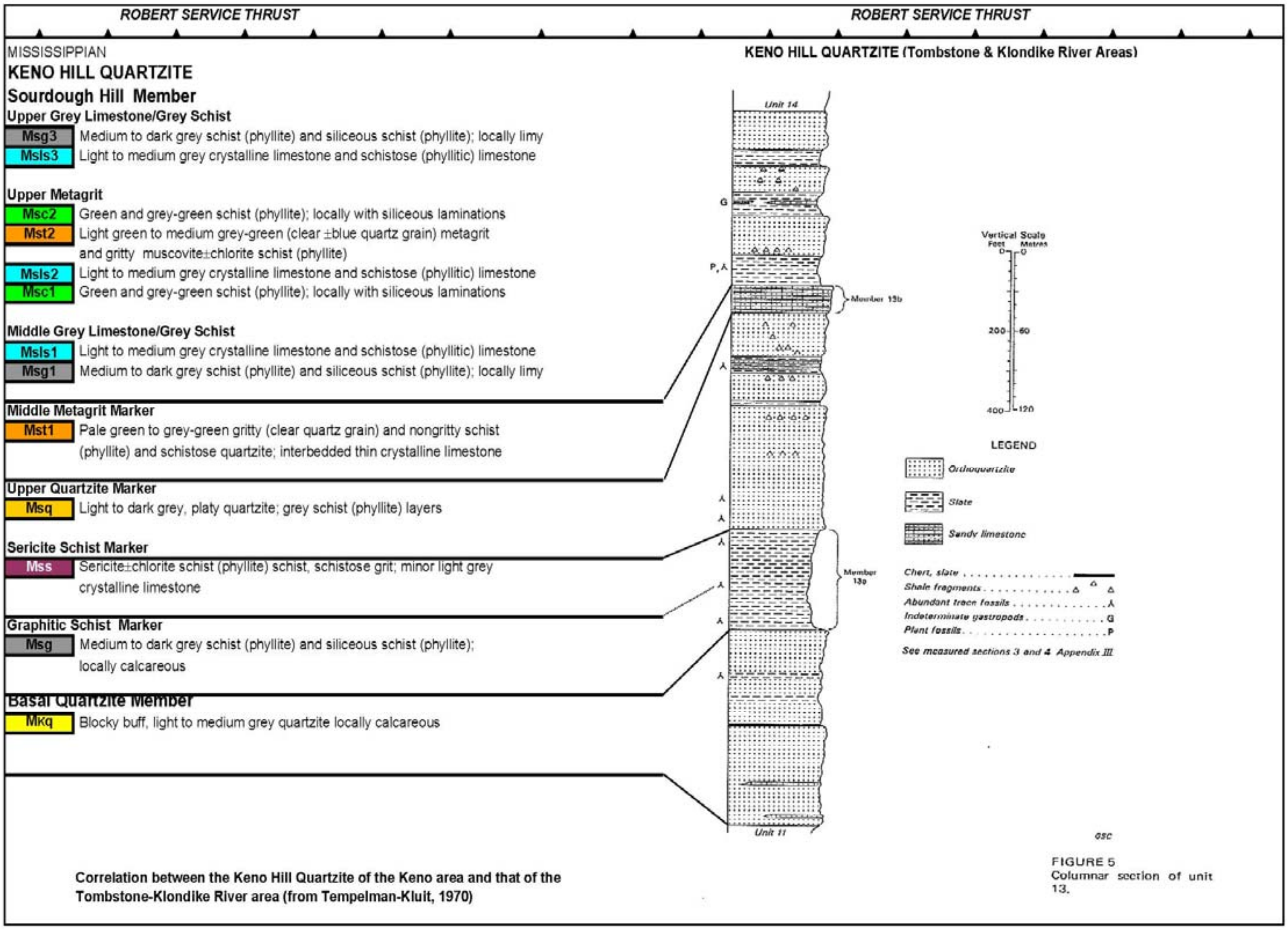


Figure 8. Correlation between the Keno Hill Quartzite of the Keno area and that of the Tombstone-Klondike River area (from McOnie and Read, 2009, after Tempelman-Kluit, 1970).

STRUCTURE - *after McOnie and Read (2009) and Read (2010)*

Folding

The Keno Hill Silver District lies within the Tombstone Strain Zone between the overlying Robert Service Thrust and the underlying Tombstone Thrust and has been affected by up to three phases of folding.

Early Phase Folding (F_0)

Examination of drill core and examples from Onek and Bermingham has uncovered rare occurrences of an early phase of folding deformed by first phase folding that has been designated as "early folding" and given the symbol "F_0" so that the fold nomenclature of all earlier investigations remains unchanged. Because of the scarcity of these folds and an uncertainty as to whether they are of a tectonic or soft sediment origin, the implications for regional structure of the early phase folds are presently unknown.

Figure 9. In the Bellekeno area, early phase folds (F_0) refolded by first phase folding (F_1) with axial-plane foliation S1. Hole K-09-0185.

Figure 10. In Bermingham West area, the axial plane (blue) of an early phase fold (F_0) deformed by first phase folding (F_1) with yellow axial plane. Hole K-09-0219 at 41.4 m.

First Phase Folding (F_1)

The first phase of folding (F_1) developed easterly trending, sub-horizontal folds which are isoclinal and strongly overturned to the north resulting in gently to moderately southerly dipping axial planes. These folds are widespread in schist where they typically form rootless hinges less than a centimetre across where preferentially oriented micaceous minerals define an axial-plane cleavage. A compositional streaky lineation composed of quartz-feldspar rich streaks defines a lineation parallel to the first phase fold axes. First phase folds are less common in the Basal Quartzite Member where they usually form complete isoclinal folds or tight fold pairs ranging from a few decimetres to several metres in width.

The intensity of deformation during first phase folding produced isoclinal anticline-syncline pairs with their common limb attenuated and truncated by a phase of faulting that was syn to post-folding. Three structurally dismembered isoclinal folds, of which the Basal Quartzite Member outlines two synforms, one underlying Monument Hill and the other Caribou Hill, while to the south, stretching from Sourdough Hill to west of the Silver King Mine on Galena Hill, is a single panel of quartzite, where first phase folds show a northerly vergence to indicate that an antiform lies to the north of the area and forms the lower limb of a northward overturned syncline third dismembered syncline with the upper, inverted limb removed by the Robert Service Thrust.

This style of regional folding extends at least 200 km to the Tombstone - Klondike River area where tight northerly to northwesterly overturned syncline-anticline pairs have their common limb replaced by a slightly more steeply dipping thrust fault (see Tempelman-Kluit, 1970).

Figure 11. Northerly verging first phase folds at metre scale in massive Basal Quartzite beds north slope of Galena Hill above Elsa.

Figure 12. Northwesterly verging first phase folds in quartz-rich sericite-chlorite schist (unit Msg), Thunder Gulch above Bellekeno decline.

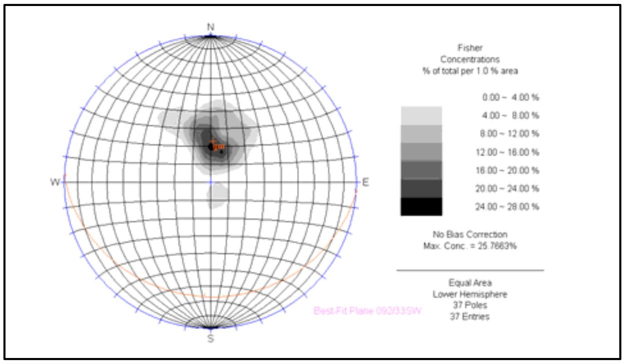


Figure 13. Equal-area lower hemisphere plot of axial planes of first phase folds.

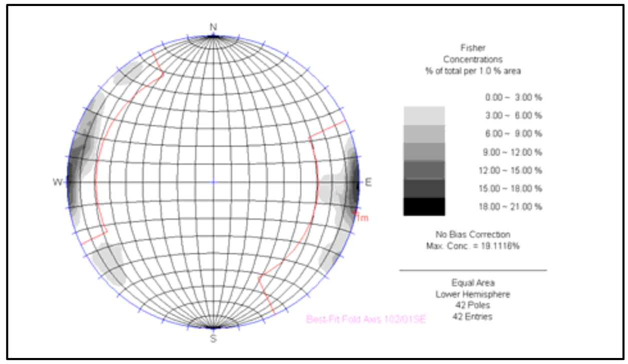


Figure 14. Equal-area lower hemisphere plot of fold axes of first phase folds.

Second Phase Folding (F_2)

Second phase folds are widespread and especially common in schist where they exhibit a chevron style (Figure 15) forming warps which die out along the axial plane. The folds have a subvertical southeasterly striking axial plane and southeasterly plunging fold axis. A crinkle lineation outlined by bent micaceous minerals parallels the fold axis.

Figure 15. On the top of Sourdough Hill, looking southeastward to second phase folds with a subvertical axial plane.

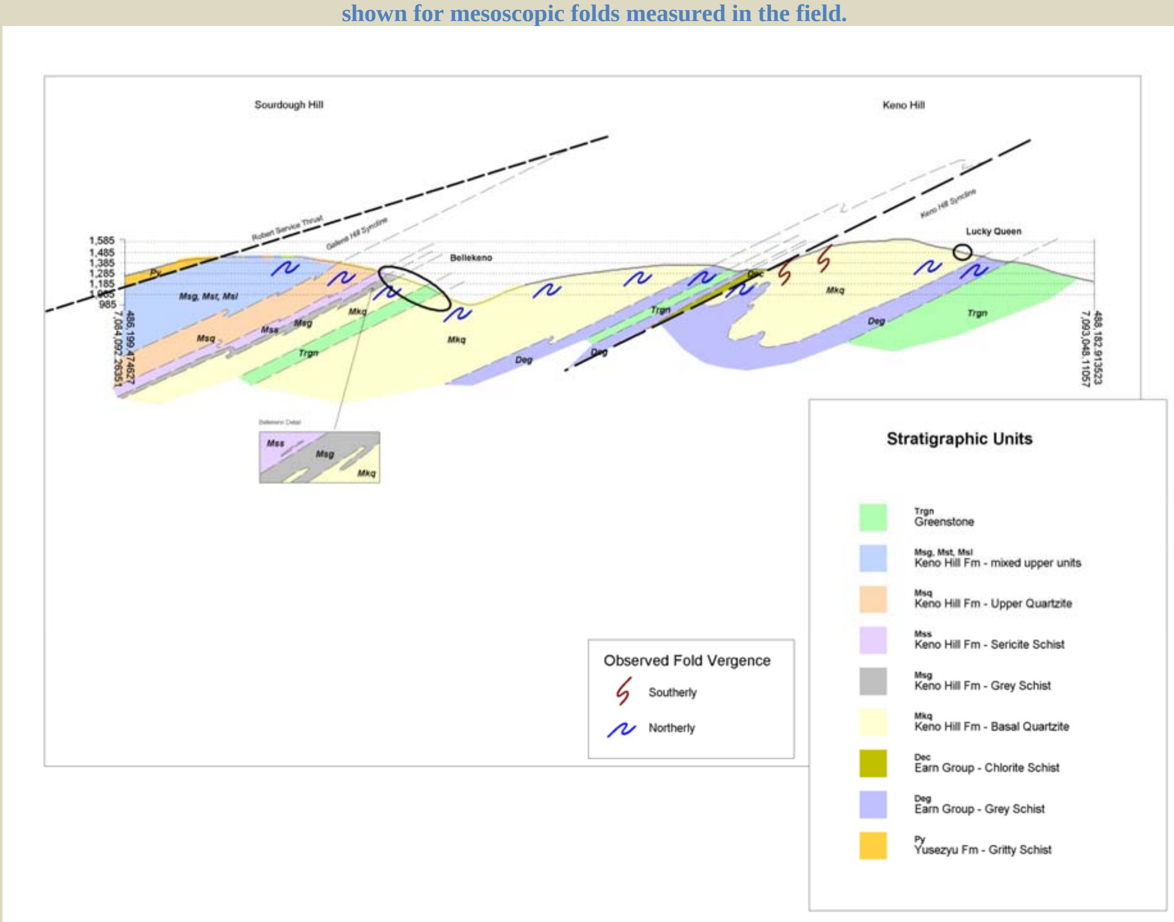
District Scale Folding at Keno Hill

- after McOnie and Read (2009) and Read (2010)

The diagrammatic cross section of Sourdough and Keno hills clearly shows a northerly overturned syncline of Basal Quartzite (**MKq**) with north-verging mesoscopic folds forming the lower limb of a syncline (Galena Hill Syncline) that extends for more than 30 km along strike. Robert Service Thrust truncates this syncline leaving essentially only the lower limb composed of, in upward stratigraphic and structural order, the Earn Group (**DEg** and **DEc**) and the Basal Quartzite (**MKq**) and overlying units **Msg**, **Mss**, **Msq** and various overlying meta-tuff (**Mst**), limestone (**Msls**) and schist (**Msg**) of the Keno Hill Quartzite.

To the north, an unnamed thrust fault omits some of the intervening Minto Hill Anticline composed of the Earn Group and the underlying Keno Hill Quartzite and sets the lower limb of Galena Hill syncline on a Basal Quartzite-cored syncline that trends through Keno and Monument hills. North verging mesoscopic folds in the Earn Group and in the Basal Quartzite near the fault support this interpretation. Farther north on the north side of Keno Hill, the Basal Quartzite and underlying rocks of the Earn Group contain northerly verging folds indicative of the lower limb of a northerly overturned syncline. This pattern of first phase folding probably continues northeastward to the Basal Quartzite-cored syncline underlying Caribou Hill. This interpretation of first phase folding takes into account the stratigraphy, orientation and character of first phase folds and is consistent with the regional style of first phase deformation first described by Tempelman-Kluit (1970) and supported by all other workers including as recently as Mair *et al*. (2006).

Diagrammatic north-south cross section through Sourdough and Keno Hills looking to the west. Vergence directions shown for mesoscopic folds measured in the field.



Faults

- after McOnie and Read (2009) and Read (2010)

At least three or possibly four periods of faulting are recognized.

Faulting Contemporaneous with First Phase Folding

Most first phase folds in schist are rootless indicating slippage along the axial-plane foliation during folding, while many boundaries between schist and quartzite beds show a low-angle truncation resulting in pinch and swell to complete truncation and disruption of the schist layers (Figure 16). What is presently unknown, but is suspected is that the juxtaposition of the three quartzite-cored synclines underlying Galena-Sourdough hills, Keno-Monument hills and Caribou Hill results from faults developed along the common limb of anticline-syncline pairs subparallel to the axial-plane foliation of the first-phase fold pairs.

Figure 16. Looking westerly in the Sime pit: Basal Quartzite showing north-verging first phase folds and a disrupted quartzite layer floating in a grey schist matrix.

Robert Service Thrust

The Robert Service Thrust truncates the top of the Keno Hill Quartzite and sets the Precambrian gritty and non-gritty schist of the Yusezyu Formation atop the Mississippian Keno Hill Quartzite. It lies at the top of the uppermost grey schist of the Keno Hill Quartzite on Sourdough Hill, in upper Duncan Creek and in Duncan Creek below its junction with Lightning Creek. Although Murphy *et al*. (1997, p. 56) described the thrust as folded and show it tightly folded in cross-section A-A' (Geoscience Map 1966-5), no evidence of changes in fold vergence directions or symmetrical distribution of rock units exist across the supposed hinges of the folded thrust on Sourdough Hill or Upper Duncan Creek. If the position of the folded fault trace was based on the occurrence of quartz grain grits and gritty rocks, these rocks occur in both the Keno Hill Quartzite and the Precambrian Yusezyu Formation and cannot be used to designate rocks as Precambrian in the Keno area. However, the thrust fault maybe very gently warped as it extends farther down Duncan Creek than anticipated from its intercepts on Sourdough Hill and Upper Duncan Creek.

These restrictions on the placement of the Robert Service Thrust mean that all the known Ag-Pb-Zn veins of the Galena and Keno hills are in rocks that lie in the footwall of the Robert Service Thrust.

Vein-Faults

In the Keno Mining District, the major vein deposits lie in left-lateral oblique normal vein-fault systems (named "vein-faults" by Boyle 1965) with major movements that typically exceed a displacement of 200 m (Table 3) and may be continuous over several kilometres in the Basal Quartzite and extend into the Earn Group.

The absolute timing of formation and periods of subsequent propagation of the mineralized vein-faults is not known, but as a result of having a detailed stratigraphy for the Sourdough Hill Member, pre to syn and post-mineralization fault offsets are more easily located.

Figure 17 Hector-Calumet vein-fault exposed in the Calumet open pit.

The south-southeast boundary of vein-faults with this magnitude of displacement passes immediately east of the Flame and Moth deposit and the Sadie-Ladue Mine. The movements of vein-faults to the east have an apparent left-lateral offset that does not exceed 100 m and the orebodies are small, widely scattered within the structure and typically do not exceed 5-10 million ounces of Ag. The western boundary of this belt is undefined and must lie west of the Husky and Silver King mines on Galena Hill, where Boyle (1965) recognized three northeasterly striking fault systems that usually dip steeply to the southeast to include:

- Western system: Silver King, Husky, Elsa, Dixie, No Cash;
- Central system: Coral and Wigwam, Bermingham, Hector-Calumet, Miller, UN adit and Formo; and
- Eastern system: West Eagle, Rico.

Vein-Fault	Attitude Strike/Dip	Slickensides Trend/Plunge	Apparent Strike-Slip[1]	Apparent Vertical[1]	Fault Movement[1]	Strike-Slip Component[1]	Dip-Slip Component[1]
Bellekeno (48)	038/75SE	080/65NE	LL 80[2]	N 40[2]	O 35[2]	LL 15[2]	N 30[2]
Moth	—	—	LL 450				
West Eagle	060/60SE	77/28 NE	LL 300	N 35	O 237	LL 203	N 120
	053/59SE	73/29NE	LL 300	N 35	O 237	LL 191	N 138
Middle Eagle	—	—	LL 300	N 25	O ~225[3]	LL ~180[3]	N ~132[3]
East Eagle	—	—	LL 100				
McLeod	—	—	LL 670				
Calumet C	348/64NE	021/49NE	LL 670	N 28	O 435	LL 245	N 365
Formo (Yukeno)	032/50SE	095/46SW	LL 150	N 33	O 99	LL 32	N 94
UN-Miller	005/69SE	013/19NE	LL 200	N 52	O 306	LL 284	N 112
Bermingham		—	—	N >30	O >118	LL >42	N >110
SW Bermingham		—	—	N >50			
Coral-Wigwam				N >50	O >96	LL >15	N >92

LL = left-lateral N = normal O = oblique R = reverse RL = right-lateral

[1]All distance are in metres

[2] Data from Otto (2009)

[3] *Components calculated assuming slickenside orientations are similar to West Eagle*

Table 3. Calculated vein-fault movements.

Post-Mineralization Faults (Cross-Faults)

High angle cross-faults, low-angle faults and bedding faults offset veins and comprise post-mineralization faults that form as breccia and gouge zones from 6 to 30 m thick. Most commonly these are northwest striking, southwest dipping cross-faults recognized by offset veins in the underground workings and open pits. On Galena Hill, the cross-faults dip southwesterly and typically show apparent right-lateral displacement, such as Brefalt, Mastiff, Jock, Hector and Calumet faults. Although Boyle (1965) noted that these faults have associated drag suggesting a reverse those faults, solved fault displacement are right-lateral oblique normal faults (Table 4). The difficulty in solving the displacements of the post-mineral faults is the complete absence of slickenside measurements on all historic underground mine maps. Of the open pits, only the Bermingham yields slickenside measurements on the Mastiff and Mirror faults.

Figure 18. A view to the south across the west end of Bermingham pit to the southwest dipping, post-mineral Mastiff cross-fault with slickensides that trend and plunge 287/36NW on a subsidiary fault surface. In the hangingwall, note an apparent fault drag implying reverse movement may be caused by an unrelated second phase fold.

Figure 19. Slickensides, plunging towards the viewer at 248/47SW, are etched on the shining surface (100/52SW) of Mirror cross-fault at the east end of Bermingham pit.

Post-Mineral Fault	Attitude Strike/Dip	Slickensides Trend/Plunge	Apparent Strike-Slip	Apparent Vertical	Fault Movement	Strike-Slip Component	Dip-Slip Component
Mastiff	316/70SW	287/36NW			O 77.3	RL 50	N 53
Mirror	100/52SW	248/47SW young					
	100/52SW	268/26SW old					
Brefalt	126/65SW		RL 1300	N 195	O 822	RL 770	N 326
Mill			RL 70-80				

LL = left-lateral N = normal O = oblique R = reverse RL = right-lateral

[1]All distance are in metres

Table 4. Calculated post-mineral cross-fault movements.

DISTRICT MINERALIZATION

The Keno Hill mineralization, comprises *polymetallic silver-lead-zinc* quartz-carbonate veins, developed in moderately steep southeasterly dipping vein-faults, with deposits hosted either by the competent Basal Quartzite Member of the Keno Hill Quartzite or in some instances in the Earn Group schist where greenstone forms part of the wall rock. Silver production has been recorded from 35 sites in the district (Table 1).

The Keno Hill deposits do not readily fit into a recognised mineral deposit model and attempts to classify a “deposit type” for the mineralization are questionable since the source(s) of metals and conditions related to ore-deposition are poorly understood.

Beaudoin and Sangster (1992) classified the Keno Hill as sediment-hosted veins, likened to the silver bearing deposits at Coeur d’Alene, USA and the Kokanee Range, Canada. A genetic relationship between silver-lead-zinc and intrusion related gold mineralization has also been postulated (Mair *et al.*, 2006).

The mineralization has been more recently classified as belonging to the Lithogene genetic group (Greybeal and Vikre, 2010) which invokes a depositional environment of re-mobilized metals, with no magmatic contribution or associated gold. Current information however, shows that this classification is not correct, as there is some magmatic component and gold is associated with the mineralization.

Mineralogy

The primary reference to the description of the mineralogy of the Keno Hill deposits is Boyle (1965). In general, common gangue minerals include (manganiferous) siderite and, to a lesser extent, quartz and calcite. Silver occurs predominantly in, or associated with, the minerals listed in the box below.

Some of the Minerals of Keno Hill (Over 85 species have been identified)

Major Minerals

- Quartz, Siderite, Calcite (gangue)
- Pyrite (FeS_2)
- Pyrrhotite ($Fe_{1-x}S$)
- Argentiferous galena ($(Pb,Ag,Sb,Bi)_2S_2$)
- Sphalerite ($(Zn,Fe,Cd)S$)
- Chalcopyrite ($CuFeS_2$)
- Arsenopyrite ($AsFeS_2$)

Sulfosalts:

- Tetrahedrite ($(Ag,Cu)_{10}(Fe,Zn)_2Sb_4S_{13}$)
- Argentiferous tetrahedrite (freibergite) ($Ag_6(Cu_4Fe_2)(Sb_4S_{13-X})$)
- Pyrargyrite Ag_3SbS_3
- Polybasite ($Cu(Cu,Ag)_6Ag_9Sb_2S_{11}$)
- Boulangerite ($Pb_5Sb_4S_{11}$)
- Jamesonite ($FePb_4Sb_6S_{14}$)
- Stephanite (Ag_5SbS_4)
- Bournonite ($PbCuSbS_3$)
- Meneghinte ($Pb_{13}Sb_7S_{23}$)

Minor Minerals

- Native silver (Ag)
- Electrum (Au,Ag)
- Acanthite (AgS_2)
- Canfieldite (Ag_8SnS_6)
- Treasurite ($Ag_7Pb_6Bi_{15}S_{32}$)
- Stibnite (Sb_2S_3)
- Stannite (Cu_2FeSnS_4)
- Cassiterite (SnO_2)
- Tourmaline ($Na(Mg,Fe)_3Al_6(BO_3)_3(Si_6O_{18})(OH)_4$)
- Hawleyite (CdS)

The presence of secondary native leaf silver, lead, zinc crystals growing in ice has been noted.

Boyle (1965) described the mineralogy of the deposits. He identified several stages of vein/mineral formation that are broadly consistent with the current observations, except perhaps for some interpretation of some minerals that he classified as “supergene”, namely some varieties of quartz, carbonates, native silver and pyrargyrite that appear to have more “epithermal” characteristics.

Hantelmann (2013, 2014a) completed a comprehensive study that established a 12-stage vein paragenesis from detailed petrological study of vein material from the Bellekeno and Flame deposits showing the relative timing of deposition and association of the mineralized phases (Figure 20). The main difference between these two deposits is that the Flame contains abundant (Stage 1) quartz – arsenopyrite-pyrite (- gold) material that is not present at Bellekeno, suggesting that mineralization may have been active over a longer period of time, as well as including greater amounts of pyrite and tin minerals although less abundant galena.

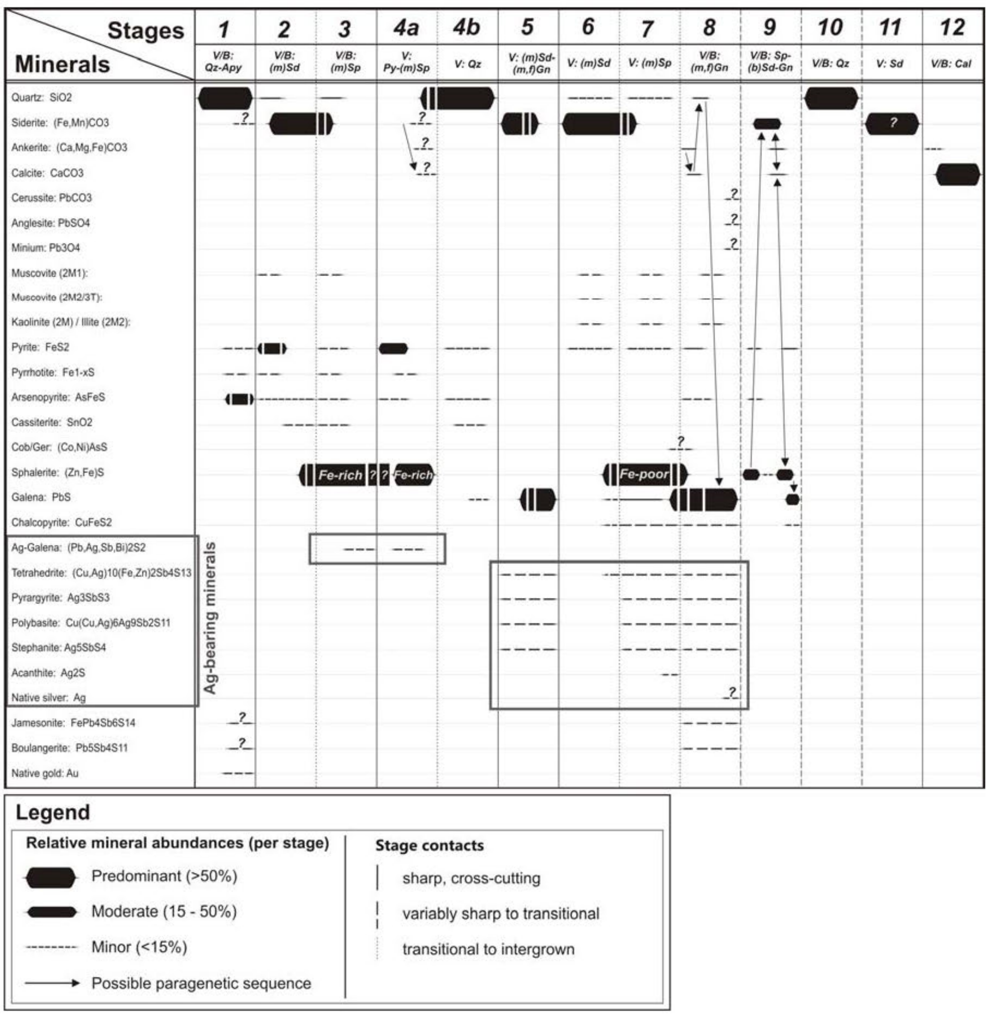


Figure 20. Vein paragenesis (Hantelmann, 2013, 2014a).

Hantelmann (2014b) also studied an extended suite of mineralized samples from the Flame Vein Lightning Zone and made a total of 87 fluid inclusion determinations that, although preliminary, do permit comparison with some other district deposits, in particular Bellekeno. As shown in Figure 21, the Flame mineralization is of higher depositional temperature with Stage 1 quartz veining (~330^{o}) not observed at Bellekeno, suggesting closer depositional proximity to a magmatic input which is in accord with the presence of tin bearing minerals and tourmaline.

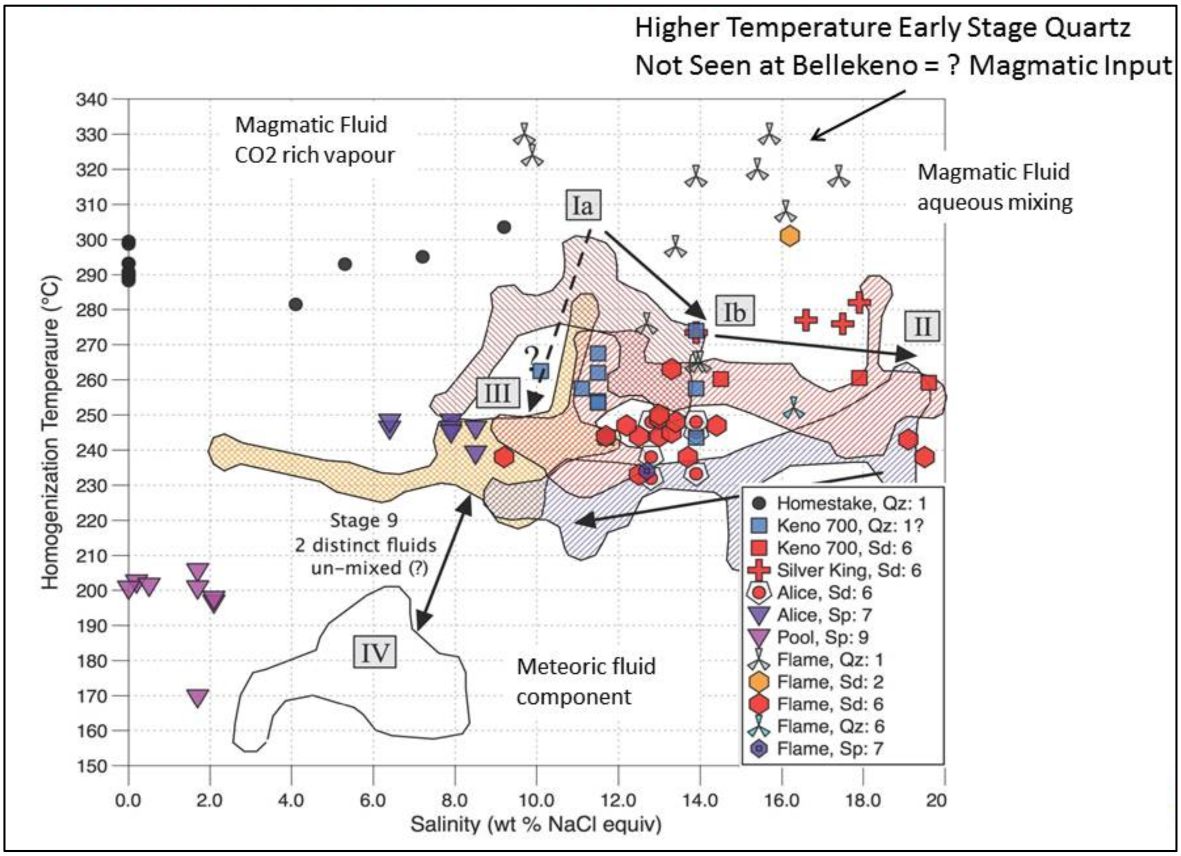


Figure 21. Microthermometry from fluid inclusion measurements, Keno Hill District (Hantelmann, 2014b).

Vein textures are commonly dominated by multiphase brecciation and re-healing. A detailed compilation of vein /mineral textures has yet to be completed, however some examples are shown below.

Figure 22. Massive siderite - sphalerite – arsenopyrite: Stage 2+ veining - Flame Vein. K-12-0432 , 317 m, (0.85 g/t Au, 268 g/t Ag, 11.5% Zn, 0.5% Pb, 1.0% As).

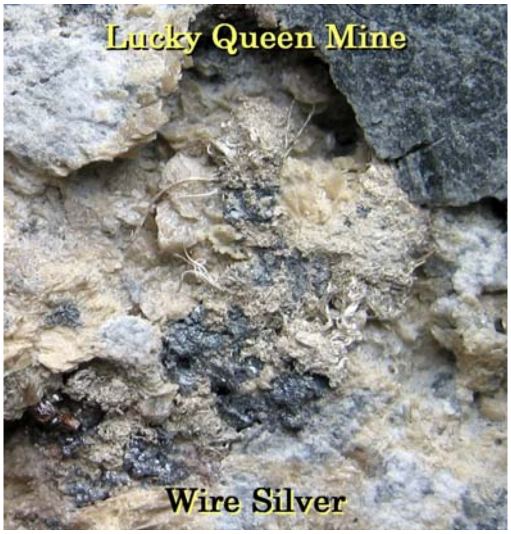


Figure 23. Wire silver from drill hole K-07-0114 Lucky Queen. Interval assayed 35,618 g/t Ag over 0.52 m from 195.97 m.

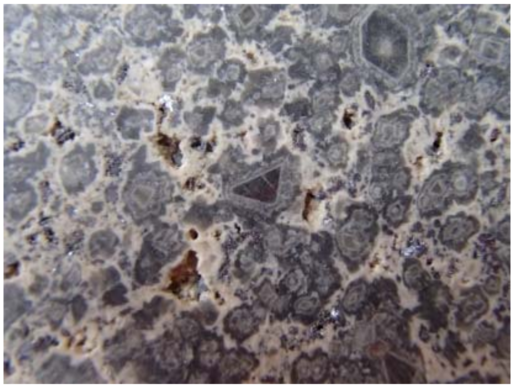


Figure 24. ? Stage 8 : Finely banded zoned clear carbonate with intergrown pyrargyrite and late white carbonate. K-15-0580, 310.3 m. 2.14 g/t Au, 29,310 g/t Ag, 35.5% Pb, 1.3% Sb.

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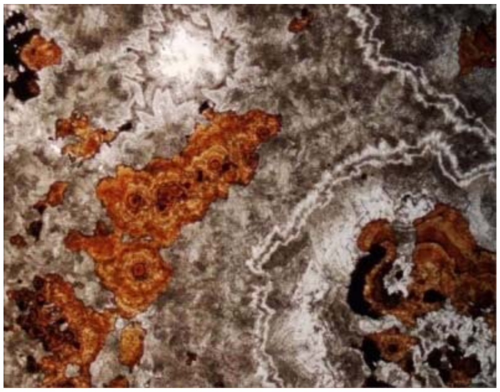

Figure 25. K-07-0106 398.6m, Bellekeno. Zoned sphalerite intergrown with banded and dog-tooth carbonate. 0.72 Au, 268 g/t Ag, 1.0% As, 11.5% Zn, 0.5% Pb.

Figure 26. Finely banded colloform banded siderite, galena and sphalerite as in detail Figure 25.

Figure 27. Wallrock veining - Hector-Calumet open pit.

Figure 28. Monomict hydro-breccia with quartz matrix cut by later quartz veinlets. Silver King open pit.

Figure 29. Polymict veined hydro-breccia - Wernecke Mine dump

Alteration

No macroscopic scale alteration is readily evident about mineralized veins.

Exposures in the open pits show a zone up to about ten metres wide with occasional narrow (oxidized) quartz-siderite-pyrite veinlets developed particularly in the hangingwall to the main vein. Drill core at Flame & Moth typically shows the increasing development of narrow veinlets containing euhedral, bright open space filled pyrite in the hangingwall to the main vein.

An XRD study of wall rock about the main Bellekeno Vein did not indicate any silicate/carbonate mineral zonation about the mineralization (Simmons and Simpson, 2007).

Age of Mineralization

The age of the Keno Hill mineralisation has not been directly determined. The youngest rocks in the district that are cut by the mineralisation are reported to be quartz-feldspar porphyry dykes (Boyle, 1965). Murphy *et al.* (1997) concluded that the mineral faults formed during the late stage cooling of the Tombstone Intrusives, following the intrusion of some dikes and emplacement of higher temperature gold bearing fluids. This is consistent with the findings of Tupper and Bennett (2009) who obtained two U-Pb age dates of approximately 93 Ma for aplite dikes in Duncan Creek just south of the Flame & Moth deposit and indicates the presence of Tombstone Suite intrusions at Keno Hill.

$^{40}Ar/^{39}Ar$ dating of biotite flakes from a pre-mineral lamprophyre exposed at the Formo prospect gave a Weighted Mean Age of 89.02 ± 0.28 My and yields a maximum age for siderite-sphalerite-galena style of mineralization (Read, 2010), and with Sinclair *et al.* (1980) K/Ar date of 87.0 ± 3 My on sericite alteration of Ag-Pb-Zn vein wallrock constrains the timing of vein formation to between 87 ± 3 My and 89 ± 0.32 My.

Trends

Cathro (2006) suggested that experience in the UKHM mines indicated a vertical mineral zonation from an upper lead to lower zinc enrichment determined a silver-poor, sphalerite-rich base to the economic mineralization. Historically, it was also believed that economic mineralization was restricted to a shallow zone of about 120 m thickness. However, the 370 m depth of production from the Hector-Calumet mine and drill indicated mineralization to over 350 m depth at Flame & Moth demonstrate that silver-rich veins exist over greater vertical intervals. Besides, there is over 935 m of vertical topographic relief between the Husky SW and Keno 200 mines.

The true influence of supergene alteration is uncertain and if present may have been largely removed by erosion.

Mineralizing Controls

The primary mineral control is the presence of dilation zones in the pre-mineral faults where multiple pulses of mineral deposition occurred from fluids as they depressurized or boiled during repeated reactivation and breccia formation along the host fault structures.

Fundamental to understanding the process is the recognition of the incremental propagation of the host fault structures, the faults that link the segments forming bends in the vein-fault surface and the parts of the structures that present dilational zones. Study of the Bellekeno vein-fault that varies between several centimetres and over five metres in width, has shown that mineralization is best developed at releasing linkages in more competent stratigraphy (Iles, 2015).

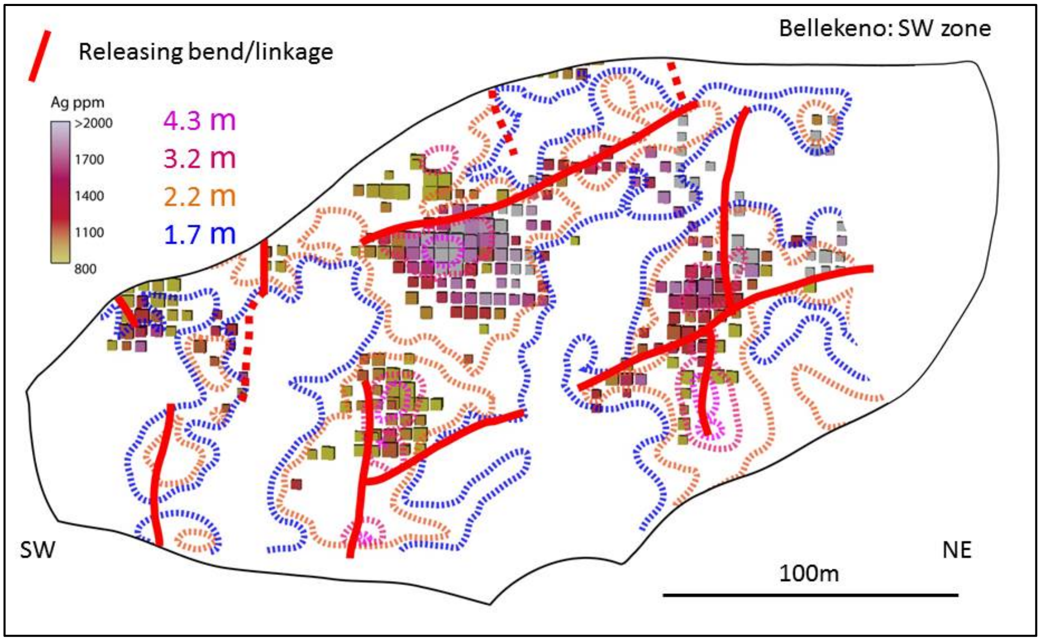

Figure 30. Longsection of Bellekeno SW Zone (looking NW) showing releasing fault linkages, contoured vein thickness and ore blocks. Sub-horizontal bends reflect stratigraphic contrasts between soft graphitic schist packages and competent thicker quartzite bands.

The secondary mineral control is the presence of a metal pregnant (mesothermal) fluid to fill the dilational spaces and physio-chemical conditions to permit deposition inferred to be predominantly through processes of de-pressurization or boiling. The actual source or path of the mineral depositing fluids has long been a matter of conjecture, however as the mineralization occurs over such a wide area and large vertical extent, the fluid reservoir is considered to have been large.

The source of the metals is inferred from detailed petrology and geochemical analysis to be at least in part magmatic, most likely related to late phases of Tombstone events.

Exploration

In 2006 Alexco acquired the entire historic archive of UKHM's mining and exploration records that were scanned and digitized to formats suitable for 3D modelling and/or GIS plotting, and aggressive exploration drilling programs have been completed every year. Up until December 2015, work has included:

- Historic Data Capture
- Aerial and Ground Geophysics
- Geochemical Surveys
- Geological Mapping
- Drilling
    - 142,240 m of surface diamond drilling
    - 1,150 m of surface RC drilling
    - 24,880 m underground drilling

- Silver Resource inventory increased by surface exploration to 45.9 Moz Indicated and 12.0 Moz Inferred at silver discovery cost less than $0.60/oz

As discussed below, exploration has targeted increasing silver resources with work completed at:

- Bellekeno
- Flame & Moth
- Lucky Queen
- Onek
- Bermingham

And numerous other opportunities are present.

The Bellekeno Deposit

A series of 10 mineralized veins including the productive Bellekeno 48 Vein occur on the northern slopes of Sourdough Hill. Small tonnages were historically mined between 1921 and 1989 to produce 2.3 Moz silver.

A small historic resource existed when Alexco acquired the property where some development was already in place; Alexco then completed drilling of 19,800 m in 70 surface holes, and 12,600 m in 184 underground holes prior to commencement of mining. The mine was in operation between 2011 and 2013 producing 5.6 Moz silver, 44.5 Mlb lead and 16.3 Mlb zinc from 242,000 tonnes ore at average grade of 779 g/t (25.0 oz/t) Ag, 9.5% Pb, 5.1% Zn at a cash cost of $11.81/oz silver.

Veins generally strike 030° to 040°, with dip directions varying 60° to 80° southeast or northwest. Within the 48 Vein structure, there are three main zones: Southwest, 99, and East. Vein true thickness ranges between a few centimetres to greater than 5.5 m (Figure 31). Left oblique-normal movement along the 48 Vein-fault is estimated from stratigraphic offset with the hangingwall downthrown approximately 35 m on a vector of $080^{o}/65^{o}$ (Figure 32).

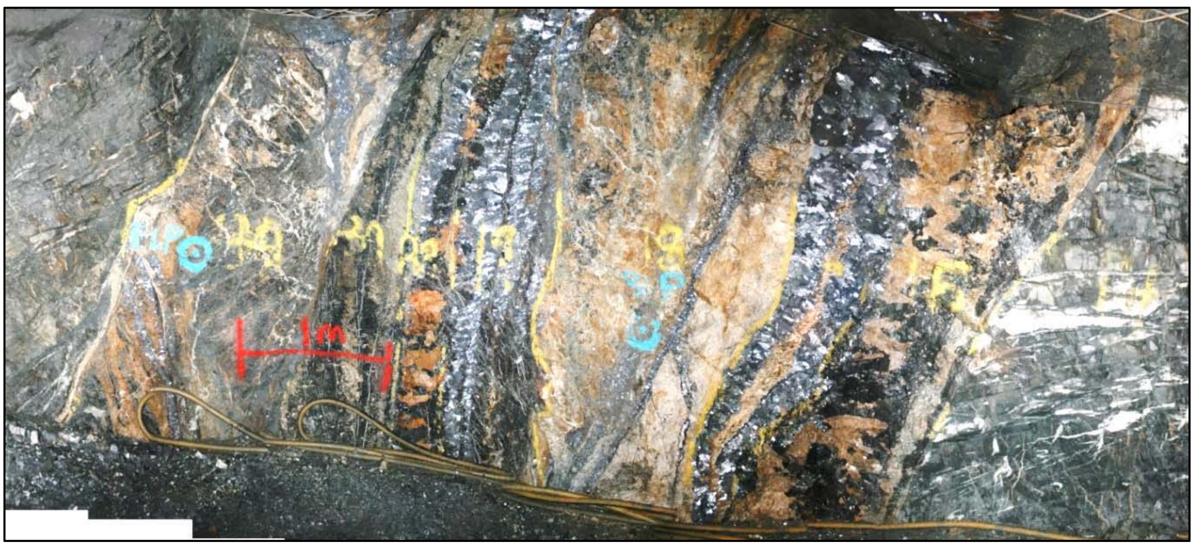

Figure 31. Bellekeno 48 Vein with bands of silvery galena, black sphalerite and buff siderite developed across approximate width of 5 m.

The distribution of surface and underground drill hole intercepts are shown in Figure 33 and Figure 34.

The mining operation is temporarily suspended due to low metal prices, however remaining mineral resources are estimated at 4.9 Moz Indicated at 585 g/t (18.8 oz/t) Ag, 3.5% Pb, 5.3% Zn; 3.3 Moz Inferred at 428 g/t (13.8 oz/t) Ag, 4.1% Pb, 5.1% Zn as shown in Figure 35 and Table 9 (SRK, 2014).

As previously discussed, study of Bellekeno has identified controls on mineralization that can be applied across the district (Figure 36).

Class	Tonnes	Ag (gpt)	Pb (%)	Zn (%)
Indicated*	365,000	658	5.3	5.3
Inferred*	243,000	428	4.1	5.1

* Mineral resources are not mineral reserves and have not demonstrated economic viability. All figures have been rounded to reflect the relative accuracy of the estimates.

** Reported at a cut-off value of C$185 (US$1 = C$1)/t using consensus long term metal prices (US$) and recoveries of Ag US$22.50/oz, recovery 96%; Pb US$ 0.85/lb, recovery 97%; Zn US$ 0.95/lb, recovery 88%; Ag grades capped at 5,000 gpt.

Table 5. Mineral resource statement for Bellekeno (SRK, 2014).

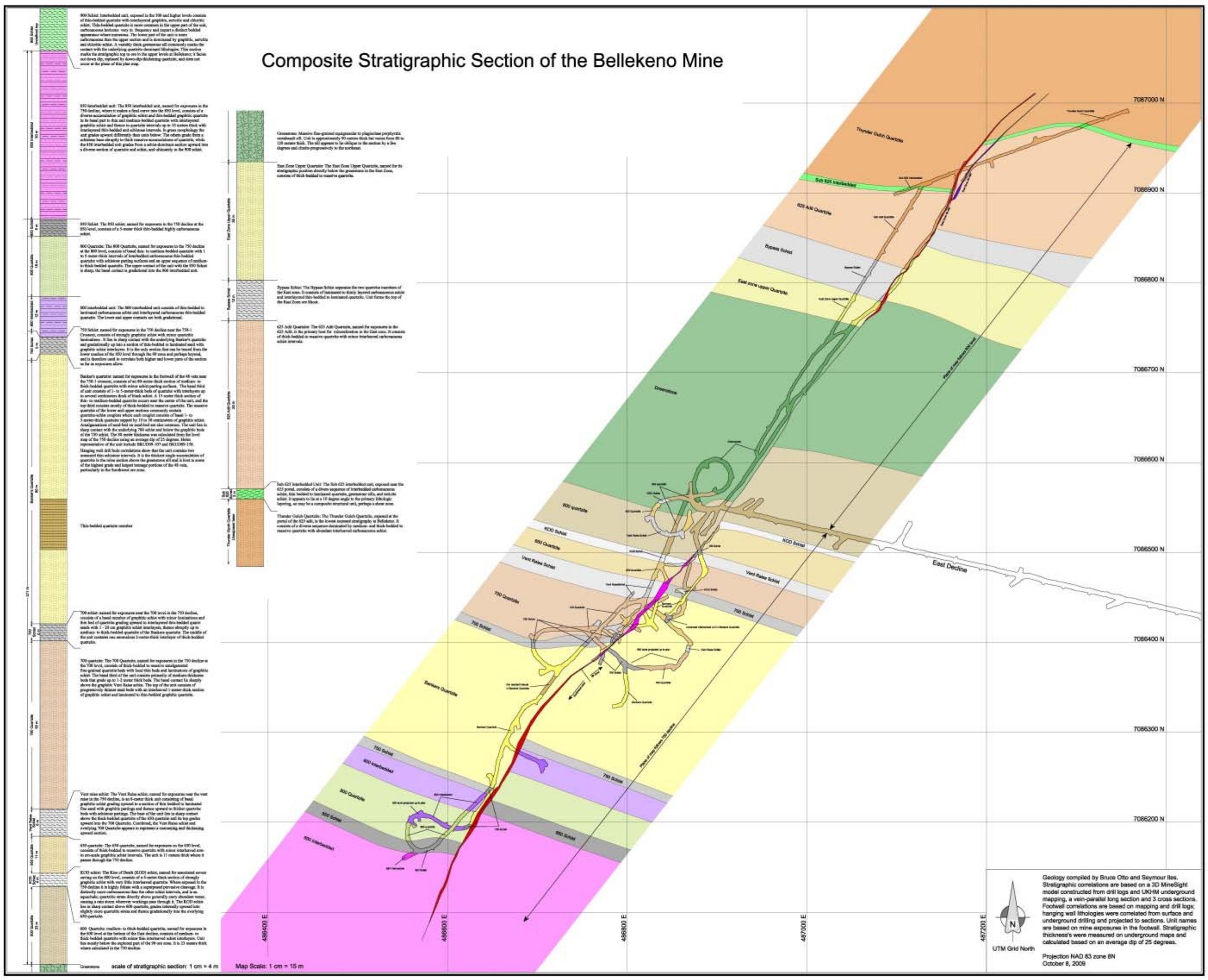

Figure 32. Detailed stratigraphic section of the Bellekeno Mine (Otto, 2009).

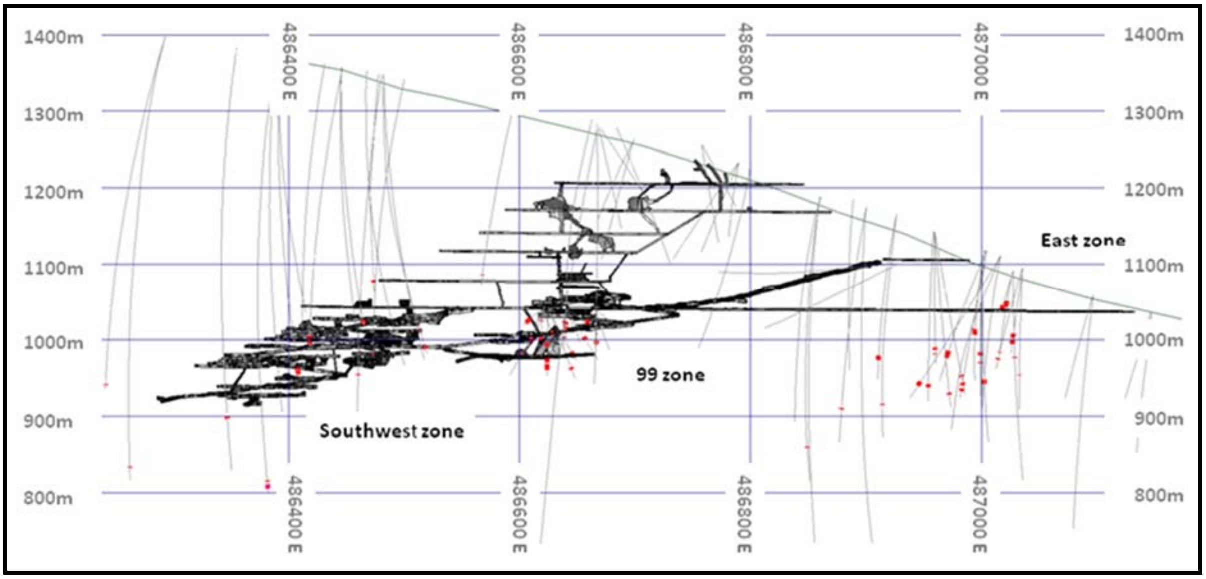

Figure 33. Bellekeno Mine long section, surface core drill holes, 2006 – 2013 (vein intercepts are highlighted in red; image view is 312AZ, looking northwest).

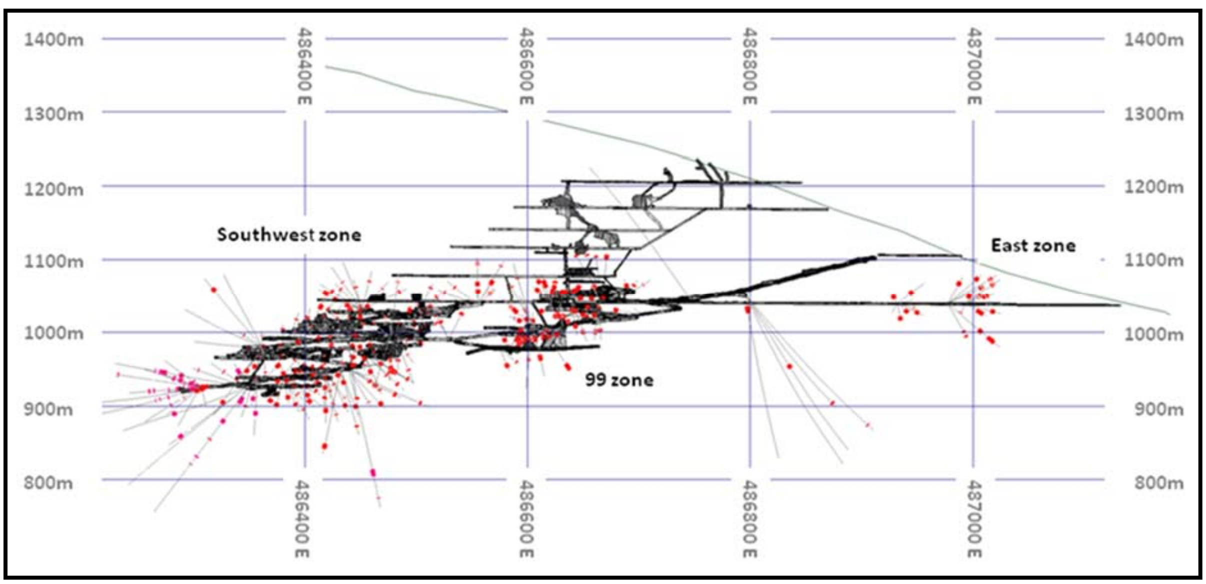

Figure 34. Bellekeno Mine long section, underground core drill holes, 2006 – 2013 (vein intercepts are highlighted in red; image view is 312 AZ, looking northwest).

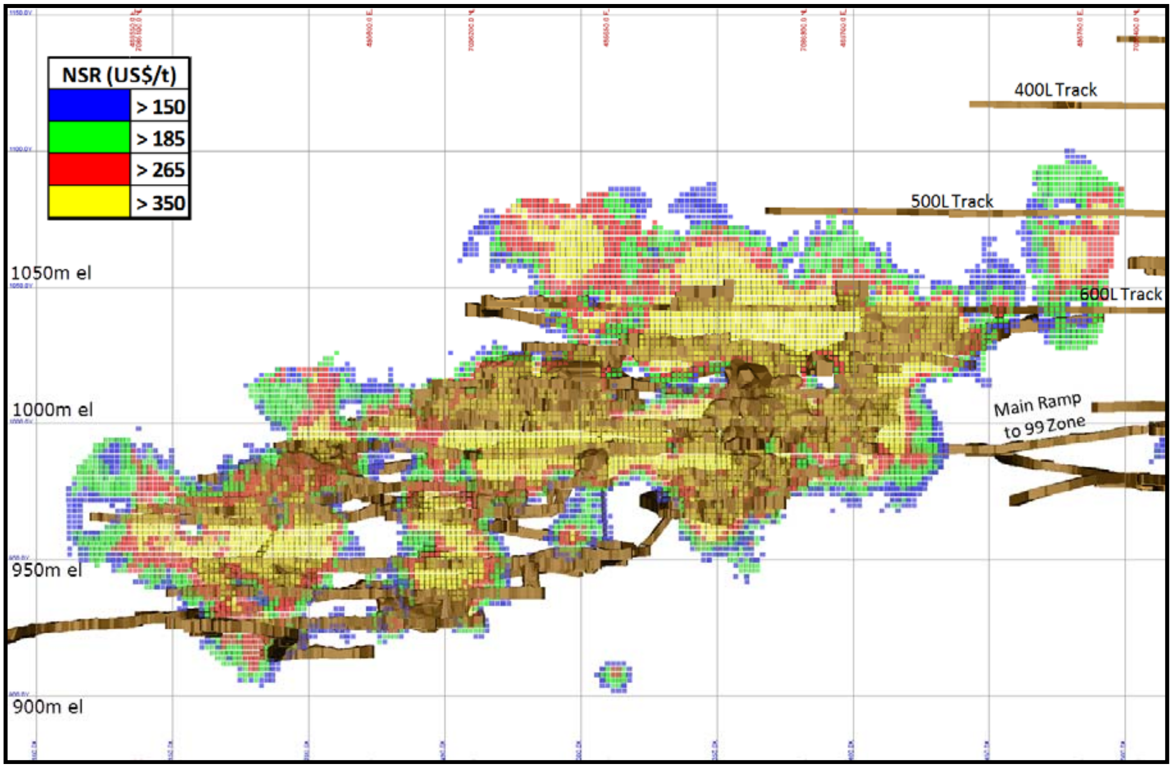

Figure 35. Long section looking northwest - Bellekeno SW Zone – showing undiluted block values (SRK, 2014).

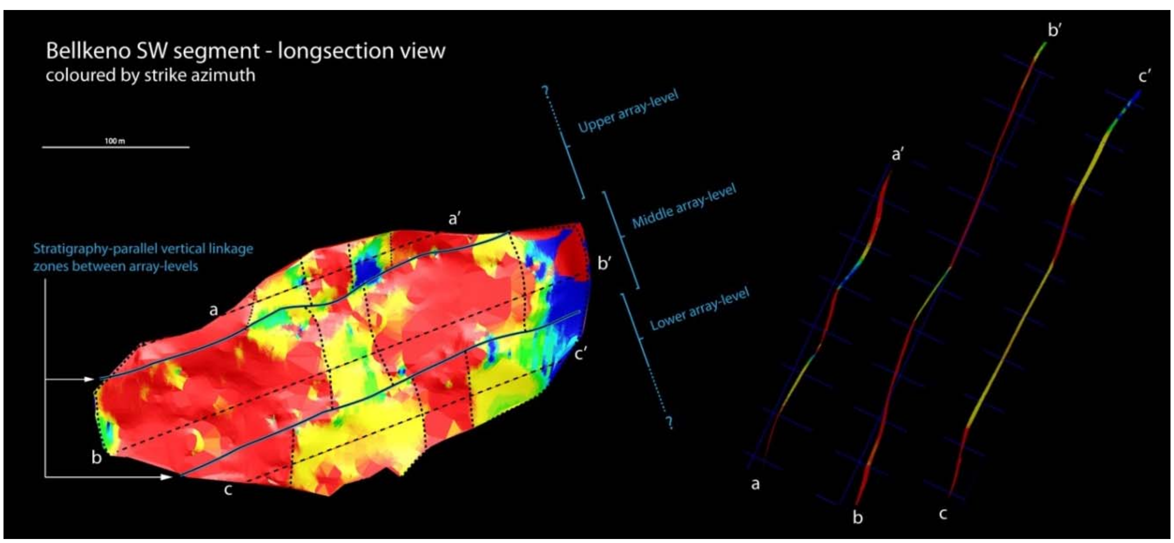

Figure 36. Long section view of the Bellekeno SW Zone coloured by strike azimuth, looking northwest. Blues lines show the location of linkage between upper, middle and lower array levels; note that they parallel stratigraphy. Inclined sections are shown for each array-level, and all exhibit abrupt strike variations that vary markedly between levels. (Iles, 2013).

The Flame & Moth Discovery
(material largely sourced from Chipman and McOnie, 2015)

The Flame Vein is a structurally controlled north-northeast striking silver-lead-zinc mineralized quartz-carbonate hosted vein-fault divided into the Christal and Lightning Zones by 95 m right oblique displacement on the post-mineral Mill Fault. It is estimated to contain a silver resource of 26.6 Moz Indicated at 506 g/t Ag and 4.1 Moz Inferred at 366 g/t Ag (Table 6, SRK, 2015a).

Class	Tonnes	Ag (g/t)	Au (g/t)	Pb (%)	Zn (%)
Indicated*	1,638,000	506	0.43	1.89	5.40
Inferred*	348,000	366	0.26	0.47	4.37

* Mineral resources are not mineral reserves and have not demonstrated economic viability. All figures have been rounded to reflect the relative accuracy of the estimates.

** Reported at a cut-off value of $185 (US$0.85 = C$1)/t using consensus long term metal prices (US$) and recoveries developed for the nearby Bellekeno deposit (Ag US$20.00/oz, recovery 96%; Pb US$ 0.94/lb, recovery 97%; Zn US$ 1.00/lb, recovery 88%; Au US$ 1,300/oz, recovery 72%

Table 6. Mineral Resource Statement for the Flame & Moth Deposit (SRK, 2015a).

It is reported that the Flame & Moth area was originally staked in 1920 over outcropping mineralized veins considered to be the source of a significant amount of pyrite that was encountered by early placer gold prospectors in Duncan Creek.

In 1950 UKHM sunk a shallow shaft on the Moth claim and identified quartz-carbonate vein hosted mineralization averaging 343 g/t silver, 1.6% lead, 5% zinc developed in quartzite and greenstone within a zone approximately 30 m long and up to 10 m wide. They conducted various exploration programs between 1950 and 1984 including a total of of 155 drill holes were historically completed for 4968 m, including nine surface diamond holes for 731 m, 13 underground diamond holes for 193 m, and 133 RC overburden holes for 3,986 m, without encountering any significant mineralization.

At the time of the UKHM shutdown in 1988, a small historical resource of 11,485 tonnes grading 594 g/t silver and 1.4% lead was listed in the mineral inventory as Probable Ore and this is now considered to comprise part of the Moth Vein, a small splay vein with an attitude of 058°/50° SE, off the recently discovered Flame Vein with the distinctly different attitude of 026°/65° SE.

The presence of a significant stratigraphic offset of about 450 m on a pre-mineral fault was recognized during district mapping (McOnie and Read, 2009), and combined with the interpretation of a large silver geochemical anomaly from the UKHM exploration (McOnie, 2008), and confirmation of the presence of mineralization obtained during construction of the District Mill in 2009 that exposed subcropping oxidized vein material assaying 1.38 g/t Au, 1,428 /t Ag, 1.4% Pb, and 2.9% Zn over two metres (McOnie and Read, 2009), Alexco commenced drilling in July 2010 (Figure 37), with the almost immediate discovery of the Flame Vein in drill hole K-10-0264.

Since then a number of geochemical and geophysical surveys, petrological studies and resource estimates have been completed as well as a total of 41,531 m surface diamond drilling completed on the wider Flame & Moth prospect area in a total of 176 drill holes (Chipman and McOnie, 2015).

The surface geology mapping of the prospect area (Figure 38) identified three important features relative to the mineralization:

- The Flame Fault shows an apparent left-strike slip stratigraphic offset of over 400 m indicating the presence of a significant pre-mineral fault;
- The stratigraphic position lies close to the top of the favourable host unit of the Keno Hill Basal Quartzite Member, creating the presence of a significant thickness of about 800 m of favourable host stratigraphy down dip; and
- The majority of the area is covered by Pleistocene glaciofluvial sediments that display rapid variation in depth to define steep walled channels in the basement rock paleosurface.

Figure 37. Drilling at Flame and Moth adjacent to the District Mill, looking west to Galena Hill.

The mineralization is hosted by the Keno Hill Basal Quartzite (Mkq) that appears to be at least 800 m thick in this section, with greenstone (Trgn) commonly the footwall host. This is conformably overlain by the Keno Hill Quartzite Sourdough Hill Member with approximately 175 m of graphitic (Msg) or sericite schist (Mss) marker units and the Upper Quartzite Marker (Msq). Stratigraphy generally parallels the dominant foliation and strikes between 90^{o} and 100^{o} with dips ranging between 25^{o} and 30^{o} southwest.

The veining is characterized by a (mesothermal) mineral assemblage with several different stages of vein development, frequently multiphase brecciated and re-healed, that essentially contain an earlier quartz dominant phase and a later siderite dominant phase both with associated pyrite, pyrrhotite, sphalerite, jamesonite, boulangerite, tourmaline, stannite, cassiterite and gold.

Pyrite is the most common sulphide, occurring both in massive sections and as veinlets that often re-heal brecciated parts of the vein. Distinctive open space bright euhedral pyrite veinlets are commonly developed up to 10’s of metres in the hangingwall of, and with increasing intensity towards, the Flame Vein mineralization. Pyrrhotite occurs within the vein as stringers and in massive form over up to 50 cm intervals, particularly in the deeper central part of the vein. Arsenopyrite is abundant as part of the early quartz stage mineralization. Galena is generally found as “steely” coloured stringers, blebs, and small bands 2-10 cm in width.

Petrographic studies (Vancouver Petrographics, 2011, 2012; Hantlemann, 2013) identified the silver bearing phases to predominantly occur as small (<0.01-2 mm) inclusions in and galena, or around sphalerite, pyrite or arsenopyrite, commonly in association with chalcopyrite.

The assemblage indicates a dominant Ag-Cu-Pb-Sb-Sn (-Bi) mineralizing association and suggests that at least a portion of the mineralizing fluids are derived from a magmatic source.

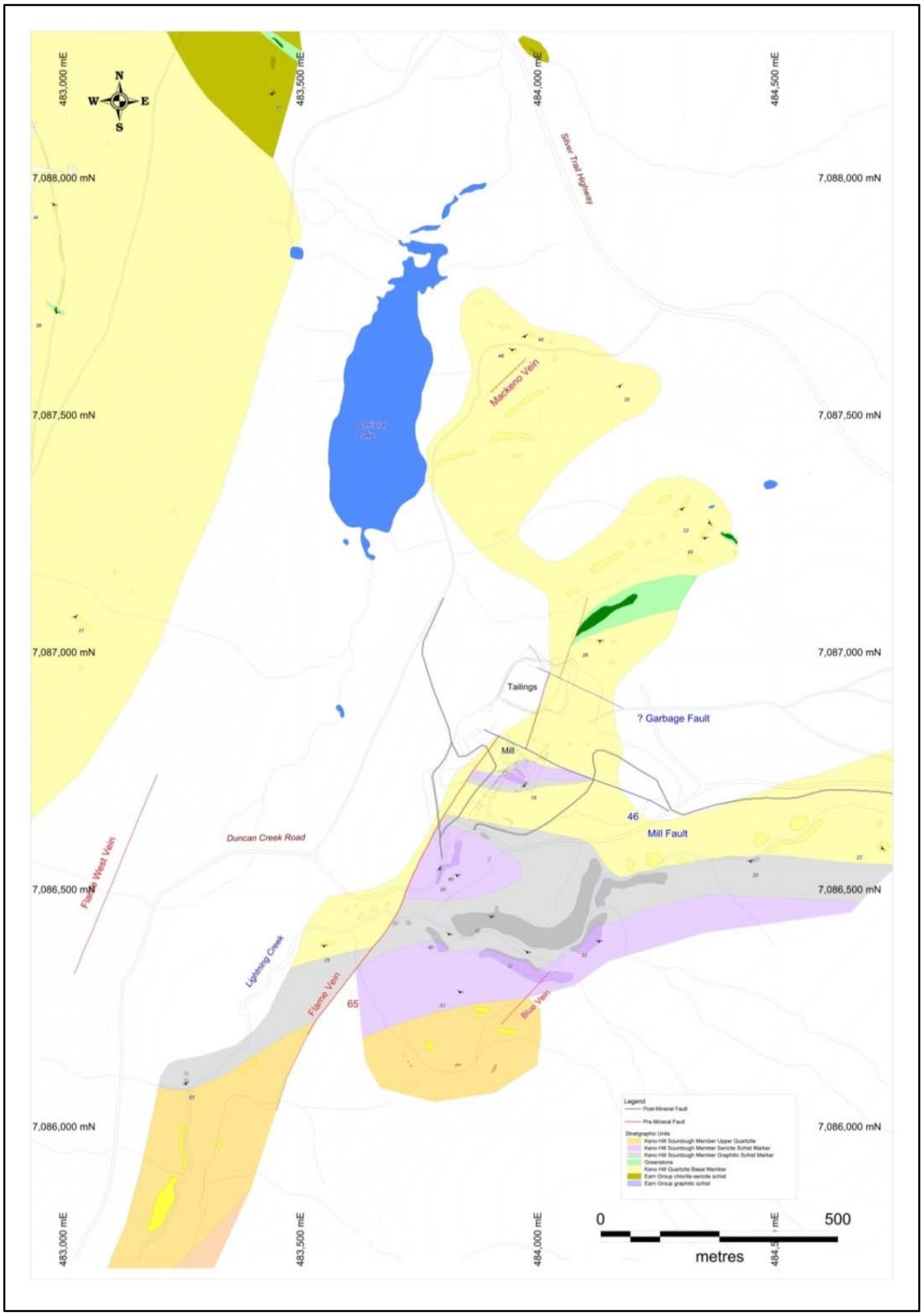

Figure 38. Detailed Geology of the Flame & Moth area (uncoloured areas are covered by Pleistocene glaciofluvial deposits).

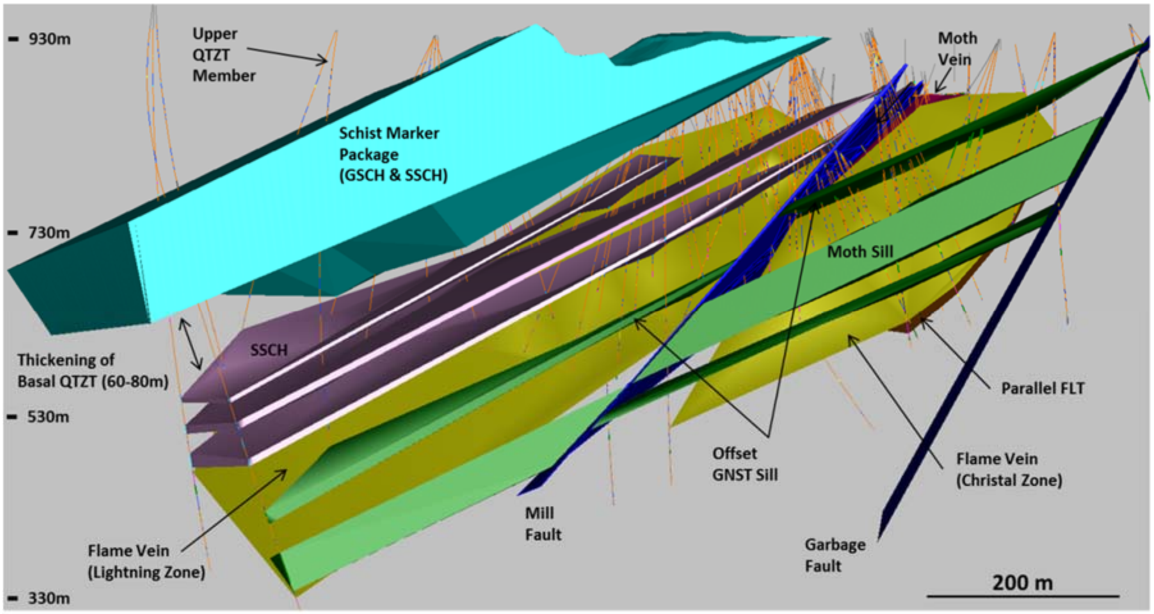

Figure 39. Longitudinal 3D View (looking west) of the Flame system showing hangingwall stratigraphy.

	Au ppm	Ag ppm	Pb ppm	Zn ppm	Cu ppm	Fe%	As ppm	Bi ppm	Ca %	Cd ppm	In ppm	K %	Mg %	Mn ppm	Na %	S %	Sb ppm	Sn ppm	W ppm
Au ppm	1.00																		
Ag ppm	0.73	1.00																	
Pb ppm	0.41	0.73	1.00																
Zn ppm	0.43	0.51	0.50	1.00															
Cu ppm	0.76	0.78	0.48	0.49	1.00														
Fe %	0.63	0.44	0.20	0.31	0.81	1.00													
As ppm	0.77	0.44	0.21	0.27	0.53	0.60	1.00												
Bi ppm	0.83	0.57	0.31	0.34	0.82	0.84	0.69	1.00											
Ca %	-0.07	0.04	0.11	0.03	-0.06	-0.13	-0.12	-0.13	1.00										
Cd ppm	0.47	0.56	0.54	0.99	0.53	0.36	0.31	0.38	0.04	1.00									
In ppm	0.40	0.46	0.49	0.27	0.51	0.45	0.47	0.40	0.03	0.31	1.00								
K %	-0.22	-0.20	-0.12	-0.28	-0.33	-0.26	-0.27	-0.32	0.15	-0.28	-0.14	1.00							
Mg %	-0.09	-0.14	-0.11	-0.26	-0.12	0.05	-0.10	-0.07	0.30	-0.25	-0.09	0.44	1.00						
Mn ppm	0.37	0.36	0.16	0.33	0.67	0.80	0.38	0.60	-0.09	0.36	0.49	-0.26	-0.09	1.00					
Na %	-0.23	-0.21	-0.11	-0.14	-0.26	-0.18	-0.26	-0.28	0.06	-0.15	-0.12	0.55	0.28	-0.19	1.00				
S %	0.66	0.55	0.36	0.54	0.73	0.79	0.66	0.72	-0.11	0.58	0.41	-0.39	-0.19	0.50	-0.23	1.00			
Sb ppm	0.46	0.80	0.53	0.37	0.46	0.18	0.30	0.23	-0.03	0.40	0.25	-0.03	-0.11	0.14	-0.14	0.36	1.00		
Sn ppm	0.51	0.59	0.42	0.18	0.49	0.38	0.53	0.39	-0.01	0.21	0.66	-0.07	-0.09	0.37	-0.14	0.41	0.59	1.00	
W ppm	0.12	0.06	-0.01	0.30	0.07	0.06	0.04	0.07	-0.01	0.30	-0.04	0.01	-0.04	0.06	-0.03	0.12	0.13	-0.05	1.00

Table 7. Correlation coefficients for elements assayed within the overall Flame structure.

Figure 40. Complete drill hole intercept of K-12-0432 (311.34-319.32 m) showing the quartz and siderite vein types. Composite assay over 6.99 m true width 1,180 g/t Ag (37.9 oz/t), 1.5 g/t Au, 2.1% Pb, 7.5% Zn.

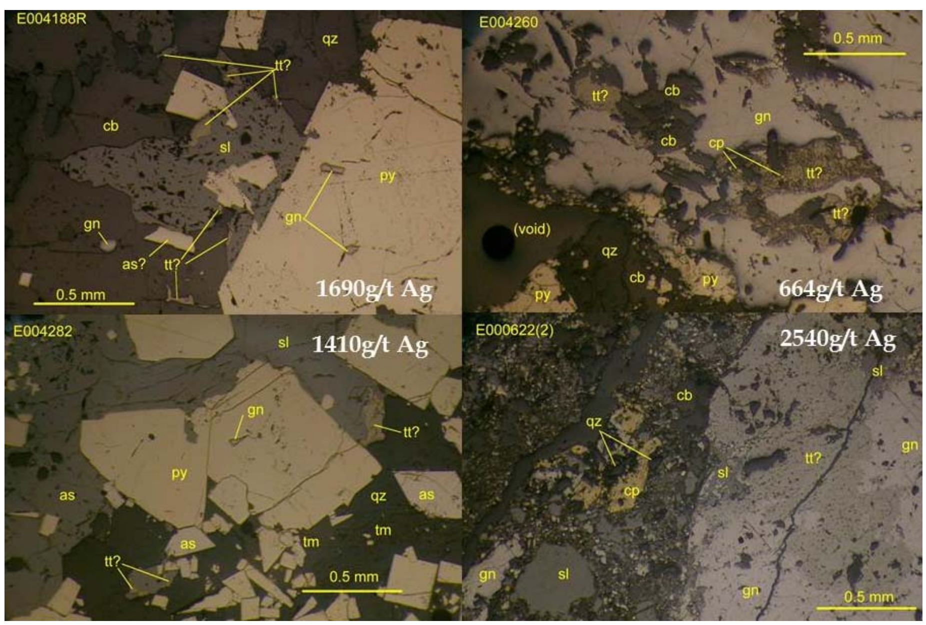

Figure 41. Photomicrographs of high grade silver mineralization Flame Vein.

[as = arsenopyrite, cb = carbonate, cp = chalcopyrite, gn = galena, qz = quartz, py = pyrite, tm = tourmaline, tt = tetrahedrite, sl = sphalerite]

The wireframe model of the mineralized vein has a strike length of approximately 980 m, plunging from a near-surface elevation of 908 m in the northeast to an elevation of 295 m in the southwest to give a vertical range of about 610 m a with a maximum mineralized down-dip component of about 300 m. It has a consistent attitude of approximately 026°/66° SE, with the attitude of the Mill Fault being 112°/46° SE. The vein appears remarkably uniform in thickness, averaging 4.0 m true width on the Lightning Zone, 2.7 m true width in the Lightning V2, and 4.0 m true width in the Christal Zone. The maximum vein width observed in drilling is 10.15 m true width. The average true thickness and weighted assay values for the wireframe are shown in Table 8.

	True Width (m)	Au g/t	Ag oz/t	Pb %	Zn %	Cu %	As %	Cd ppm
Average Composite Value	3.95	0.39	15.4	1.9	4.4	0.2	1.03	332
Maximum Composite Value	10.15	1.51	127.4	19.2	15.5	0.6	5.17	1110
Maximum Individual Assay		6.85	429.75	52.4	35.6	3.35	12.9	2935

Table 8. Average true width and composite assay values for drill intervals in the Flame Vein wireframe.

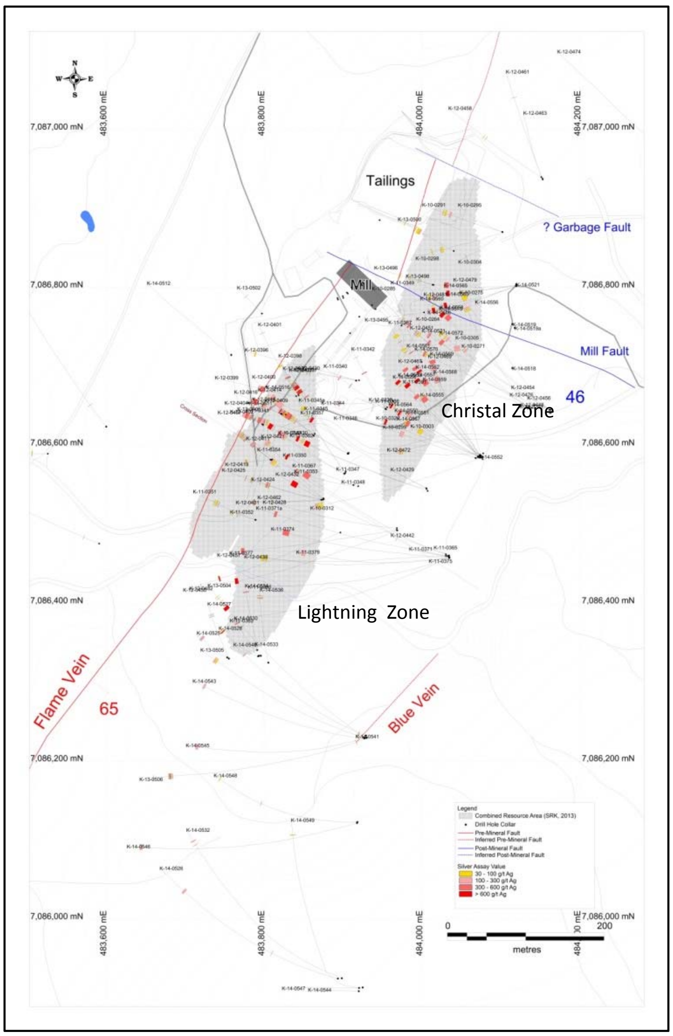

Figure 42. Drill holes, silver assays and resource location, Flame and Moth surface plan.

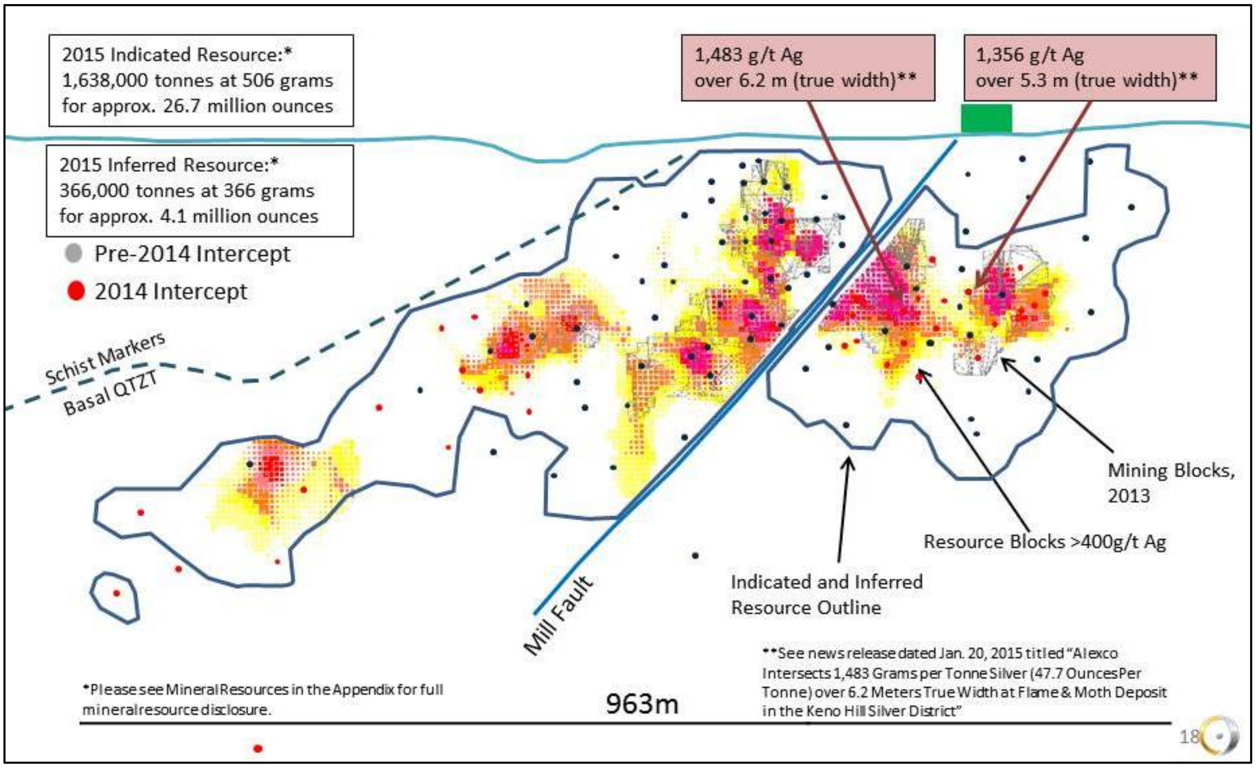

Figure 43. Longitudinal view of the Flame resource outline and 2014 surface drilling (looking west).

The distribution of (silver grade x true thickness) (Figure 44) and other elements within the reconstructed Flame Vein illustrates a central core of silver mineralization as somewhat separate sub-vertical shoots with irregular top and base developed over a vertical range of about 250 m. The distribution of zinc is more variable than silver-lead, and there appears to be an enrichment of iron and sulphur in the lower part of the mineralization.

The Flame and Moth area is generally covered by highly variable amounts of alluvium largely deposited at the terminal face of secondary arm of a major glacier that flowed west from the Ladue valley down the South McQuesten valley near to where it joined drainage from a smaller glacier that flowed south down the Lightning Creek drainage from the Mt. Hinton area. These comprise predominantly glaciofluvial channel deposits associated with lateral and interfluve meltwater channels of the Late Pleistocene McConnell Glaciation (Bond, 1998) that extend across the area between Lightning Creek and the Silver Trail Highway and from Christal Lake to Keno City.

The overburden deposits encountered by drilling range between very coarse boulder beds several metres in thickness, fine running sands, and very fine lacustrine silt and clay beds, that may range up to over 85 m in thickness close to the Silver Trail Highway, and up to 45 m in the vicinity of the Flame & Moth. Rapid lateral changes in thickness indicate the presence of steep walled paleo-channels.

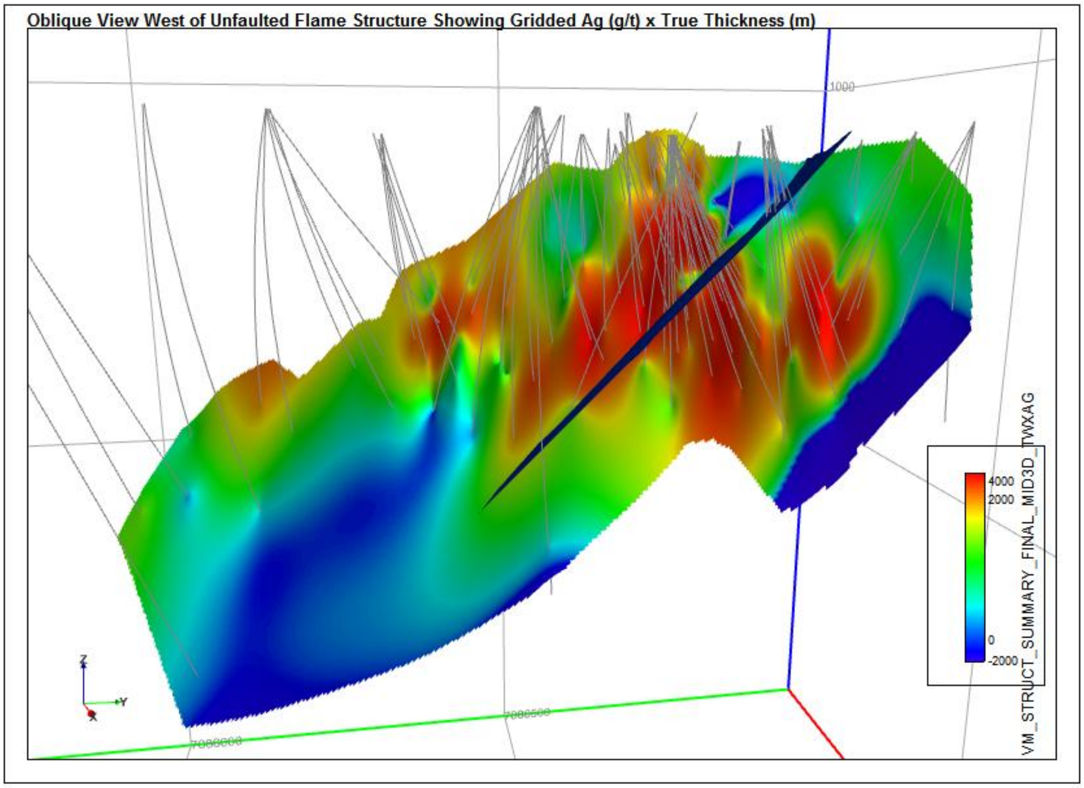

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Figure 44. Showing gridded Ag (g/t) x true thickness (m). Oblique view west of restored Flame Vein – colours hotter than light green indicate equivalent > 20 oz/t over 1 m true width.

Bermingham
(material largely sourced from Iles and McOnie, 2016)

The first claims in the Bermingham area were staked in the vicinity of the open pit in 1921, but no underground exploration was conducted until 1923 when vein float was discovered. Underground workings by Treadwell Yukon Company who optioned the claim group in 1928 showed the Bermingham Vein to carry grades of up to 150 oz/t silver to a maximum width of 17 m immediately east of the Mastiff Fault, across which the vein was later located with a 90 m offset.

UKHM subsequently purchased the property and extended underground exploration between 1948 - 1954 but failed to locate significant mineralization. Subsequent shallow drilling between 1965 and 1982 outlined an open pit resource that was mined between 1977 and 1983 and produced 1.52 Moz silver at about 18 oz/t Ag (Figure 45). Later drilling below the open pit and along strike did not locate additional resource.

In total, the Bermingham area produced 3.8 Moz of silver at an average grade of about 22 oz/t Ag (Cathro, 2006).

Figure 45. Looking northeasterly along the Bermingham open pit from the immediate hangingwall side of the Mastiff Fault.

Alexco commenced exploration work in the area, initially on the Ruby Vein, in 2006. Since 2009 significant annual surface exploration programs including diamond drilling, surface mapping, geophysical and geochemical surveys and petrological studies have taken place on the Bermingham veins most years.

A review of historical exploration data identified the Bermingham area as containing a significant silver geochemical anomaly over wide intervals in drilling under the scraped off area to the southwest of the Bermingham open pits, and led to a proposal to conduct deeper exploration drilling on this extension of the Bermingham vein-fault structure.

At the same time the area was included in the district wide mapping program that showed the area to lie at the upper contact of the Basal Quartzite Basal Member (McOnie & Read, 2009). In total Alexco has completed 22,110 m of core drilling in 74 drill holes (Figure 46).

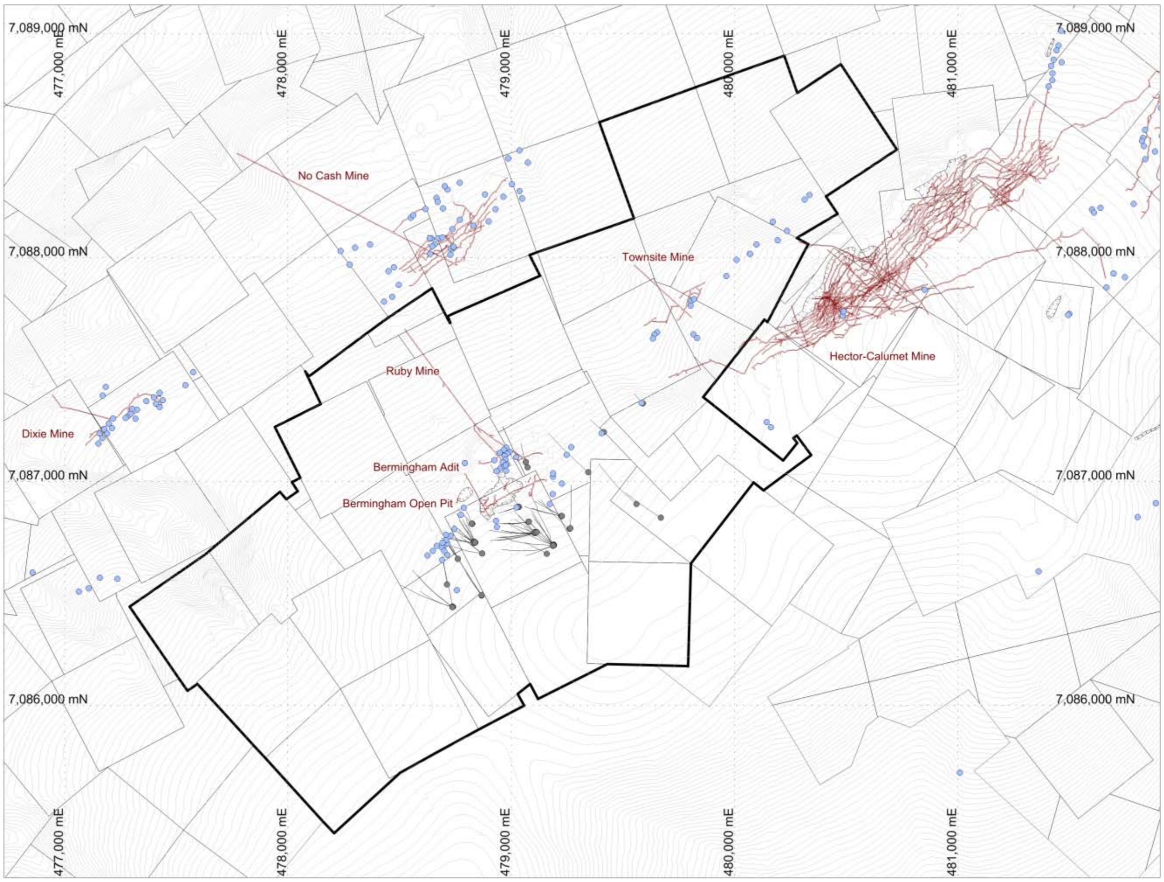


Figure 46. Location of Alexco diamond drill holes (grey) and historic surface diamond drill holes (blue) at Bermingham.

The mineralization is essentially located at the stratigraphic top of, and hosted by, the Keno Hill Basal Quartzite (Mkq) that here contains minor interbedded greenstone (Trgn), and is overlain by the Keno Hill Quartzite Sourdough Hill Member with approximately 175 m of graphitic (Msg) or sericite schist (Mss) marker units below the Upper Quartzite Marker (Msq).

The position is close to the junction between the Bermingham, Ruby and Townsite mineralized vein-faults, and is about one kilometre from the southwestern extent of the Hector-Calumet mine. The structural setting is complex.

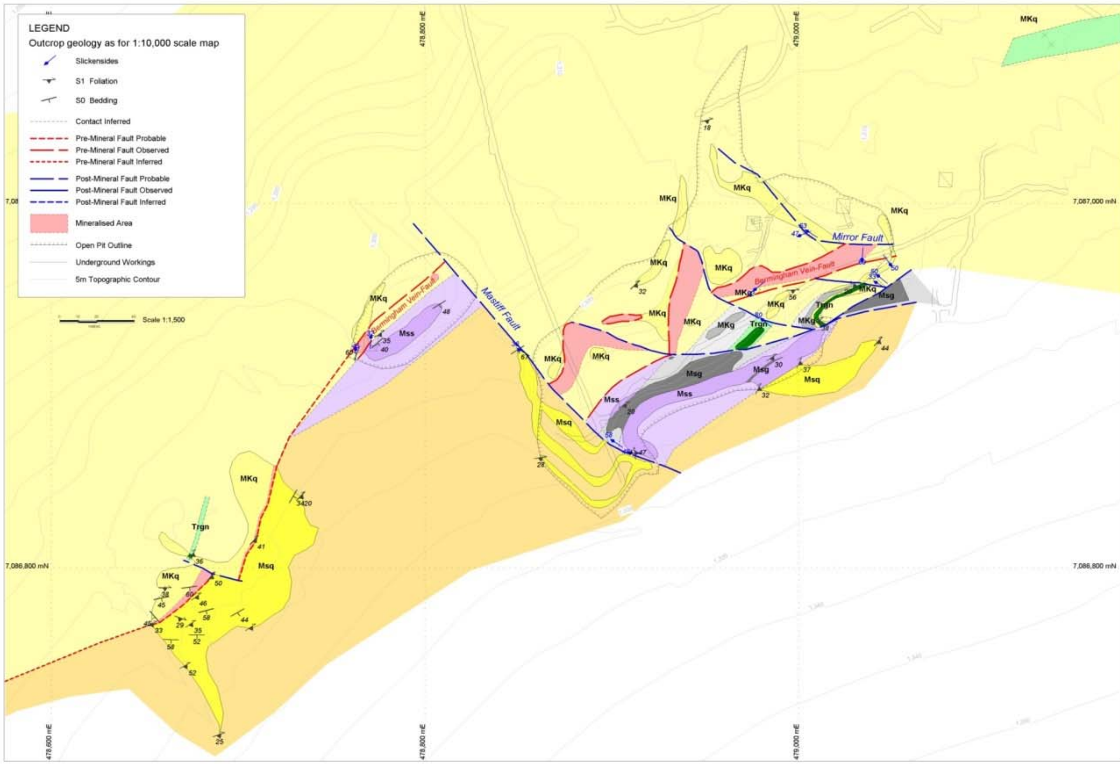


Figure 47. Geology of the Bermingham area.

Currently, three mineralized vein-faults have been identified - the Aho, Bermingham, and Bermingham Footwall veins.

The Aho Vein comprises predominantly quartz, and occurs over several metres width within a wide halo of structurally damaged rocks. Sulphides are present but constitute only a small proportion of the vein, usually less than about 2%, of which arsenopyrite and pyrite are the most abundant, followed by galena and sphalerite.

The Bermingham and Bermingham Footwall veins typically exist within a 5 to 10 m wide structurally damaged zone containing numerous stringers, veinlets, breccia, and gouge. In most cases, a discrete vein 0.5 to 2.5 m wide exists within this zone and consists predominantly of carbonate (dolomite, ankerite, and siderite), quartz and calcite gangue, and sulphides: sphalerite, galena, pyrite, and arsenopyrite, with accessory, chalcopyrite, argentian tetrahedrite (freibergite), jamesonite, pyrargyrite (ruby silver) and native silver.

Initial resource estimates on the Bermingham and Bermingham Footwall veins identified a total of 5.2 Moz silver Indicated and 0.8 Moz Inferred (Alexco Resource Corp, 2016) as shown in Table 9.

Figure 48. This interval with pyrargyrite in drill hole K-15-0580 (~ 310 m), assayed 29,000 g/t, (932 oz/t) Ag within a zone of 7,500 g/t (240 oz/t) Ag of 5 m true thickness (width of NQ core 4.76 cm).

Zone	Class	Tonnes	Ag	Pb	Zn	Au
			g/t	%	%	g/t
Bermingham Vein (including breccia)	Indicated	246,000	426	1.66	1.64	0.07
	Inferred	16,000	458	1.38	1.24	0.16
Bermingham Footwall Vein (including breccia)	Indicated	130,000	437	1.46	1.91	0.06
	Inferred	36,000	485	1.14	2.16	0.10
Total	**Indicated**	**376,000**	**430**	**1.59**	**1.74**	**0.07**
	Inferred	**52,000**	**477**	**1.22**	**1.88**	**0.12**

* *Reported at a NSR cut-off grade of C$185.00/t* using metal prices (USD) and recoveries of Ag US$20.00/oz, recovery 96%; Pb US$ 0.94/lb, recovery 97%; Zn US$ 1.00/lb, recovery 88%; Au US$ 1,300/oz, recovery 72%.
All numbers have been rounded to reflect the relative accuracy of the estimates. Mineral resources are not mineral reserves and do not have demonstrated economic viability. Confidence in the estimate of Inferred mineral resources is insufficient to allow the meaningful application of technical and economic parameters or to enable an evaluation of economic viability worthy of public disclosure.

Table 9. Mineral Resource Statement, Bermingham deposit, does not include new high grade shoot discovery (SRK, 2015b).

Drilling completed in 2014-2015 discovered a high grade silver shoot, referred to as the Bear Zone at depth within an inferred dilational segment of the Bermingham Vein (Figure 49 and Figure 50). Modelling of this zone suggests the possibility of linkage to the package of stratigraphy that hosted the nearby 96 Moz silver producing Hector-Calumet mine, and presents exploration opportunities that are currently being tested (Figure 51).

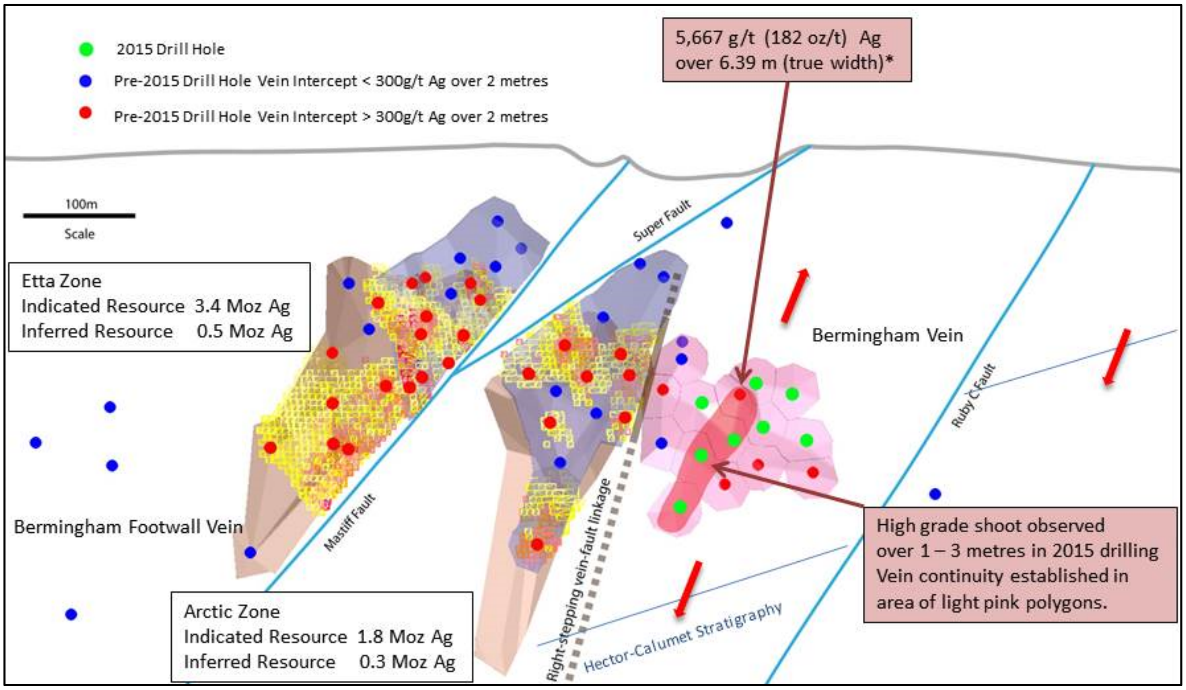
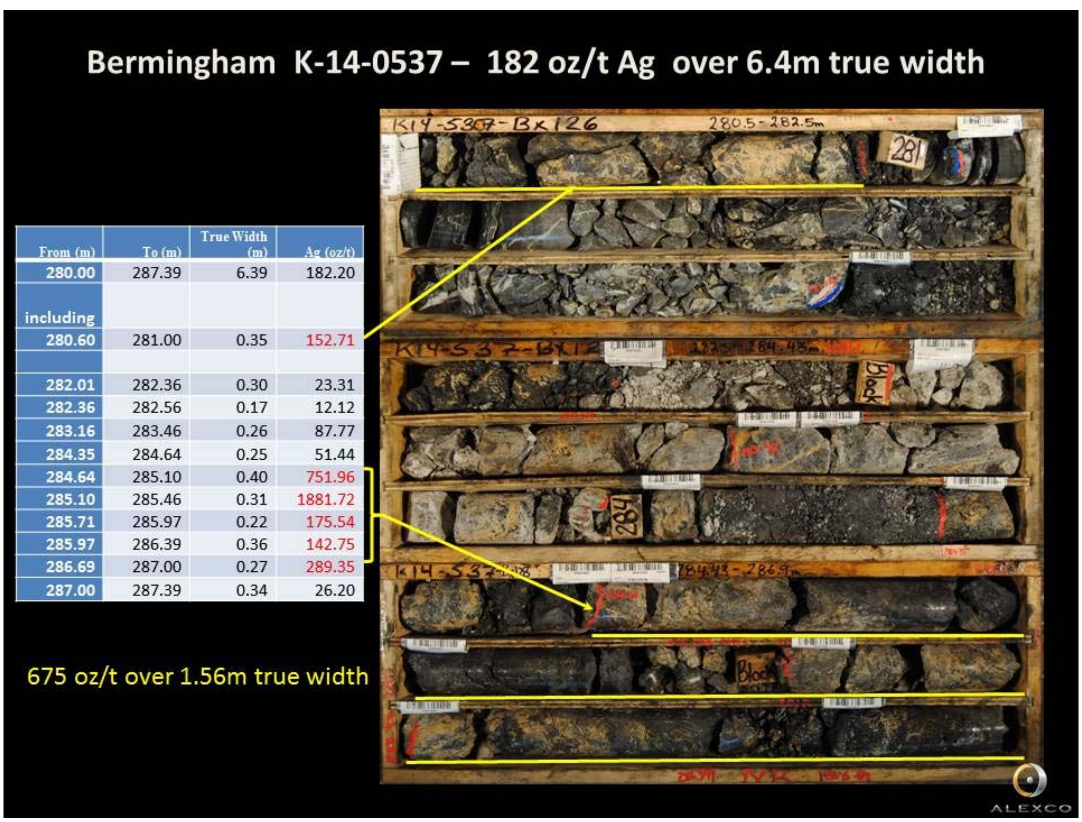


Figure 49. Bermingham Longsection (looking north) showing resource blocks +400 g/t Ag and location of high grade Bear Zone.



From (m)	To (m)	True Width (m)	Ag (oz/t)
280.00	287.39	6.39	182.20
including			
280.60	281.00	0.35	152.71
282.01	282.36	0.30	23.31
282.36	282.56	0.17	12.12
283.16	283.46	0.26	87.77
284.35	284.64	0.25	51.44
284.64	285.10	0.40	751.96
285.10	285.46	0.31	1881.72
285.71	285.97	0.22	175.54
285.97	286.39	0.36	142.75
286.69	287.00	0.27	289.35
287.00	287.39	0.34	26.20

Figure 50. First high grade intercept of Bear Zone.

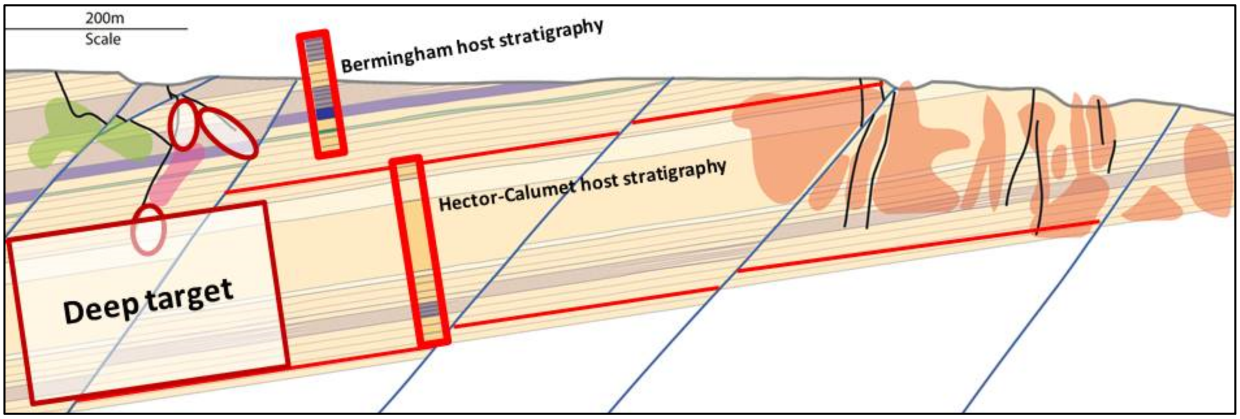


Figure 51. Schematic long section showing 2015 exploration target zones at Bermingham in relation to existing resource (green) and high grade Bear Zone (pink), and relationship to the Hector-Calumet stratigraphy and 96 Moz Ag production (orange).

Lucky Queen
(After SRK, 2014)

The Lucky Queen deposit was mined from 1927 to 1932 when mineral inventory was exhausted, producing 112,100 tonnes of vein material at 3,060 gpt silver for 11 Moz from two mineralized shoots. Four levels of underground workings, totalling approximately 1,085 m, were developed.

The Lucky Queen vein and strike extensions were explored intermittently by surface overburden drilling, trenching, and soil sampling throughout the decades from 1950 to the early 1980s. A 500 level exploration drift, collared near the Black Cap prospect and totalling approximately 1,800 m, was developed by UKHM in 1985-1987. It was designed to come in underneath the historical Lucky Queen workings and to drive a raise up to the 300 level and connect with the No 2 inclined shaft. Poor ground conditions around the shaft, combined with difficulty in locating the vein and an urgent need for miners elsewhere in the Keno Hill Silver District caused the adit to be abandoned.

Surface drilling by Alexco between 2006 and 2010 totalled 47 drill holes for 11,104 m, and 210 m in four underground holes in 2012. Alexco rehabilitated the UKHM adit and advanced minor development between 2012 and 2013 when work was suspended with the closure of the Bellekeno Mine.

Class	Tonnes	Ag (gpt)	Au (gpt)	Pb (%)	Zn (%)
Indicated*	124,000	1,227	0.17	2.57	1.72
Inferred*	150,000	571	0.16	1.37	0.92

* Mineral resources are not mineral reserves and have not demonstrated economic viability. All figures have been rounded to reflect the relative accuracy of the estimates.
** Reported at a cut-off value of $185 (US$1 = C$1)/t using long term metal prices (US$) and recoveries developed for the nearby Bellekeno deposit (Ag US$18.50/oz, recovery 96%; Pb US$ 0.90/lb, recovery 97%; Zn US$ 0.95/lb, recovery 88%; Au US$ 1,100/oz, recovery 72%). Ag grades capped at 6,300 gpt; Pb capped at 14.8%, Zn capped at 7%, Au grades capped at 2 gpt.

Table 10. Mineral resource statement for the Lucky Queen deposit, SRK 2014.

The Lucky Queen vein structure has an average strike of approximately 043° with local variations ranging from 025° to 060°, and an average dip of around 45° to the southeast, within a range of 30° to 55°. The main structure has a strike length, as defined by drilling, of approximately 650 m and is open along strike to both the northeast and southwest. Stratigraphic units correlated across the structure show a normal separation of approximately 30-35 m. Vein thickness ranges from just a few centimetres to several metres. Mineralized zones are largely composed of brecciated wall rock, siderite (± limonite), and vein quartz, and contain silver sulphosalts, galena, sphalerite, and native silver (Figure 53). Minor primary minerals present include arsenopyrite and pyrite.

Figure 52. View south to Sourdough Hill from Lucky Queen.

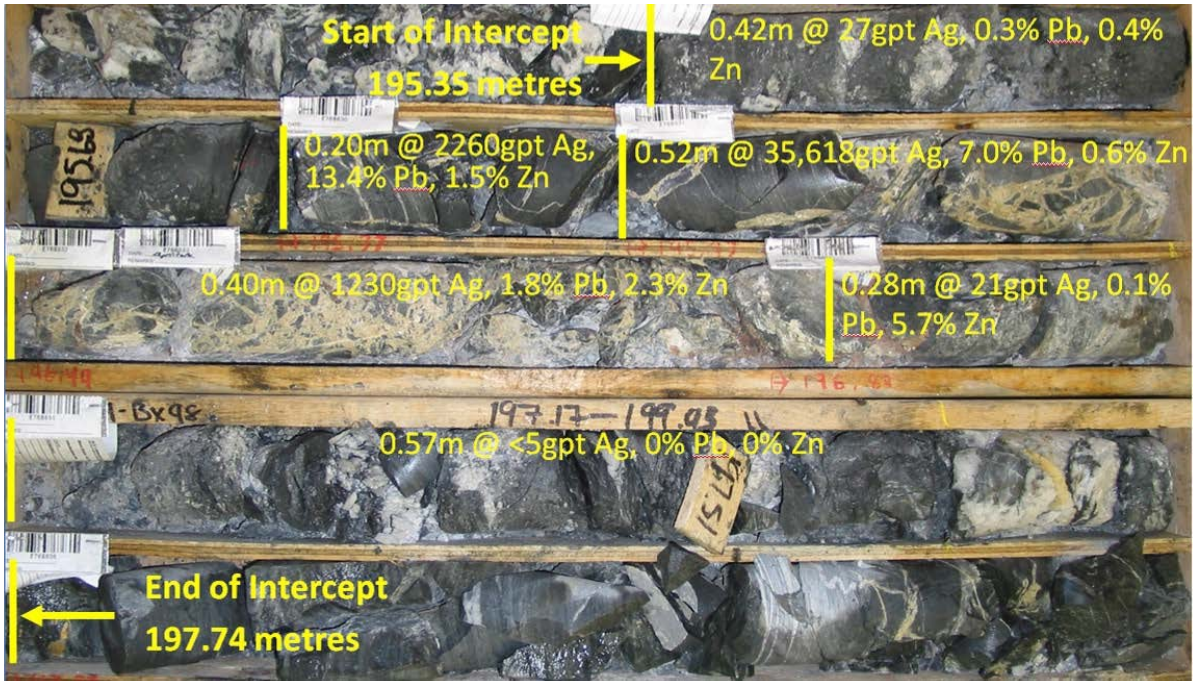


Figure 53. Vein-Fault intercept in drill hole K-07-0114, in the central part of the Lucky Queen deposit.

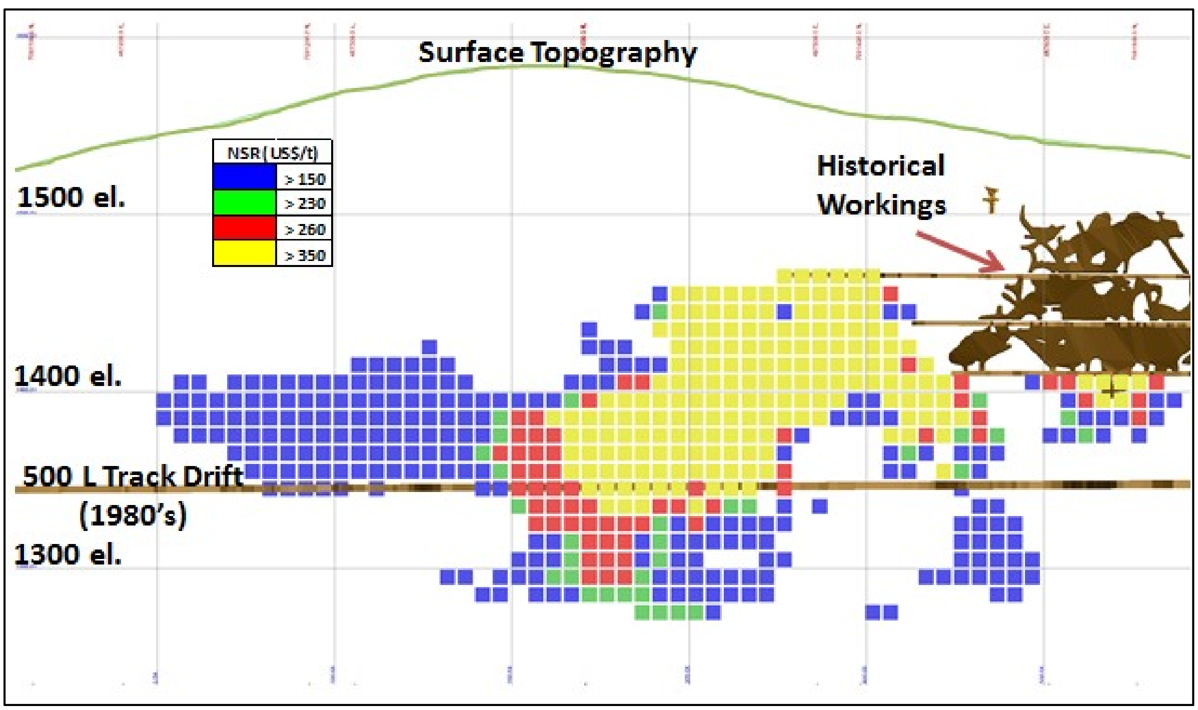


Figure 54. Long section looking northwest – Lucky Queen undiluted block values (SRK, 2014).

Onek
(After SRK, 2014)

The Onek Mining Company Ltd. was formed in 1922 to explore the Onek claims near Keno City by open cuts and shallow underground workings in two shafts. From 1950 to 1952, UKHM re-opened the shafts and drove an adit in from the northwest to drift along the vein strike at the 400 Level for about 396 m, driving raises up into the historic workings. Some developmental ore was removed. The Onek Mine was revisited in the early 1960s with limited success. Mining at Onek ceased in 1965 until the late 1980s when a 20-40 m deep open pit was developed over the length of the majority of the Onek workings around the historical shafts. Historical production from the Onek deposit is estimated at 1.3 Moz silver at an average grade of 466 g/t Ag.

Surface drilling by Alexco between 2007 and 2012 totalled 82 drill holes for 12,750 m, and 738 m in 12 underground holes in 2013. Alexco drove a 220 m decline from Lightning Creek valley between 2012 and 2013 when work was suspended with the closure of the Bellekeno Mine.

Class	Tonnes	Ag (gpt)	Au (gpt)	Pb (%)	Zn (%)
Indicated*	**654,000**	**200**	**0.62**	**1.29**	**12.30**
Inferred*	234,000	134	0.44	1.24	8.86

* Mineral resources are not mineral reserves and have not demonstrated economic viability. All figures have been rounded to reflect the relative accuracy of the estimates.

Reported at a dollar cut-off grade of C$185.00/t using metal prices (USD) and recoveries of Ag US$20.00/oz, recovery 96%; Pb US$ 0.90/lb, recovery 97%; Zn US$ 0.95/lb, recovery 88%; Au US$ 1,250/oz, recovery 72%. Confidence in the estimate of Inferred mineral resources is insufficient to allow the meaningful application of technical and economic parameters or to enable an evaluation of economic viability worthy of public disclosure.

Table 11. Mineral resource statement for the Onek deposit (SRK, 2014).

The Onek vein-fault system comprises at least three individual structures occurring within a broad northeast striking, southeast dipping zone. They occur over a strike length of at least 600 m and are characterized by brittle fractured or milled zones, locally containing massive sulphide vein material in or associated with siderite, consisting of sphalerite and galena along with minor pyrite, arsenopyrite and quartz. Mineralized breccia zones consisting of wall rock fragments and siderite-sulphide cement are also present. These zones are often surrounded by brittle fractured zones cemented by siderite and minor sphalerite stringers.

Figure 55 Vein-Fault Intercept in Drill Hole K-10-0306, in the Onek Deposit

FIELD TRIP MAP

A map will be provided at the time of the field trip when ground access conditions are known.

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