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Cretaceous Epigenetic Base-Metal Mineralization at the Lead Creek Prospect, Eastern Yukon-Tanana Upland, Alaska: Constraints from U-Pb Zircon Dating and Pb-Isotopic Analyses of Sulfides

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Abstract

The Lead Creek Pb-Zn-Ag prospect, located 8 km west of the Taylor Highway in the Eagle C–1 quadrangle, eastern Alaska, occurs in very weakly metamorphosed sedimentary and volcanic rocks of the Seventymile terrane. The Seventymile terrane forms a belt of fault-bounded slices of varyingly serpentinized peridotite, weakly metamorphosed mafic volcanic rocks (including pillowed greenstone), and Mississippian to Upper Triassic sedimentary rocks. Lead Creek diamond-drill hole LC–7 penetrated 783 ft of weakly metamorphosed sedimentary and volcanic rocks, as well as altered felsic hypabyssal rocks that we interpret to be dikes or sills. Pyrite, galena, sphalerite, and minor chalcopyrite mineralization in the Lead Creek core occurs in crosscutting veins and veinlets, silicified breccia, and, less commonly, stratiform replacement zones. Zircons separated from a felsic dike or sill rock gave a concordant $^{206}Pb/^{238}U$ age of 96.2±1.0 Ma, which we interpret to be the crystallization age of the sample. About 13 km northwest of the Lead Creek property, a Cretaceous(?) pluton that intrudes a chlorite-muscovite-quartz schist unit of the Yukon-Tanana terrane caused the formation of base- and precious-metal-bearing skarns (Champion I and II prospects). Pb-isotopic compositions determined for galena samples from the Lead Creek prospect and one sample from the Champion II prospect all fall within the field defined by igneous feldspars from Early Cretaceous and mid-Cretaceous intrusions and are far removed from the sulfide Pb-isotopic compositions that would be expected for middle Paleozoic syngenetic mineralization. The compositional similarity of the galena samples from the Lead Creek and Champion II prospects clearly indicates that mineralization in the two occurrences was nearly contemporaneous and that the lead in the Lead Creek prospect was also likely derived from Cretaceous intrusions. We propose that the mineralization at Lead Creek comprises an epigenetic vein and manto-style replacement deposit and that previous correlation with syngenetic, middle Paleozoic mineralization in the Finlayson Lake area, central Yukon Territory, Canada, is unwarranted. The base- and precious-metal mineralization at Lead Creek likely represents a more distal equivalent to the epigenetic, pluton-related skarn mineralization at the Champion I and II prospects.

Introduction

The vicinity of the Lead Creek prospect (fig. 1) has been a focus of mineral exploration since the 1970s. In summer 1968, the U.S. Geological Survey conducted a geochemical and geologic reconnaissance of parts of the Fortymile River drainage area in the eastern part of the Eagle quadrangle (Foster and Clark, 1970). During this reconnaissance, galena was discovered in float on a ridge just west of the recent Lead Creek drilling. Rock and stream-sediment samples in the Champion Creek area showed anomalous Ag, Pb, Zn, Cr, Cu, and Mo contents (Foster and Clark, 1970). In the middle and late 1970s, stream-sediment sampling by the Alaska Division of Geological and Geophysical Surveys and WGM, Inc., showed anomalous Pb, Ag, and Zn contents in an 8-km-long tributary to Columbia Creek, subsequently given the informal name “Lead Creek” (WGM, Inc., 1979). Stream-sediment and soil analyses from the upper part of the creek showed highly anomalous Pb and Ag contents, and siliceous nodules containing 2 weight percent Pb and 2 troy oz Ag/ton were observed weathering from black pelitic schist (WGM, Inc., 1979). Trenching in an area underlain by graphitic schist resulted in the discovery of Pb-Ag mineralization within what was interpreted to be siliceous exhalites that were interbedded in the schist; the graphitic schist was enriched in Pb and Ag as well. Exploratory drilling, managed by WGM, Inc., was conducted on the Lead Creek property in 1978 and subsequently in 1997, 2000, and 2001.

The U.S. Bureau of Mines evaluated the mineral resources of the Fortymile River area, including the Lead Creek area, during 1993 and 1994. Siliceous nodules within graphitic schist generally contained as much as 2 weight percent Pb and 29 ppm Ag; a select sample of the siliceous nodules contained 10.7 weight percent Pb, 112.5 ppm Ag and 1,174 ppm Sb (U.S. Bureau of Mines, 1995). Galena was identified in crosscutting quartz veins,

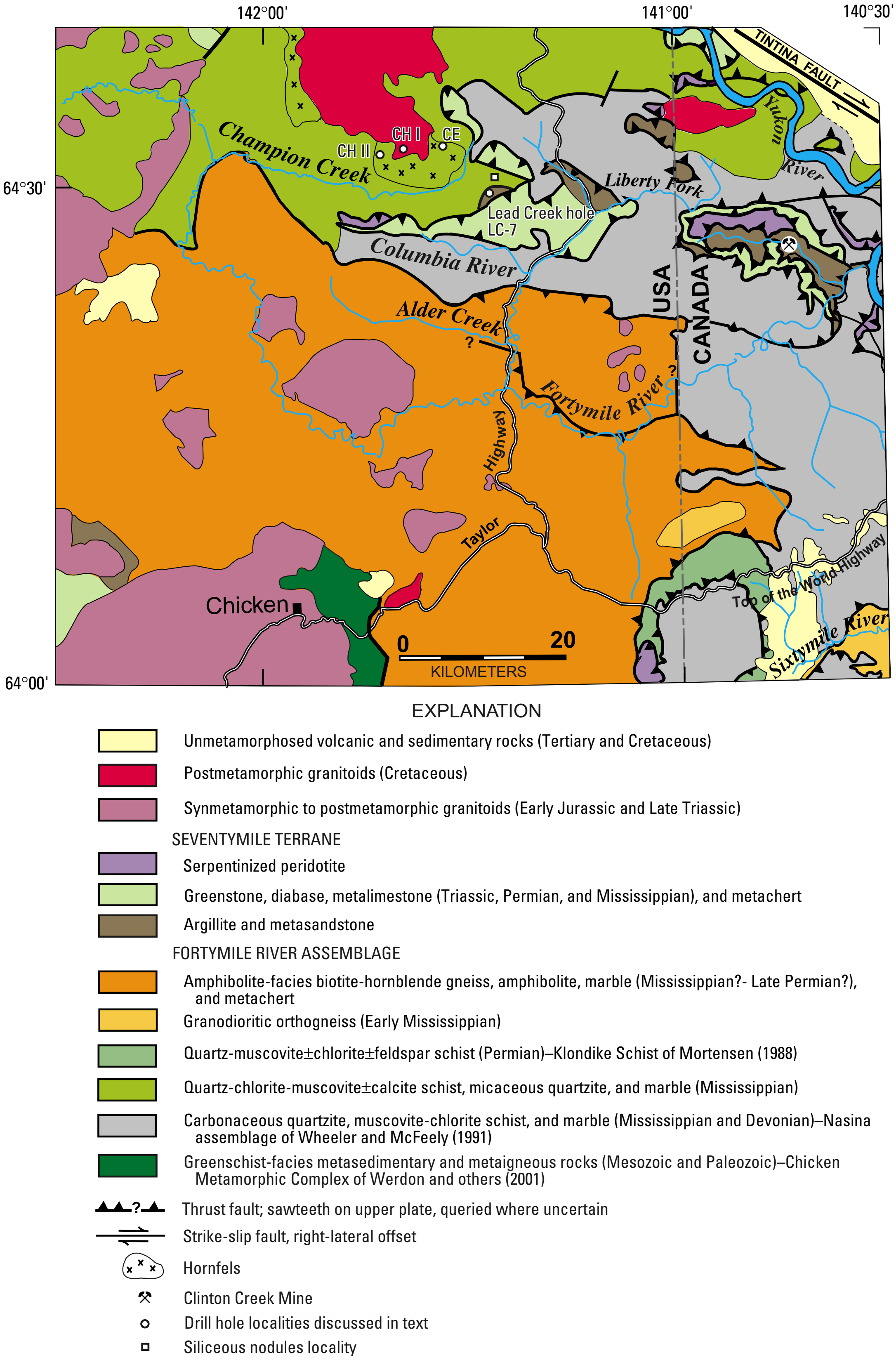


Figure 1. Generalized geologic map of the Fortymile River area, eastern Alaska, showing location of Lead Creek diamond-drill hole LC–7 within the Seventymile terrane (modified from Foster, 1976, 1992, and Mortensen, 1988). Localities CH I, CH II, and CE, U.S. Bureau of Mines (1995) skarn prospects Champion I, Champion II, and Champion East, respectively. Location of hornfels from Foster (1976) and U.S. Bureau of Mines (1995); area of siliceous nodules from U.S. Bureau of Mines (1995).

and a sample from a feldspar porphyry dike contained 1,309 ppm Pb and 2,450 ppm As (U.S. Bureau of Mines, 1995).

Sampling by Dusel-Bacon and others (1998) in the vicinity of the siliceous nodules yielded a sample of pyrite-bearing carbonaceous quartzite containing >10,000 ppm As and 170 ppb Au, and a grab sample of highly mineralized and oxidized gray-and-yellow-banded weathered rock contained 2,330 ppb Au, 2,126 ppm Ag, >10,000 ppm As, >100 ppm Cd, 1,420 ppm Cu, 10.8 weight percent Pb, and >10,000 ppm Sb.

In the late 1970s and continuing into the mid-1990s, the origin of the base and precious metals was uncertain but was thought to be primarily stratabound, syngenetic sedimentary exhalative mineralization (WGM, Inc., 1979, 2001), or of less process specific, shale-hosted origin (Schmidt, 1997). The discovery of numerous large volcanic-hosted deposits within carbonaceous assemblages in the Finlayson Lake area, central Yukon Territory, Canada, in the mid-1990s (Hunt, 1997) increased interest in the mineral-resource potential of the Lead Creek area. The Finlayson Lake deposits occur in middle Paleozoic rocks just east of the right-lateral Tintina Fault zone in rocks of the Yukon-Tanana terrane, comparable to those in the greater Fortymile River area. Restoration of 450 km of right-lateral offset along the fault zone brings these two areas relatively close together.

Dusel-Bacon and others (1998) concluded that the variety of metals and host rocks at the Lead Creek prospect may indicate the presence of multiple ages and styles of mineralization. Pb- and Ag-enriched siliceous nodules in carbonaceous schist and metachert suggest a possible diagenetic origin. However, the presence of a relatively young feldspar porphyry dike in the vicinity that showed anomalous Pb and As contents, as well as the high levels of Pb, Sb, and As in oxidized material, along with the presence of quartz-galena veins, evidence for local contact-metamorphic effects, and the presence of sulfide-bearing intrusions in the immediate area, suggests that some metals may have been remobilized or introduced during a later magmatic hydrothermal event (Dusel-Bacon and others, 1998). Our isotopic investigations of the Lead Creek core were undertaken to date the mineralization and to test the proposed correlation between mineralization in the Lead Creek and Finlayson Lake areas.

Local Geologic Setting of Lead Creek

The Lead Creek property occurs near the contacts of several geologic units (fig. 1; Foster, 1976, 1992). Most of the drilling at Lead Creek penetrated very weakly metamorphosed sedimentary and volcanic rocks of the Seventymile terrane, which forms a belt of fault-bounded slices of varyingly serpentinized peridotite, weakly metamorphosed mafic volcanic rocks (including pillowed greenstone), and Mississippian to Upper Triassic sedimentary rocks. The terrane is interpreted, in part, as a dismembered ophiolite (Foster and others, 1994). Rocks of the Seventymile terrane are not penetratively deformed and structurally overlie (in east-central Alaska; Foster, 1992) or are imbricated with (in the Yukon; Mortensen, 1990) continental-margin rocks of the Nasina assemblage (Wheeler and McFeely, 1991), the Klondike Schist (Mortensen, 1988; Dusel-Bacon and others, 1998), and the Fortymile River assemblage (fig. 1; Dusel-Bacon and others, 2002) of the Yukon-Tanana terrane. Northeast-trending high-angle faults further complicate the structural relation between the poorly exposed bedrock units in the region (for example, Werdon and others, 2001).

At Lead Creek, low-grade sedimentary rocks of the Seventymile terrane are bordered to the north by greenschist-facies carbonaceous rocks of the Nasina assemblage and an unnamed unit of chlorite-muscovite-quartz schist of uncertain age. A Cretaceous(?) pluton that intrudes the chlorite-muscovite-quartz schist north of Champion Creek caused local hornfelsing of the chlorite schist to biotite metamorphic grade (Foster, 1976) and formation of base- and precious-metal-bearing skarns (Champion I and II prospects; U.S. Bureau of Mines, 1995), 13 km northwest of the Lead Creek property (fig. 1). The U.S. Bureau of Mines concluded that the Cu-Pb-Zn-Ag-Au mineralization at these prospects constitutes pyroxene skarn within a roof pendant of Paleozoic biotite schist (Champion I property) and a stratabound lens of garnet-pyroxene skarn that formed in intercalated marble units within a Paleozoic quartz-mica schist proximal to Cretaceous or Tertiary dacite to granodiorite intrusive rocks (Champion II property). The north contact of the low-grade sedimentary rocks that contain the Lead Creek prospect was interpreted by WGM, Inc. (2001), to be a high-angle normal fault, downdropped to the north; and the south contact with greenstone and minor diabase, limestone, and metachert of the Seventymile terrane was interpreted by Foster (1992) as a thrust fault. About 9 km to the east, along the Taylor Highway, weakly metamorphosed argillite, shale, limestone, and sandstone (unit ₽zs of Foster and Keith, 1969) and silicified tuff(?) (unit Mz₽zt of Foster, 1976), comparable to the rocks drilled at Lead Creek, was interpreted by Foster (1976) to be in depositional contact with greenstone of the Seventymile terrane.

Lead Creek Base- and Precious-Metal Target

The Lead Creek Pb-Zn-Ag prospect is 9 km west of the Taylor Highway in the Eagle C–1 quadrangle (fig. 1) on Doyon Ltd.'s Native selection lands that are currently held (as of April 2002) under option by Ventures Resource Corp. as part of its 609,000-acre Champion property. The most productive diamond-drill holes on the property are located in an area referred to as "Pebble Dike Hill," 1.3 km south of the small area in which metalliferous siliceous nodules were discovered. Diamond drilling in the Pebble Dike Hill area (drill hole LC–01–15) in 2001 intersected 50.6 ft of rock containing 5.1 weight percent Pb and 11.9 troy oz Ag/ton. A hole (LC–00–14) drilled the previous year, 400 ft to the north, yielded rock containing 6.4 weight percent Pb and 23.3 troy oz Ag/ton over an interval of 31.5 ft (Ventures Resource Corp., 2001). These two drill holes were collared approximately 370 m south of drill hole LC–7 (fig. 1), drilled in 1997, from which we selected the various core samples for our analyses. Higher-grade drill-core intervals for drill hole LC–7 are listed in table 1.

Table 1. Assay results for higher-grade intervals in diamond-drill hole LC–7 (fig. 1).

[Data from Venture Resources Corp. (2001)]

Drill-hole interval					
From (ft)	To (ft)	Length (ft)	Ag (oz/ton)	Pb (wt pct)	Zn (wt pct)
496.0	504.0	8.0	2.8	3.5	0.3
552.0	566.0	14.0	2.2	3.1	1.0
593.0	599.5	6.5	2.6	3.7	2.6
721.5	725.0	3.5	8.8	14.2	.3

The Lead Creek property is underlain by at least three thrust panels (WGM, Inc., 2001). The upper thrust panel, which is preserved as klippen on ridgetops, consists of graphitic and micaceous schist (Nasina assemblage and the quartz-muscovite schist units; fig. 1) that has been thrust over a middle panel composed of interbedded mafic to intermediate-composition metavolcanic rocks, siltstone, and limestone (greenstone unit of the Seventymile terrane) that, in turn, have been thrust over a lower panel of predominantly Triassic limestone (see Dusel-Bacon and Harris, this volume), siltstone, shale, and sandstone (low-grade sedimentary rocks of the Seventymile terrane). Rocks of the upper panel crop out on a hill that contains the high-grade polymetallic mineralization occurring as siliceous cerussite(?)-bearing nodules which are believed to occur in structural zones cutting rocks of the upper panel (WGM, Inc., 2001). Rocks of the middle and lower panels underlie Pebble Dike Hill. All structural units are cut by dikes and plugs of dacite porphyry, granodiorite, and diabase (WGM, Inc., 2001).

Lead Creek diamond-drill hole LC–7 (fig. 1) penetrated 783 ft of weakly metamorphosed sedimentary rocks that dip ~40° E., as well as weakly metamorphosed volcanic rocks and altered felsic hypabyssal rocks (fig. 2). The first ~250 ft consists of the middle-panel assemblage of calcareous rocks and interlayered siltstone underlain by metabasalt and minor siltstone. This assemblage is separated from a lower-panel assemblage by an ~100-ft-thick mylonite zone. The lower panel is composed primarily of limestone and carbonaceous siltstone, with several thin intervals of silicified felsic rocks that were initially interpreted as either felsic tuff or dikes. Late Carnian to early Norian (Late Triassic) conodonts were recovered from an ~10-ft-thick interval of locally recrystallized, slightly pyritic, carbonaceous quartzose limestone (see Dusel-Bacon and Harris, this volume) within the lower panel (fig. 2). Core from one of the felsic intervals (sample LC7–678, figs. 2, 3*D*) was sampled for U-Pb zircon dating. This interval is described in the drill log as "pale tan-green massive tuffaceous limestone with scattered lapilli; vaguely bedded perpendicular to core axis; pervasively bleached; with numerous blebs of talc, few calcite veins, and traces of very fine grained pyrite." This description was probably based primarily on the apparent fabric, which was interpreted to be depositional. In thin section, however, no preferred orientation of minerals is evident. Sample LC7–678 has a porphyritic texture and contains a few volume percent of 1- to 1.5-mm-diameter relict phenocrysts that were probably feldspar and mafic silicates, set in a fine-grained groundmass of polygonal quartz and intergranular calcite and white mica. We conclude that the fabric visible in the core (fig. 3*D*) is formed by parallel fractures and is not evidence of a tuffaceous origin for the felsic rock; instead, we infer that the dated sample is a felsic dike or sill rock.

Pyrite, galena, sphalerite, and minor chalcopyrite occur in carbonaceous shale, argillite, graywacke, and limestone within the lower-panel assemblage. Mineralization occurs in crosscutting veins and veinlets (fig. 3*A*), silicified breccias (fig. 3*B*), and, less commonly, stratiform replacement zones (fig. 3*C*). The relation between the mineralization and the high-grade polymetallic mineralization in siliceous cerussite(?)-bearing nodules in structural zones cutting rocks of the upper panel is uncertain (WGM, Inc., 2001).

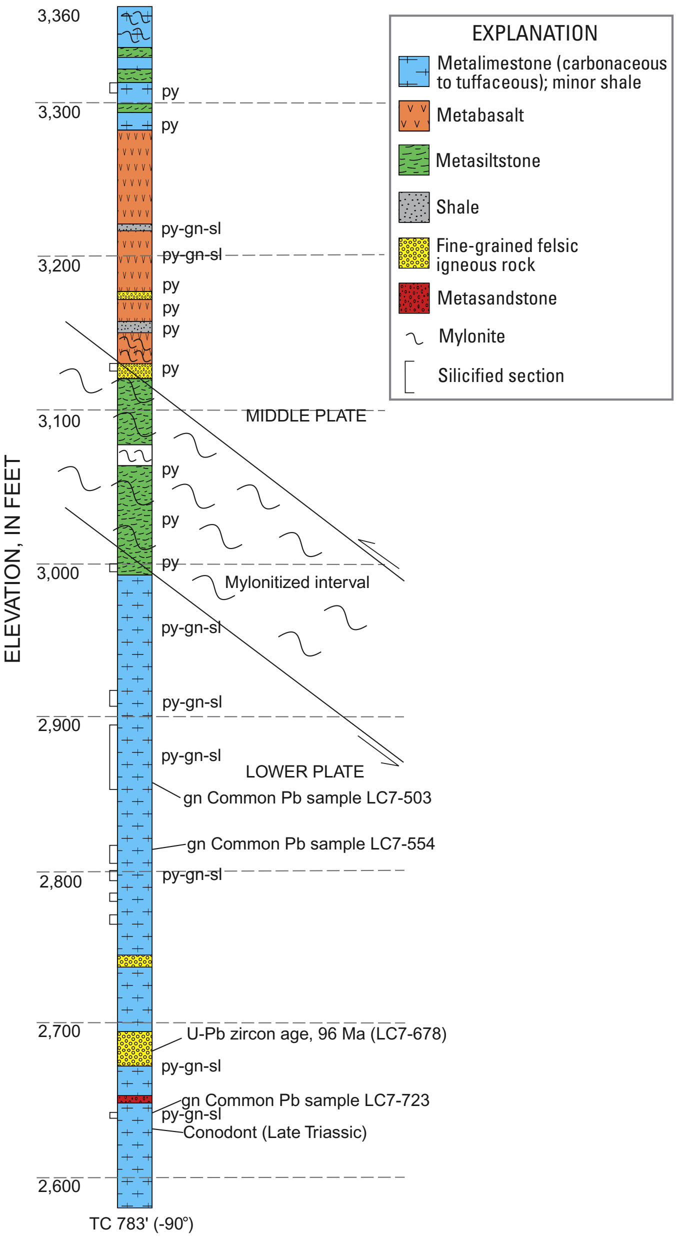


Figure 2. Generalized core log for diamond-drill hole LC–7 (WGM, Inc., 2001) (see fig. 1 for location). Collar of drill hole is located at lat 64°31′09″ N., long 141°25′42″ W. All contacts are shown schematically as horizontal.

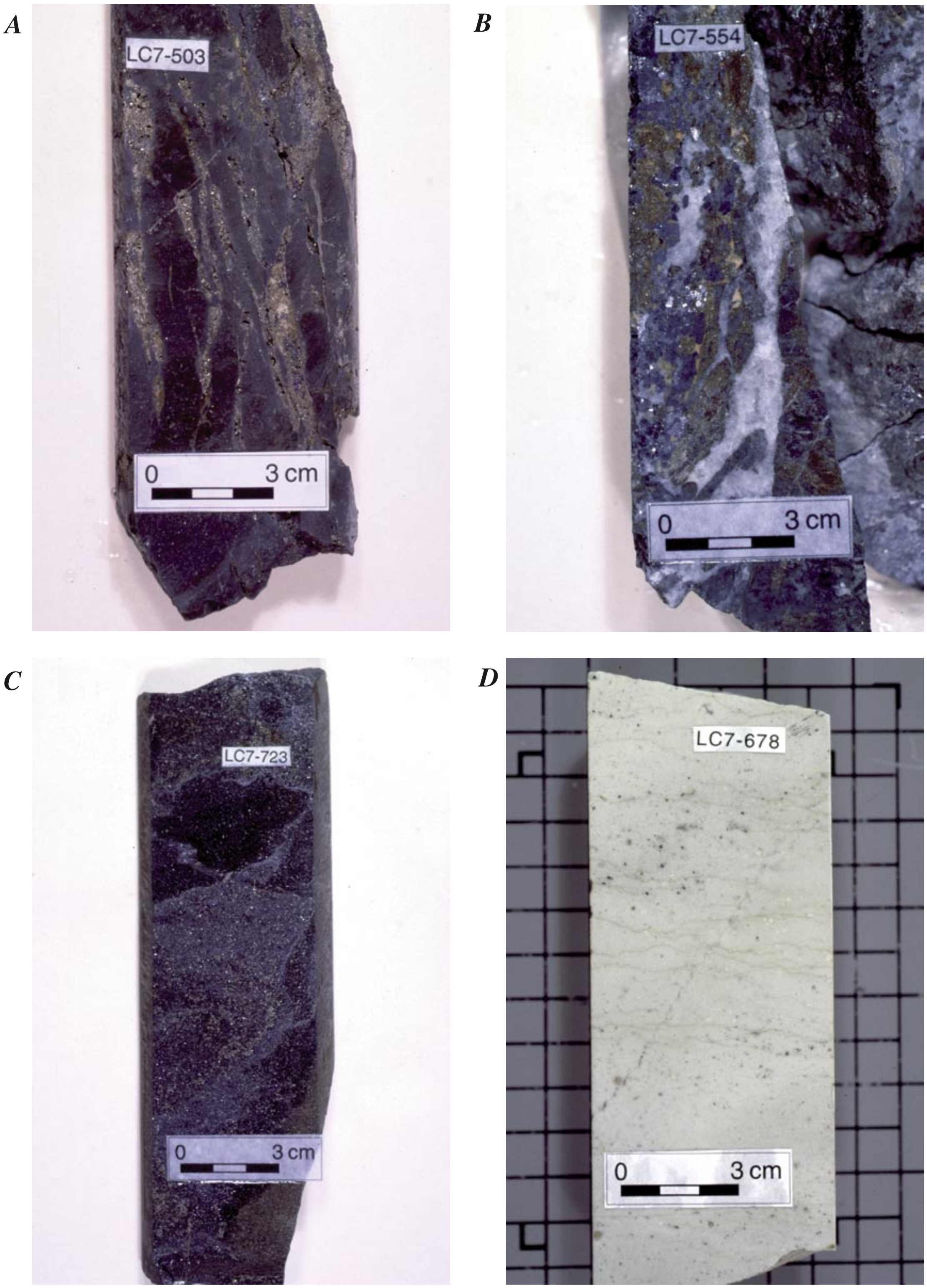


Figure 3. Core samples from Lead Creek diamond-drill hole LC–7 (fig. 1) for which Pb-isotopic data were determined. Last three numbers in label give depth (in feet) from collar of drill hole. Sample locations are shown in fig. 2. *A*, Carbonaceous and calcareous fine-grained quartz arenite with veins or fracture fillings of pyrite and galena. *B*, Fracture and breccia matrix fillings of pyrite (brassy-metallic color), galena (silver-metallic color), sphalerite (pinkish-metallic color), calcite (bright white), and quartz (grayer white) from within a 4-ft interval of brecciated and silicified limestone. *C*, Semimassive, fine- to medium-grained pyrite and galena disseminated in a laminated carbonaceous quartz siltstone/sandstone, with scattered traces of sphalerite. *D*, U-Pb zircon sample of fine-grained porphyritic felsic igneous rock. Photographs by Mike Diggles.

U-Pb Geochronology

Zircons were separated from an ~3-kg sample of felsic igneous rock (split-core interval 670–678.5 ft in diamond-drill hole LC–7, fig. 1; see fig. 3*D*), using conventional crushing, grinding, Wilfley table, heavy liquids, and Frantz magnetic-separator techniques. U-Pb analyses were done in the Geochronology Laboratory of the University of British Columbia, using the methodology for zircon grain selection, abrasion, dissolution, geochemical preparation, and mass spectrometry of Mortensen and others (1995). Procedural blanks for Pb and U were 2 and 1 pg, respectively. The U-Pb data are plotted on a conventional U-Pb concordia diagram in figure 4. Errors attached to individual analyses were calculated by using the numerical error-propagation method of Roddick (1987). Decay constants used are those recommended by Steiger and Jäger (1975). Compositions for initial common Pb were from the model of Stacey and Kramer (1975). All errors are listed at the 2σ level.

A moderate amount of euhedral, pale-yellow zircon was recovered from the sample. A range of grain morphologies was present in the concentrate, which mainly consisted of stubby to elongate prisms with simple to multifaceted terminations. Rounded cloudy cores were present within many of the grains. Six single and multigrain fractions were analyzed (table 2). Most fractions were air abraded (Krogh, 1982) before dissolution to minimize the effects of postcrystallization Pb loss. Considerable scatter is present in the data, reflecting both inheritance in some grains and postcrystallization Pb loss that has affected two of the fractions. Fraction A, consisting of four tips broken off of grains with obvious cloudy cores, and fraction D, consisting of a single stubby multifaceted prism with no visible core, yield overlapping concordant analyses, with a total range in ^{206}Pb/^{238}U age of 96.2±1.0 Ma, which is interpreted as the crystallization age of the sample. Fractions B (unabraded elongate prisms) and E (a single stubby multifaceted prism) have evidently lost a significant amount of Pb, indicating a previously unrecognized post-Cretaceous thermal/structural event. Fractions C (elongate square prism) and F (stubby multifaceted prism) did not contain visible cores but yielded much older Pb/Pb ages, indicating that at least some grains in each of these fractions contained inherited “cryptic” cores which could not be distinguished visually.

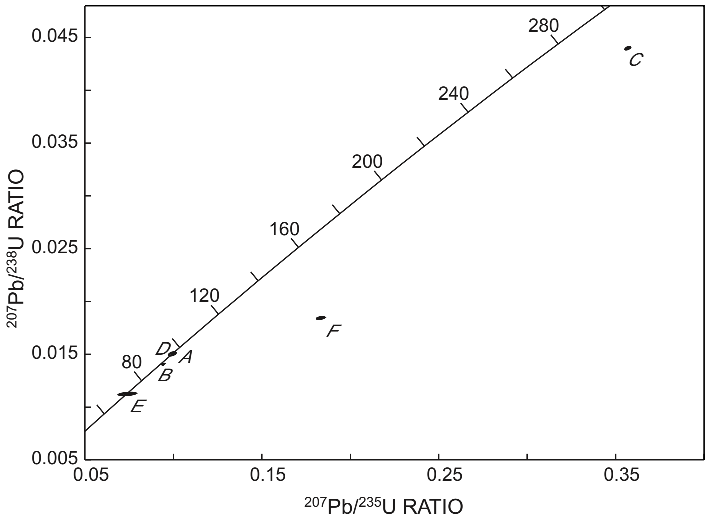


Figure 4. Conventional concordia U-Pb plot for zircons from sample LC7–678. Position of sample in drill core is shown in figure 2; photograph of core from which zircons were separated is shown in figure 3*D*.

Pb-Isotopic Analyses

Small clean cubes of galena were handpicked, washed, and dissolved in dilute HCl. Approximately 10 to 25 ng of Pb as chloride was loaded on a rhenium filament, and isotopic compositions were determined by using a modified VG54R thermal-ionization mass spectrometer. The measured ratios were corrected for instrumental mass fractionation of 0.12 percent per mass unit, based on repeated measurements of the National Bureau of Standards SRM 981 Standard Isotopic Reference Material. Errors reported in table 3 were determined by propagating all mass-fractionation and analytical errors through the calculation.

Pb-isotopic compositions were determined for galena samples from three different drill-core intervals of hole LC–7 (fig. 5; table 3). In addition, Pb-isotopic analyses of galena from a surface sample of mineralization at the Lead Creek property (U.S. Bureau of Mines, 1995), and of galena from a sulfide sample from the Champion II prospect (Venture Resources Corp., 2001), are plotted in figure 5.

The Pb-isotopic data plotted in figure 5, are shown with reference to the “shale curve” of Godwin and Sinclair (1982), which closely approximates the evolution of upper-crustal Pb in the North American miogeocline and the Yukon-Tanana terrane of the northern Cordillera. Also shown is the field defined by the Pb-isotopic compositions of feldspars from Early Cretaceous and mid-Cretaceous intrusions, and from various closely associated mineral occurrences, in the Yukon-Tanana terrane of western Yukon and east-central Alaska (data from Aleinikoff and others, 2000; Joyce, 2002). Although the ultimate origin of the Early Cretaceous and mid-Cretaceous magmatism in interior Alaska is still uncertain, the fact that the Pb-isotopic compositions of igneous feldspar fall on or close to the shale curve clearly indicates that the magmas either are entirely crustal in origin or represent mantle-derived melts that have been extensively contaminated with upper-crustal rocks. Pb-isotopic analyses of galena from the Lead Creek samples, as well as of galena from the Champion II sample, all fall within the field defined by igneous feldspars and are far removed from the sulfide Pb-isotopic compositions that would be expected for middle Paleozoic syngenetic mineralization (fig. 5).

Table 2. Zircon U-Pb analytical data for sample LC7–678 (fig. 2).

Sample description[1]	Weight (mg)	U content (ppm)	Pb[2] content (ppm)	^{206}Pb/^{204}Pb ratio[3]	Total common Pb content (pg)	^{208}Pb[2] content (atomic percent)	^{206}Pb/^{238}U[4] ratio (±1σ)	^{207}Pb/^{235}U[4] ratio (±1σ)	^{207}Pb/^{206}Pb[4] ratio (±1σ)	^{206}Pb/^{238}U age ratio (Ma; ±2σ)	^{207}Pb/^{206}Pb age ratio (Ma; ±2σ)
A: N2,+149,tips,4	0.020	162	2.4	449	7	8.9	0.01510 (0.19)	0.09989 (0.52)	0.04799 (0.42)	96.6 (0.4)	98.6 (20.1)
B: N2,62-92,e,u,10	.070	709	10.4	800	56	13.6	.01410 (0.14)	.09419 (0.34)	.04861 (0.24)	90.0 (0.3)	128.9 (11.3)
C: N2,134-149,e,1	.020	207	9.6	2,264	5	13.8	.04399 (0.15)	.35686 (0.21)	.05884 (0.15)	277.5 (0.8)	561.3 (6.7)
D: N2,+149,s,1	.020	276	4.1	740	7	9.8	.01504 (0.54)	.09937 (1.01)	.04793 (0.82)	96.2 (1.0)	95.6 (38.8)
E: M2,+149,s,1	.020	252	2.8	149	27	7.5	.01126 (0.53)	.07388 (3.26)	.04769 (3.03)	72.0 (0.8)	83.9 (143.0)
F: N2,+149,s,1	.020	322	6.2	876	9	11.1	.01843 (0.28)	.18324 (0.60)	.07212 (0.50)	117.7 (0.7)	989.3 (20.2)

[1] N2, M2 = nonmagnetic, magnetic at given degrees of side slope on Frantz isodynamic magnetic separator. Grain size in micrometers; u, unabraded; e, elongate; s, stubby. Number refers to number of grains analyzed.

[2] Radiogenic Pb; corrected for blank, initial common Pb, and spike.

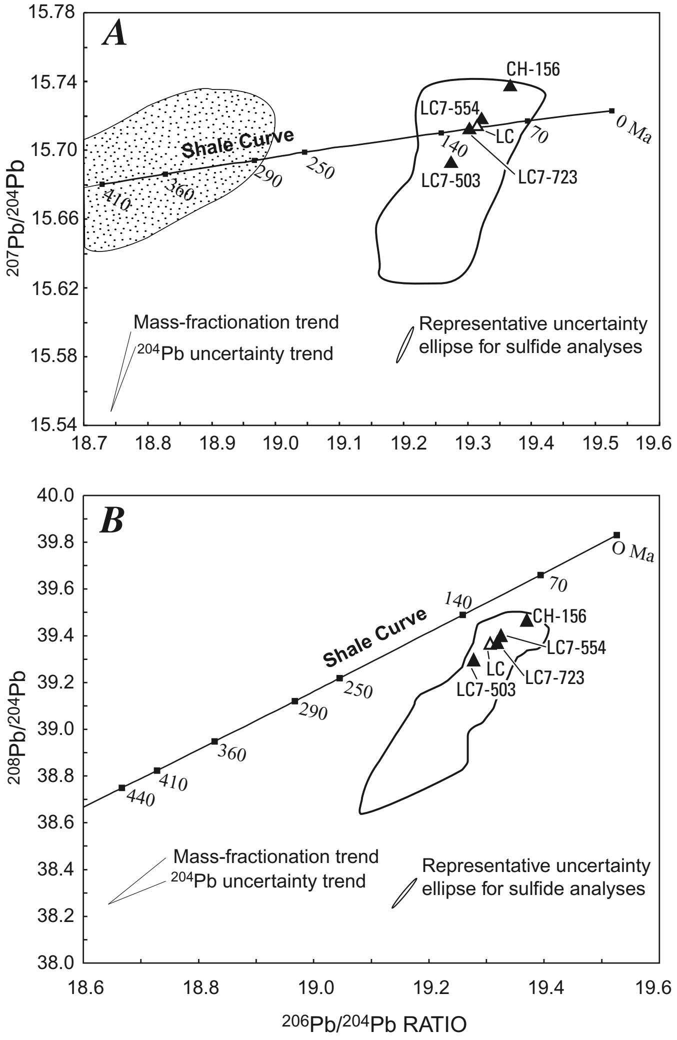
[3] Corrected for spike and fractionation.

[4] Corrected for blank Pb and U, and common Pb.

Table 3. Common Pb data for Lead Creek and Champion II prospects.

[Positions of galena samples in core from diamond-drill hole LC–7 are shown in figure 2; photographs of core from which galena was sampled at Lead Creek are shown in figures 3*A* through 3*C*. Sample LC, galena from a Lead Creek sample collected by the U.S. Bureau of Mines (1995). Numbers in parenthesis, 2σ error]

Sample	^{206}Pb/^{204}Pb ratio	^{207}Pb/^{204}Pb ratio	^{208}Pb/^{204}Pb ratio
LC7-723	19.304 (0.01)	15.713 (0.01)	39.365 (0.01)
LC7-554	19.323 (0.01)	15.719 (0.01)	39.398 (0.01)
LC7-503	19.275 (0.01)	15.694 (0.01)	39.294 (0.01)
CH-156	19.368 (0.01)	15.738 (0.01)	39.463 (0.01)
LC	19.316 (0.01)	15.715 (0.01)	39.368 (0.01)



◂ **Figure 5.** ^{207}Pb-isotopic (*A*) and ^{208}Pb-isotopic (*B*) compositions of galena samples from the Lead Creek and Champion II prospects, eastern Alaska (fig. 1). Shale curve of Godwin and Sinclair (1982) is shown for reference, as well as fields for Pb-isotopic compositions of galena from Devonian and Mississippian stratiform syngenetic occurrences from interior Alaska (stippling; Dusel-Bacon and others, 1998) and for igneous feldspars from Early and mid-Cretaceous intrusions and closely associated mineral occurrences from the western Yukon Territory, Canada, and east-central Alaska (black outline; Aleinikoff and others, 2000; Joyce, 2002). Positions of galena samples in core from diamond-drill hole LC–7 are shown in figure 2; photographs of core from which galena was sampled at Lead Creek are shown in figures 3*A* through 3*C*. Solid triangles, galena data from our samples from Lead Creek and one sample we analyzed from Champion II drill core (from 156-ft interval in drill hole CH–1). Open triangle LC, galena data from a Lead Creek sample previously collected by the U.S. Bureau of Mines (1995). Representative uncertainty ellipses extend from center of triangle symbols.

The Champion II occurrence, which is clearly a skarn, is presumed to be genetically associated with the Cretaceous intrusion that lies immediately north of this occurrence. The compositional similarity of the galena samples from the Lead Creek and Champion II prospects clearly indicates that mineralization in the two occurrences was nearly contemporaneous and that Pb in the Lead Creek prospect also was likely derived from Cretaceous intrusions.

Discussion

The mid-Cretaceous (96.2±1.0 Ma) U-Pb zircon crystallization age determined for the felsic igneous rock that was penetrated in diamond drilling at the Lead Creek prospect (presumed to be a dike or sill rock), and the Cretaceous common Pb signatures from galena samples, suggest that the mineralization at both Lead and Champion Creeks is related to felsic magmatism. The mineralization at Lead Creek is therefore interpreted to comprise an epigenetic vein and manto-style replacement deposit (WGM, Inc., 2001), and correlation with syngenetic, middle Paleozoic mineralization in the Finlayson Lake area is thus unwarranted. The base- and precious-metal mineralization at Lead Creek likely represents a more distal equivalent to the epigenetic, pluton-related skarn mineralization at the Champion I and II prospects.

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