Lead isotopic constraints on the metallogeny of southern Wolf Lake, southeastern Teslin and northern Jennings River map areas, Yukon and British Columbia: Preliminary results

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ABSTRACT

Southern Wolf Lake (105B), southeastern Teslin (105C) and northern Jennings River (104O) map areas contain a wide variety of styles of mineralization, including carbonate replacement deposits, skarns, greisens and veins, as well as several apparently stratiform occurrences that have been interpreted to be syngenetic in origin. Lead isotopic compositions of galena and other sulphide minerals from many of these occurrences help to constrain the nature and approximate age of individual occurrences. Preliminary results of this study indicate that most mineralization in the area, including that at Dan, Logan, Logtung, Arsenault, Fiddler and Hart occurrences, is epigenetic and of Mesozoic to Early Tertiary age. Galena analyses from the Cabin Lake and Mor occurrences in southwestern Wolf Lake and southeastern Teslin map areas, respectively, yield relatively non-radiogenic compositions that are consistent with a syngenetic (VMS) origin and broadly Devono-Mississippian age.

RÉSUMÉ

Les régions représentées par la partie sud du feuillet de Wolf Lake (105B), par la partie sud-est du feuillet de Teslin (105C) et par la partie nord du feuillet de Jennings River (104O) renferment une grande variété de types de minéralisation, y compris des gisements de remplacement des carbonates, des skarns, des greisens et des veines, ainsi que plusieurs occurrences apparemment stratiformes, que l'on estime être d'origine syngénétique. Les teneurs en isotopes du plomb dans la galène et des autres minéraux sulfurés d'un grand nombre de ces occurrences aident à en déterminer la nature et l'âge approximatif. Les résultats préliminaires de cette étude indiquent que la plupart des minéralisations dans la région, y compris celles des gisements de Dan, Logan, Logtung, Arsenault, Fiddler et Hart, sont épigéniques et datent du Mésozoïque au Tertiaire précoce. Des analyses de la galène provenant des occurrences de Mor et de Cabin Lake, situées respectivement dans la région sud-ouest de la carte de Wolf Lake et dans la région sud-est de la carte de Teslin, indiquent que ces occurrences sont relativement peu radiogéniques et de compositions compatibles avec une origine syngénétique (SMV) et un âge approximatif du Dévono-Mississippien.

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INTRODUCTION

A wide variety of styles of mineralization are present in southern Wolf Lake (105B), southeastern Teslin (105C) and northern Jennings River (104O) map areas (Fig. 1). Carbonate replacement deposits, skarns, porphyries, greisens, veins and stratabound deposits are all represented. Recent mapping has greatly improved our understanding of the geology of this area, and in particular, the geological setting of the various mineral occurrences. The area is extensively intruded by plutons of several different ages, and some occurrences are clearly intrusion-related (e.g., skarns and porphyries). However, the exact relationship between mineralization and magmatism is not well constrained. In addition, the question of whether some of the stratabound occurrences (e.g., Dan, Yukon MINFILE, 2001, 105B 027; Cabin Lake) are intrusion-related or syngenetic in origin is in dispute. In this study, we use Pb isotopic compositions of sulphide minerals to constrain the possible age and origin of many occurrences in the study area. The authors' isotopic database includes previously published analyses

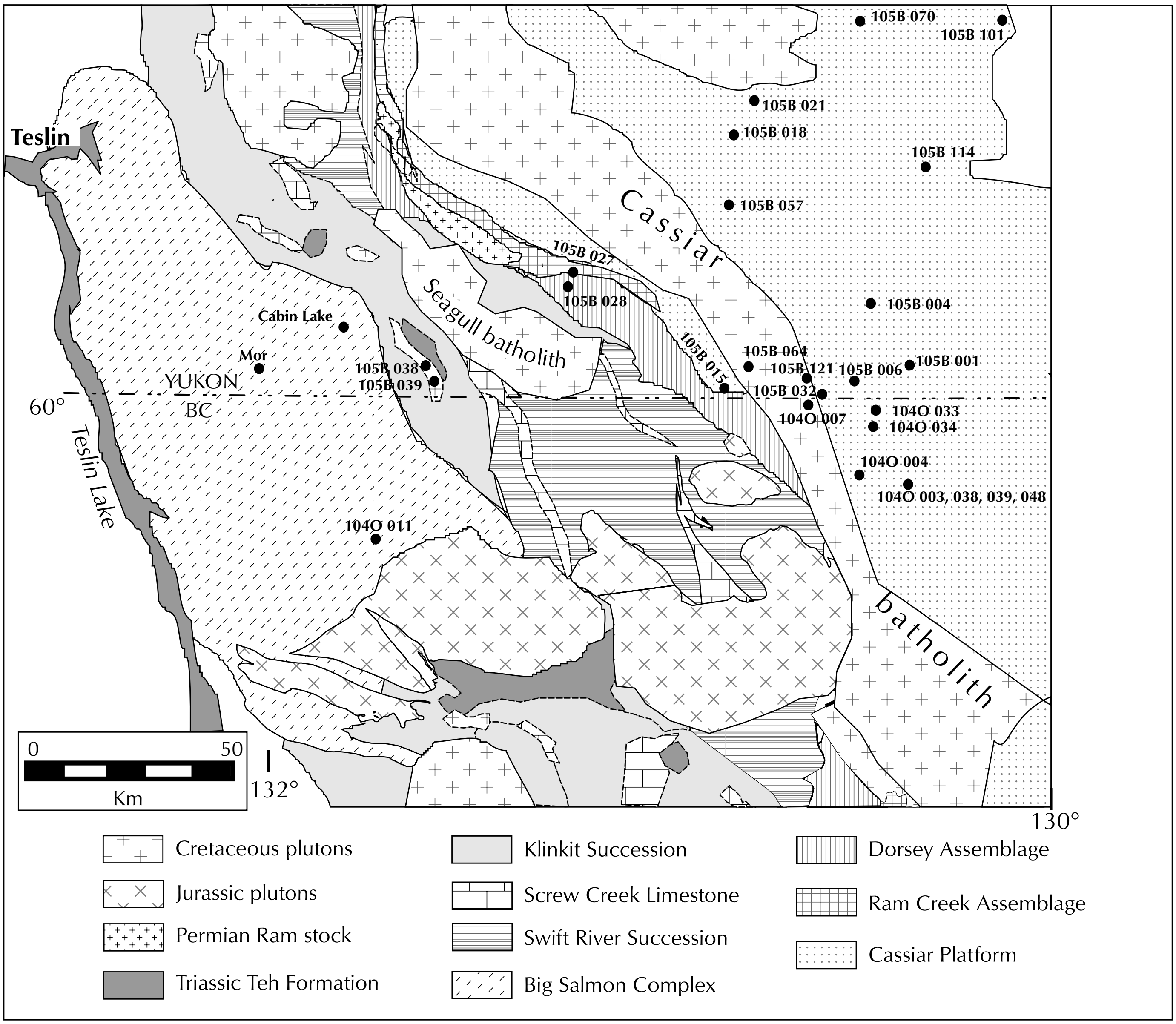

***Figure 1.** Simplified geological map of the study area, showing the main supracrustal assemblages and plutonic suites present, and the locations of the main mineral occurrences discussed in the paper. Occurrences are labeled with their Yukon MINFILE (2001) occurrence numbers. Base geological map compiled by C. Roots, 2001*

as well as a number of new analyses. This contribution reports initial results of an on-going study, which in the future will be expanded to include Pb isotopic analyses of whole rocks and igneous feldspars, to better constrain possible source reservoirs for metals in the various mineral occurrences.

GEOLOGICAL SETTING

The main supracrustal assemblages in the study area include the Big Salmon Complex and the Ram Creek, Dorsey, Swift River and Klinkit assemblages, all considered to be part of either the Yukon-Tanana Terrane, or adjacent miogeoclinal rocks of the Cassiar Terrane. The supracrustal rocks are intruded by at least three distinct suites of intrusions (Fig. 1). Brief lithological descriptions of each of the main supracrustal assemblages given below are summarized from Harms and Stevens (1996), Mihalynuk et al. (1998), Nelson (2000), Roots et al. (2000), Mihalynuk and Devine (2001), and Nelson et al. (2001).

The *Big Salmon Complex* comprises Late Devonian to late Mississippian mafic and minor felsic metavolcanic rocks, quartz-rich metaclastic rocks, and minor carbonate and metamorphosed chert-exhalite ('crinkled chert'). Broadly coeval, mafic to felsic intrusive rocks are also locally abundant. The *Ram Creek assemblage* is a package of mafic to felsic metavolcanic rocks of mainly Mississippian age that are locally interlayered with minor metasedimentary rocks including marble, meta-argillite and meta-chert. The *Dorsey assemblage* comprises highly deformed, quartz-rich metaclastic rocks, marble, mafic and felsic metavolcanic rocks (mainly of Mississippian age), and intermediate to felsic intrusions. Most metaplutonic rocks in the Dorsey assemblage yield Mississippian U-Pb ages; however, a large unfoliated body named the Ram stock gives a Late Permian U-Pb age (Mortensen, unpublished data). The *Swift River succession* is a pre-late Mississippian package of metachert, metatuff, coarse metaclastic rocks and marble. The *Screw Creek limestone* is a thick, laterally continuous band of late Mississippian to early Pennsylvanian limestone that stratigraphically overlies the Swift River succession. The Klinkit assemblage comprises mafic to intermediate volcanic and epiclastic rocks that interfinger with and overlie the Screw Creek limestone. Late Triassic, thin-bedded clastic rocks with minor chert and limestone unconformably overlie the Klinkit rocks.

Late Proterozoic through Late Triassic carbonate and siliciclastic strata of the Cassiar Platform dominate the eastern part of the study area. The Cassiar Terrane is a portion of the Cordilleran miogeoclinal margin that has been displaced approximately 425 km northwestward along the Tintina fault zone.

Post-tectonic intrusions of Early to mid-Cretaceous age (e.g., Cassiar batholith, Seagull batholith, Marker Lake batholith) occur throughout the study area (Fig. 1). Several mafic to intermediate plutons of Early Jurassic age are also present, as well as a single large, mainly unfoliated, felsic intrusion of Late Permian age (the Ram stock).

ANALYTICAL METHODS

Small clean cubes of galena collected from various mineral occurrences were hand-picked, washed and dissolved in dilute hydrochloric acid, and approximately 10-25 nanograms of the lead in chloride form was loaded directly onto a rhenium filament. Trace sulphide samples were hand-picked and then leached in dilute hydrochloric acid to remove surface contamination before dissolution in nitric acid. The samples were passed through ion exchange columns in hydrobromic acid, and the Pb was stripped using hydrochloric acid. Isotopic compositions were measured using a Faraday collector on a modified VG54R thermal ionization mass spectrometer. The measured ratios were corrected for instrumental mass fractionation of 0.12% per mass unit based on repeated measurements of the N.B.S. SRM 981 Standard Isotopic Reference Material (composition from Thirlwall, 2000). Errors reported in Table 1 were obtained by propagating all mass fractionation and analytical uncertainties through the calculation. The average total procedural blank for the trace Pb chemistry was 300 ± 5 picograms.

INITIAL RESULTS OF THE STUDY

Samples from which lead isotopic compositions were determined in this study and previous work (Godwin et al., 1988) represent most styles of mineralization in the study area. A total of 77 analyses are available from 26 individual deposits and occurrences. Table 1 provides information for each occurrence for which Pb isotopic data are available, including the MINFILE number, location, style of mineralization, host assemblage and the age and composition of the immediate host rocks (all information taken from Yukon MINFILE, 2001, and British

Columbia MINFILE, 2001). Appendix 1 lists new Pb isotopic analyses generated during this study; other data discussed here are from Godwin et al. (1988). The complete Pb isotopic data set is plotted on $^{208}Pb/^{204}Pb$ *vs.* $^{206}Pb/^{204}Pb$, $^{207}Pb/^{204}Pb$ *vs.* $^{206}Pb/^{204}Pb$ and $^{208}Pb/^{206}Pb$ *vs.* $^{207}Pb/^{206}Pb$ diagrams in Figure 2. The latter plot is used in order to eliminate uncertainties associated with measurement of the relatively small ^{204}Pb peak. This source of error can be significant in some of the early analyses reported in Godwin et al. (1988), and employing the $^{208}Pb/^{206}Pb$ *vs.* $^{207}Pb/^{206}Pb$ plot commonly results in a tighter clustering of closely related analyses and a clearer discrimination between unrelated analyses. The data on all the plots is shown relative to the 'shale curve', which is a model average Pb isotopic growth curve derived for miogeoclinal strata of Ancestral North America (Godwin and Sinclair, 1982). Lead isotopic analyses of sulphides from syngenetic base metal deposits within the Yukon-Tanana Terrane in Yukon and Alaska define an average growth curve for this terrane that is very similar to the 'shale curve' (Mortensen, unpublished data).

Table 1. *Locations and brief descriptions of mineral occurrences from which lead isotopic analyses are available (summarized from current Yukon MINFILE, 2001 and BC MINFILE, 2001 descriptions).*

Deposit name	Map sheet/ MINFILE no.	Lat.	Long.	Host lithology	Host age	Deposit type	Tectonic element
Arsenault	104O 011	59.81	131.71	'crinkled chert'	Early Carboniferous	epigenetic	Big Salmon Complex
Midway (Silvertip)	104O 003	59.92	130.35	McDame Group limestone	Late Devonian	replacement	Cassiar Platform
Amy (Marbaco)	104O 004	59.93	130.50	marble, schist, Kechika Group	Cambrian-Ordovician	vein	Cassiar Platform
Luck Allochthon	104O 033	59.98	130.45	quartz diorite	Cretaceous	vein	Sylvester
Rancheria	104O 034	59.92	130.48	skarn in limestone, near Cassiar batholith	Ordovician - Devonian	skarn	Cassiar Platform
Midway (Discovery)	104O 038	59.93	130.33	McDame Gp limestone	Late Devonian	replacement	Cassiar Platform
Tootsee Star	104O 039	59.90	130.30	chert, limestone, argillite	Mississippian to Permian	vein	Cassiar Platform
Silverknife	104O 048	59.93	130.36	Rosella Fm. marble and Kechika Gp. hornfels	Lower Cambrian - Ordovician	replacement	Cassiar Platform
Star (YP)	105B 001	60.06	130.37	dolomite, near Cassiar batholith	Lower Cambrian	vein/ stratabound	Cassiar Platform
A and B	105B 003	60.12	130.45	limestone, near Cassiar batholith	Cambrian	vein	Cassiar Platform
Fiddler	105B 004	60.13	130.43	phyllite and limestone, near Cassiar batholith	Cambrian	vein	Cassiar Platform
Lola	105B 007	60.01	130.48	quartz diorite, Cassiar batholith	Cretaceous	vein	Cassiar batholith
Dale Mountain	105B 007	60.01	130.48	fault zone in Cassiar batholith	Cretaceous	vein	Cassiar batholith
Blackrock	105B 015	60.01	130.78	greenstone/Cassiar batholith	Devono-Mississipian	vein	Cassiar Platform
Hart	105B 021	60.33	130.74	Atan Gp.? Bi-qtz and calcareous schist near Cassiar batholith	Cambrian	skarn/vein	Cassiar Platform
Dan (Bar)	105B 027	60.17	131.13	garnet-diopside skarn along shear contact meta-tuff and marble	Permo-Carboniferous	skarn	Ram Creek assemblage
Bom	105B 028	60.15	131.21	hornfelsed clastic and carbonates	Carboniferous: Cretaceous related	skarn	Swift River assemblage
Logjam	105B 038	60.02	131.60	quartz diorite	Cretaceous	vein	Klinkit succession
Logtung	105B 039	60.01	131.60	banded argillite and quartzite, cut by quartz monzonite	Pennsylvanian	vein/ porphyry	Klinkit succession
CMC	105B 057	60.29	130.73	granodiorite	Cretaceous	vein	Cassiar batholith
MC Ridge	105B 088	60.20	131.74	hornfelsed clastic and carbonate near Seagull batholith	Carboniferous: Cretaceous related	skarn	Klinkit succession
Logan	105B 070	60.50	130.47	biotite schist cut by granodiorite	Cretaceous-related	vein	Marker Lake batholith
Wolf (Cordilleran)	105B 101	60.55	130.05	quartz biotite schist, calcareous phyllite	Lower Cambrian	replacement	Cassiar Platform
Meister	105B 114	60.30	130.33	phyllite, marble	Lower Cambrian	replacement	Cassiar Platform
Cabin Lake	105B/4	60.10	131.78	felsic schist (metavolcanic rock?)	Paleozoic?	stratiform	Big Salmon Complex
Mor	105C/1	60.08	132.08	felsic schist (metavolcanic rock?)	Paleozoic?	stratiform	Big Salmon Complex

Carbonate replacement, skarn and vein mineralization

Epigenetic mineral occurrences within the study area have been described by numerous authors, including Abbott (1983), Bremner and Liverton (1990), Germann et al. (1992) and D'el-Rey Silva et al. (2001). The Midway deposit (BC MINFILE, 2001, 104O 003, 038) and other epigenetic base metal occurrences in the immediate area of the deposit (Silverknife – 104O 048 and Amy – 104O 004, BC MINFILE, 2001) are massive sulphide replacements and veins in Lower Paleozoic carbonate rocks. Lead isotopic analyses from Midway, and most analyses from Amy, cluster near the shale curve and correspond to model ages of ~100 Ma (Fig. 2). One possible interpretation of these data is that metals in Midway and Amy are magmatic in origin and were derived from Early to mid-Cretaceous intrusions in the area. The tight clustering of the data from Midway and Amy indicates that lead in these deposits was either derived from a single homogeneous source (such as a body of magma), or derived from multiple sources and completely homogenized by a very large and vigorous hydrothermal circulation system. Analyses from the Silverknife occurrence are slightly more radiogenic (relatively high measured $^{206}Pb/^{204}Pb$ ratios), and plot on the shale curve in Figure 2. This suggests that Silverknife mineralization is slightly younger than that at Midway and Amy, and/or that metals in the deposits were derived from different sources.

Most other epigenetic occurrences in the study area (including skarns and porphyry occurrences that are clearly intrusion-related) also yield model ages that are younger than their immediate host rocks. There is considerable scatter in the data, however, which suggests that Pb was derived from several isotopically

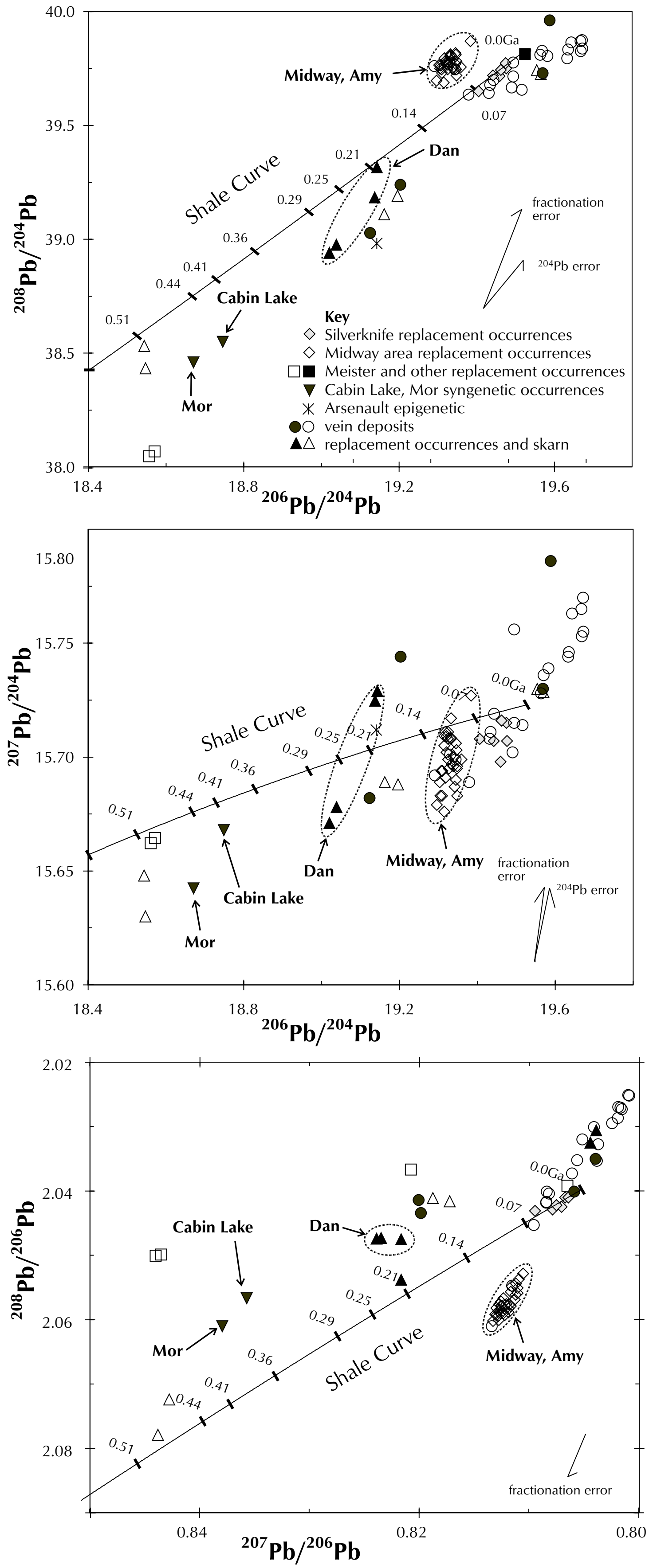

Figure 2. *Plot of $^{208}Pb/^{204}Pb$ vs. $^{206}Pb/^{204}Pb$, $^{207}Pb/^{204}Pb$ vs. $^{206}Pb/^{204}Pb$, and $^{208}Pb/^{206}Pb$ vs. $^{207}Pb/^{206}Pb$ for sulphide minerals from the study area. Included are previously published data from Godwin et al. (1988) and data from this study. Analyses from occurrences within the Cassiar Platform are shown in open symbols and those from the Yukon-Tanana Terrane are shown as closed symbols.*

distinct sources (possibly magmatic Pb plus Pb leached from sedimentary and/or volcanic wall rocks of various ages and compositions). Alternatively, intrusion-related mineralization may be associated with more than one magmatic suite. Many of the vein and skarn occurrences are spatially associated with the Early and mid-Cretaceous intrusions in the area; however, Early Jurassic intrusions and at least one large Late Permian intrusion are also present in the area and may have provided a source of metals.

The MC Ridge and Meister occurrences (Yukon MINFILE, 2001, 105B 088 and 105B 114, respectively) comprise skarn and carbonate replacement style mineralization, respectively, within Lower Paleozoic phyllite and carbonate of the Cassiar Platform (Table 1). Duplicate analyses of a single sample from each occurrence yield surprisingly non-radiogenic compositions (Appendix 1; Fig. 2). Two other analyses from the MC Ridge occurrence give compositions more similar to other epigenetic occurrences in the area. The implications of the non-radiogenic analyses from these two occurrences are uncertain. Distal, intrusion-related carbonate replacement deposits with low base metal contents, such as the Ketza River deposit, have been shown to have relatively scattered Pb isotopic compositions that approach those of the host rocks that have been replaced (Fonseca, 1998). On the other hand, veins rich in base metals, such as those at the Iona Silver mine, thought to be genetically closely associated with the replacement style mineralization at Ketza River, yield tightly clustered analyses that are interpreted as more representative of Pb of magmatic derivation (Fonseca, 1998). The non-radiogenic compositions of the Meister sulphides and some from the MC Ridge occurrence may therefore indicate that metals in these occurrences were derived largely from the host rocks. Further work is required to test this model.

Stratabound and stratiform mineralization

Several occurrences within the study area are broadly conformable with enclosing strata and have been postulated as syngenetic in origin. Included in this group are the Arsenault occurrence (BC MINFILE, 2001, 104O 111) which is hosted in the 'crinkled chert' (metamorphosed chert exhalite) unit of the Big Salmon complex, the Cabin Lake and Mor occurrences (no MINFILE numbers assigned) hosted by felsic metavolcanic rocks of the Big Salmon Complex, and the Dan (Bar) occurrence (Yukon MINFILE, 2001, 105B 027), which is hosted by marble, calc-silicate, metapelite and metatuffaceous rocks of the Ram Creek assemblage. Analyses of galena from the Cabin Lake and Mor occurrences (Appendix 1) fall somewhat below the shale curve and yield broadly Devono-Mississippian model ages. This is consistent with the inferred age of the host strata and thus provides strong support for a syngenetic origin for this mineralization, as has been proposed by E. Balon and W. Jakubowski (pers. comm., 2001). An analysis of sulphides from the Arsenault occurrence, however, yields a much more radiogenic Pb composition (Appendix 1; Fig. 2), suggesting that this occurrence is more likely to be epigenetic in nature.

The Dan occurrence comprises three roughly conformable bands of massive sphalerite, pyrrhotite and magnetite with minor galena that occur along the contact between underlying massive marble and calc-silicate rock, and overlying metatuffaceous rocks (Table 1; Bremner and Liverton, 1990; D'el Rey Silva et al., 2001). Previous workers have suggested a syngenetic origin for the mineralization, based, in part, on the presence of meta-tuffaceous rocks in the immediate hanging wall. Bremner and Liverton (1990), however, presented textural and structural evidence, observable in the field, that argues for an epigenetic, possibly intrusion-related origin. Four Pb isotopic analyses of galena and pyrrhotite from the Dan deposit have been carried out (Appendix 1), and clearly do not support the syngenetic model (Fig. 2). The Dan analyses, together with the single analysis of sulphide minerals from the Arsenault and two other analyses from veins and skarns, form a loose cluster that is less radiogenic than Pb isotopic compositions of most other epigenetic occurrences in the study area (Fig. 2). This cluster of analyses corresponds to broadly mid-Triassic to mid-Jurassic model ages. Both the Dan and Arsenault occurrences are located near Early Jurassic intrusions, and it is possible that these occurrences are temporally and genetically associated with the Early Jurassic magmatism.

DISCUSSION

The extensive Pb isotopic database now available for sulphide occurrences from throughout the study area provides a powerful tool for understanding the metallogeny of this complex region. In particular, it makes it possible to discriminate with some confidence between a syngenetic and epigenetic origin for specific occurrences (providing the geology of the area is reasonably well understood). In some instances, the data also gives a rough indication of the age of individual occurrences. In order to gain a more complete understanding of the nature and origin of mineralization in this area, however, the Pb isotopic composition of potential source reservoirs for the metals (e.g., intrusive rocks of different ages, or sedimentary or volcanic host rocks, particularly for replacement-style mineralization) must be determined. A Pb isotopic study of igneous feldpars in intrusive rocks of various ages in the study area is now underway to constrain the possible composition(s) of magmatic Pb that may be present in mineral occurrences.

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APPENDIX 1. Pb ISOTOPE ANALYTICAL DATA

Deposit name	Mineral	$^{206}Pb/^{204}Pb$	Pb64 % err	$^{207}Pb/^{204}Pb$	Pb74 % err	$^{208}Pb/^{204}Pb$	Pb84 % err	$^{207}Pb/^{206}Pb$	Pb76 % err	$^{208}Pb/^{206}Pb$	Pb86 % err	Analyst
Arsenault	CP	19.142	0.25	15.712	0.25	38.986	0.25	0.821	0.02	2.037	0.03	GA
Midway (Silvertip)-012a	GL	19.345	0.02	15.706	0.01	39.818	0.03	0.8119	0.00	2.058	0.00	GA
Midway (Silvertip)-012b	GL	19.325	0.04	15.699	0.03	39.747	0.05	0.8124	0.00	2.057	0.00	GA
Midway (Silvertip)-013	GL	19.321	0.00	15.702	0.01	39.771	0.00	0.8127	0.00	2.059	0.00	GA
Midway (Silvertip)-501	GL	19.303	0.00	15.689	0.16	39.765	0.22	0.8128	0.00	2.060	0.00	GSC
Midway (Silvertip)-001a	GL	19.315	0.01	15.676	0.02	39.688	0.02	0.8116	0.00	2.055	0.00	AN
Midway (Silvertip)-001b	GL	19.347	0.02	15.695	0.01	39.747	0.02	0.8112	0.00	2.054	0.00	GA
Midway (Silvertip)-507	GL	19.340	0.11	15.700	0.16	39.795	0.22	0.8118	0.00	2.058	0.00	UA
Midway (Silvertip)-508	GL	19.334	0.11	15.697	0.16	39.806	0.22	0.8119	0.00	2.059	0.00	UA
Amy (Marbaco)-001	GL	19.406	0.02	15.708	0.01	39.649	0.05	0.8095	0.00	2.043	0.00	GA
Amy (Marbaco)-002	GL	19.315	0.00	15.705	0.00	39.773	0.00	0.8131	0.00	2.059	0.00	GA
Amy (Marbaco)-003	GL	19.324	0.00	15.711	0.01	39.773	0.00	0.8130	0.00	2.058	0.00	GA
Amy (Marbaco)-004	GL	19.321	0.00	15.709	0.03	39.762	0.00	0.8130	0.00	2.058	0.00	GA
Luck-001	GL	19.563	0.00	15.728	0.01	39.810	0.00	0.8040	0.00	2.035	0.00	GA
Luck-501	GL	19.588	0.00	15.786	0.00	39.962	0.00	0.8059	0.00	2.040	0.00	GSC
Rancheria	GL	19.331	0.00	15.708	0.00	39.780	0.00	0.8126	0.00	2.058	0.00	UA
Midway (Discovery)-002	GL	19.296	0.04	15.679	0.04	39.696	0.04	0.8126	0.00	2.057	0.00	GA
Midway (Discovery)-003	GL	19.310	0.01	15.694	0.01	39.731	0.01	0.8128	0.00	2.058	0.00	GA
Midway (Discovery)-005	GL	19.346	0.02	15.703	0.01	39.811	0.03	0.8117	0.00	2.058	0.00	GA
Midway (Discovery)-006	GL	19.326	0.03	15.695	0.03	39.766	0.04	0.8121	0.00	2.058	0.00	GA
Midway (Discovery)-007	PY	19.324	0.00	15.708	0.01	39.783	0.02	0.8129	0.00	2.059	0.00	GA
Midway (Discovery)-008	GL	19.331	0.03	15.708	0.03	39.803	0.04	0.8126	0.00	2.059	0.00	GA
Midway (Discovery)-009	GL	19.317	0.06	15.711	0.06	39.795	0.07	0.8133	0.00	2.060	0.00	GA
Midway (Discovery)-010	GL	19.359	0.01	15.699	0.01	39.757	0.02	0.8110	0.00	2.054	0.00	GA
Midway (Discovery)-011	GL	19.338	0.01	15.696	0.01	39.753	0.02	0.8117	0.00	2.056	0.00	GA
Midway (Discovery)-502	GL	19.348	0.11	15.696	0.16	39.782	0.22	0.8112	0.00	2.056	0.00	UA
Midway (Discovery)-503	GL	19.341	0.11	15.687	0.16	39.747	0.22	0.8111	0.00	2.055	0.00	UA
Midway (Discovery)-504	GL	19.348	0.11	15.683	0.16	39.719	0.22	0.8106	0.00	2.053	0.00	UA
Midway (Discovery)-505	GL	19.309	0.11	15.683	0.16	39.746	0.22	0.8122	0.00	2.058	0.00	UA
Midway (Discovery)-506	GL	19.384	0.11	15.727	0.16	39.871	0.22	0.8113	0.00	2.057	0.00	UA
Midway (Discovery)-509	GL	19.305	0.11	15.683	0.16	39.749	0.22	0.8124	0.00	2.059	0.00	UA
Midway (Discovery)-510	GL	19.318	0.11	15.691	0.16	39.782	0.22	0.8122	0.00	2.059	0.00	UA
Midway (Discovery)-511	GL	19.345	0.00	15.690	0.16	39.771	0.22	0.8111	0.00	2.056	0.00	UA
Tootsee Star	GL	19.291	0.00	15.692	0.00	39.760	0.00	0.8134	0.01	2.061	0.01	GA
Silverknife-001	GL	19.462	0.01	15.716	0.02	39.744	0.02	0.8076	0.00	2.042	0.01	GA
Silverknife-002	GL	19.459	0.00	15.698	0.00	39.717	0.00	0.8067	0.01	2.041	0.01	GA
Silverknife-003	GL	19.442	0.00	15.707	0.00	39.719	0.00	0.8079	0.01	2.043	0.00	GA
Silverknife-004	GL	19.476	0.00	15.707	0.00	39.751	0.00	0.8065	0.01	2.041	0.00	GA
Silverknife-005	GL	19.474	0.00	15.715	0.00	39.774	0.00	0.8071	0.00	2.043	0.00	GA
Silverknife-006	GL	19.462	0.01	15.716	0.01	39.744	0.01	0.8076	0.00	2.042	0.00	GA
Star (YP)-501	GL	19.671	0.00	15.770	0.00	39.874	0.00	0.8017	0.00	2.027	0.00	AN
Star (YP)-502	GL	19.633	0.00	15.744	0.00	39.795	0.00	0.8019	0.00	2.027	0.00	AN
Star (YP)-503	GL	19.568	0.00	15.730	0.00	39.827	0.00	0.8039	0.00	2.035	0.00	AN
Star (YP)-504	GL	19.635	0.00	15.746	0.00	39.833	0.00	0.8019	0.00	2.029	0.00	AN
Star (YP)-505	GL	19.643	0.00	15.763	0.00	39.865	0.00	0.8025	0.00	2.029	0.00	AN
Star (YP)-506	GL	19.667	0.00	15.765	0.00	39.871	0.00	0.8016	0.00	2.027	0.00	AN
A & B	GL	19.516	0.08	15.714	0.15	39.657	0.19	0.8052	0.00	2.032	0.00	RY
Fiddler-101	GL	19.672	0.01	15.755	0.00	39.837	0.01	0.8009	0.00	2.025	0.00	GA
Fiddler-102	GL	19.668	0.01	15.753	0.01	39.826	0.01	0.8010	0.00	2.025	0.00	GA
Lola-001a	GL	19.344	0.03	15.699	0.01	39.747	0.04	0.8116	0.00	2.055	0.00	GA

Deposit name	Mineral	$^{206}Pb/^{204}Pb$	Pb64 % err	$^{207}Pb/^{204}Pb$	Pb74 % err	$^{208}Pb/^{204}Pb$	Pb84 % err	$^{207}Pb/^{206}Pb$	Pb76 % err	$^{208}Pb/^{206}Pb$	Pb86 % err	Analyst
Lola-001b	GL	19.431	0.02	15.708	0.01	39.642	0.02	0.8084	0.00	2.040	0.00	GA
Lola-002	GL	19.330	0.05	15.701	0.02	39.776	0.07	0.8123	0.00	2.058	0.00	GA
Lola-003	GL	19.434	0.04	15.711	0.02	39.678	0.05	0.8084	0.00	2.042	0.00	GA
Lola-501	GL	19.443	0.00	15.719	0.00	39.699	0.00	0.8085	0.00	2.042	0.00	AN
Dale Mountain	GL	19.379	0.00	15.689	0.00	39.636	0.00	0.8096	0.00	2.045	0.00	GSC
Blackrock-001a	GL	19.490	0.02	15.702	0.02	39.667	0.02	0.8056	0.00	2.035	0.00	GA
Blackrock-001b	GL	19.494	0.03	15.715	0.01	39.715	0.03	0.8061	0.00	2.037	0.00	GA
Hart-001	GL	19.554	0.02	15.730	0.02	39.742	0.02	0.8044	0.01	2.033	0.01	GA
Hart (Meteorite)-101	GL	19.494	0.02	15.756	0.02	39.777	0.02	0.8082	0.01	2.040	0.01	GA
Hart (Breccia)-102	GL	19.565	0.01	15.729	0.02	39.727	0.02	0.8039	0.00	2.031	0.01	GA
Dan (Bar)-001	GL	19.038	0.01	15.678	0.01	38.976	0.02	0.8235	0.00	2.047	0.01	PI
Dan (Bar)-002	GL	19.020	0.02	15.671	0.02	38.940	0.02	0.8239	0.01	2.047	0.01	PI
Dan (Bar)-005	SL	19.137	0.04	15.725	0.05	39.184	0.07	0.8217	0.02	2.048	0.03	GA
Bom	GL	19.143	0.00	15.729	0.00	39.316	0.00	0.8217	0.00	2.054	0.00	GSC
Logjam	GL	19.203	0.00	15.744	0.00	39.240	0.00	0.8199	0.00	2.043	0.00	GSC
Logtung	GL	19.123	0.03	15.682	0.03	39.035	0.03	0.8201	0.00	2.041	0.00	GA
CMC	GL	19.582	0.00	15.739	0.00	39.805	0.00	0.8037	0.00	2.033	0.00	AN
MC Ridge (K3)-001a	GL	18.544	0.06	15.648	0.14	38.532	0.13	0.8438	0.00	2.078	0.00	RY
MC Ridge (K3)-001b	GL	18.547	0.02	15.630	0.02	38.433	0.02	0.8428	0.00	2.072	0.00	GA
MC Ridge (K1)-002a	GL	19.196	0.06	15.688	0.12	39.191	0.13	0.8173	0.00	2.042	0.00	RY
MC Ridge (K1)-002b	GL	19.162	0.02	15.689	0.02	39.109	0.02	0.8188	0.00	2.041	0.00	GA
Logan	GL	19.570	0.02	15.736	0.02	39.729	0.02	0.8041	0.01	2.030	0.01	PI
Wolf (Cordilleran)	GL	19.524	0.02	15.747	0.03	39.813	0.03	0.80655	0.01	2.039	0.02	GA
Meister-002	GL	18.571	0.03	15.665	0.02	38.068	0.03	0.8435	0.00	2.050	0.00	GA
Meister-002	GL	18.557	0.03	15.662	0.02	38.044	0.03	0.8440	0.00	2.050	0.00	GA
Cabin Lake	PY	18.747	0.14	15.668	0.21	38.552	0.28	0.8358	0.07	2.057	0.14	GA
Mor	PY	18.670	0.03	15.644	0.05	38.470	0.06	0.8379	0.02	2.061	0.03	GA

Notes

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Deposit names have been suffixed with sample numbers from LEADTABLE, where multiple samples were analysed.

Multiple analyses are listed as a, b. Minerals are GL = galena, CP = chalcopyrite, PY = pyrite.

Analytical errors are quoted at the 2σ level.