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A U-Pb zircon age for host rocks of a syngenetic strontium(-zinc) occurrence in the Kitsault Lake area, west-central British Columbia

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Abstract

An unusual type of syngenetic, volcanic exhalative strontium(-zinc) occurrence is present within the upper part of the Hazelton Group in the Kitsault Lake area of west-central British Columbia. A U-Pb zircon age of 193.5 ± 0.4 Ma was obtained for a felsic volcanic unit that underlies this occurrence. This dates the deposit, and provides a constraint for regional correlation within the Hazelton Group in the northern Coast Mountains of British Columbia.

Résumé

Une venue de strontium(-zinc) exhalatif volcanique syngénétique d' un type inhabituel est présente dans la partie supérieure du groupe de Hazelton dans la zone du lac Kitsault du centre-ouest de la Colombie-Britannique. On a obtenu une datation U-Pb sur zircon de 193,5 ± 0,4 Ma pour une unité volcanique felsique qui repose au-dessous de cette venue. On peut ainsi dater le gisement et affiner la corrélation régionale au sein du groupe de Hazelton dans le nord de la chaîne Côtière en Colombie-Britannique.

INTRODUCTION

The Kitsault River area (NTS 103 P/11, 12) is located on the eastern side of the Coast Mountains about 42 km southeast of Stewart, British Columbia (Fig. 1). This area has been the site of intermittent mineral exploration and limited mining since the early 1900s. The Torbrit mine (Fig. 1) produced approximately one million tonnes of silver ore between 1949 and 1957 (Campbell, 1959), and minor production also came from the Dolly Varden and North Star properties (Black, 1952). In recent years exploration for silver, gold, copper, lead and zinc has been carried out on a number of mineral occurrences in this area (Fig. 1). A variety of occurrences are present. Most are epigenetic; however some syngenetic ones have also been recognized south of Kitsault Lake at the head of Kitsault River (Fig. 1). These occurrences consist of bedded celestite and minor sphalerite within a sequence of volcanic and volcaniclastic rocks of the Hazelton Group.

Syngenetic, volcanic exhalative mineral deposits are known in several places in the Coast Mountains of British Columbia. Metamorphism, complex structural relationships, and lack of diagnostic fossils in some areas has precluded accurate dating of many of these deposits. Interest in syngenetic deposits within Hazelton Group strata in northwestern British Columbia has recently been revived, largely because of the discovery of the rich Eskay Creek deposit 120 km to the northwest (Britton et al., 1990). In this paper we report a U-Pb zircon age for the volcanic rocks that underlie the Kitsault Lake syngenetic occurrence. The age provides an important constraint both

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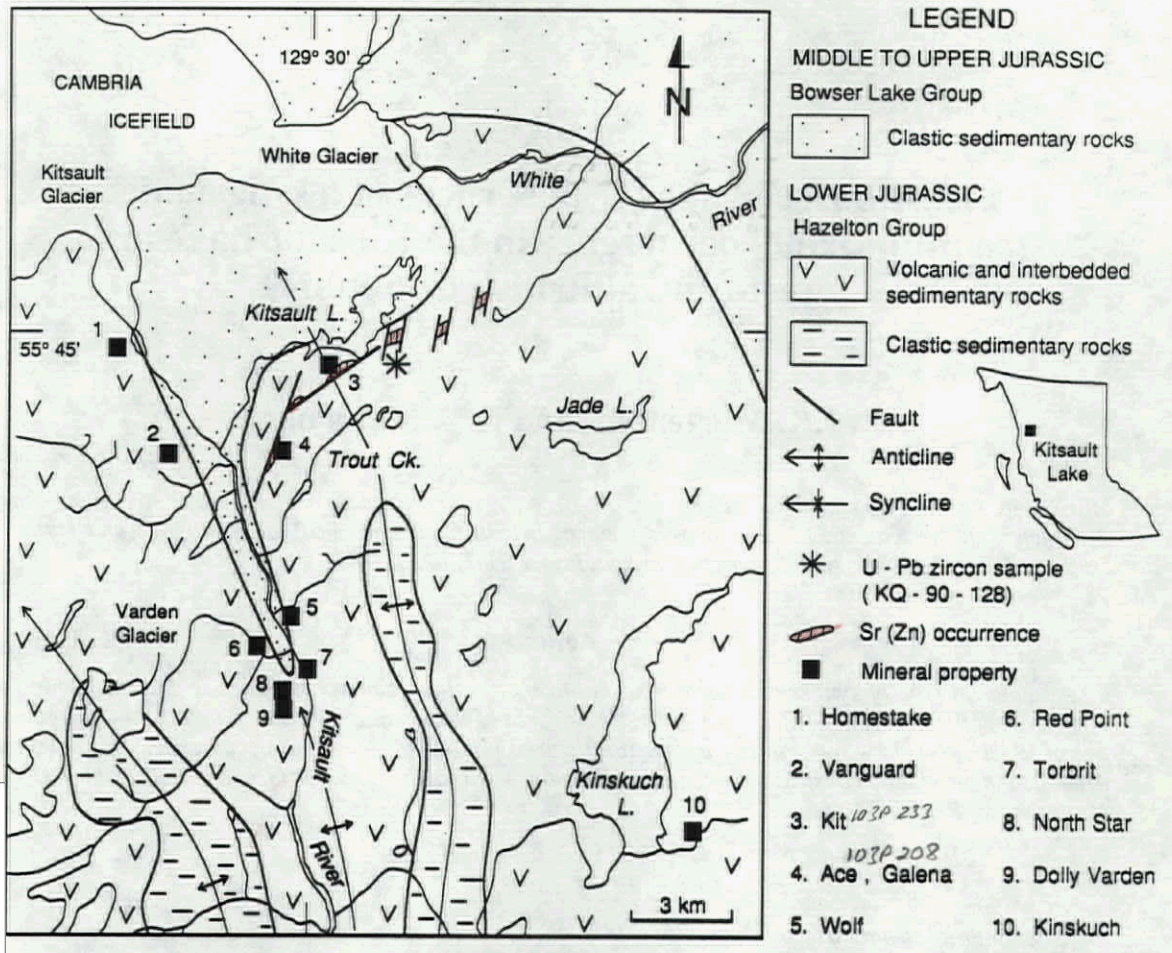

Figure 1. Generalized geology of the Kitsault Lake area (adapted from Dawson and Alldrick, 1986), showing the location of the strontium(-zinc) occurrence and the U-Pb dating sample.

Figure 2. Typical well-bedded celestite (barite) from the Main showing, Kit property. Photograph is about 25 cm high (GSC 1991-390A).

Table 1. U-Pb analytical data

Fraction, Size[1]	Weight (mg)	U (ppm)	Pb^2 (ppm)	$^{206}Pb/^{204}Pb$[3]	^{208}Pb[2] (%)	$^{206}Pb/^{238}U$[4]	$^{207}Pb/^{235}U$[4]	$^{207}Pb/^{206}Pb$[4]	$^{207}Pb/^{206}Pb$ age[5]
Sample KQ-90-128									
A N2,+177	0.168	291	8.8	6453	8.7	0.03049(.09)	0.21005(.10)	0.04997(.04)	193.7(1.6)
B N2,+177	0.110	379	11.8	2599	9.1	0.03047(.10)	0.21018(.12)	0.05002(.08)	196.0(3.8)
C N2,+105-149,u	0.274	322	9.6	4301	8.8	0.03021(.10)	0.20828(.11)	0.05000(.05)	195.1(2.1)

[1]sizes (+62-74 refers to size of zircons in microns; N5=non-magnetic cut with Frantz at 5 degrees side slope; u = unabraded
[2]radiogenic Pb
[3]measured ratio, corrected for spike and fractionation
[4]corrected for blank Pb and U and common Pb (errors quoted are 1σ in percent)
[5]corrected for blank and common Pb (errors are 2σ in Ma)
Initial common Pb compositions from Stacey and Kramers (1975)

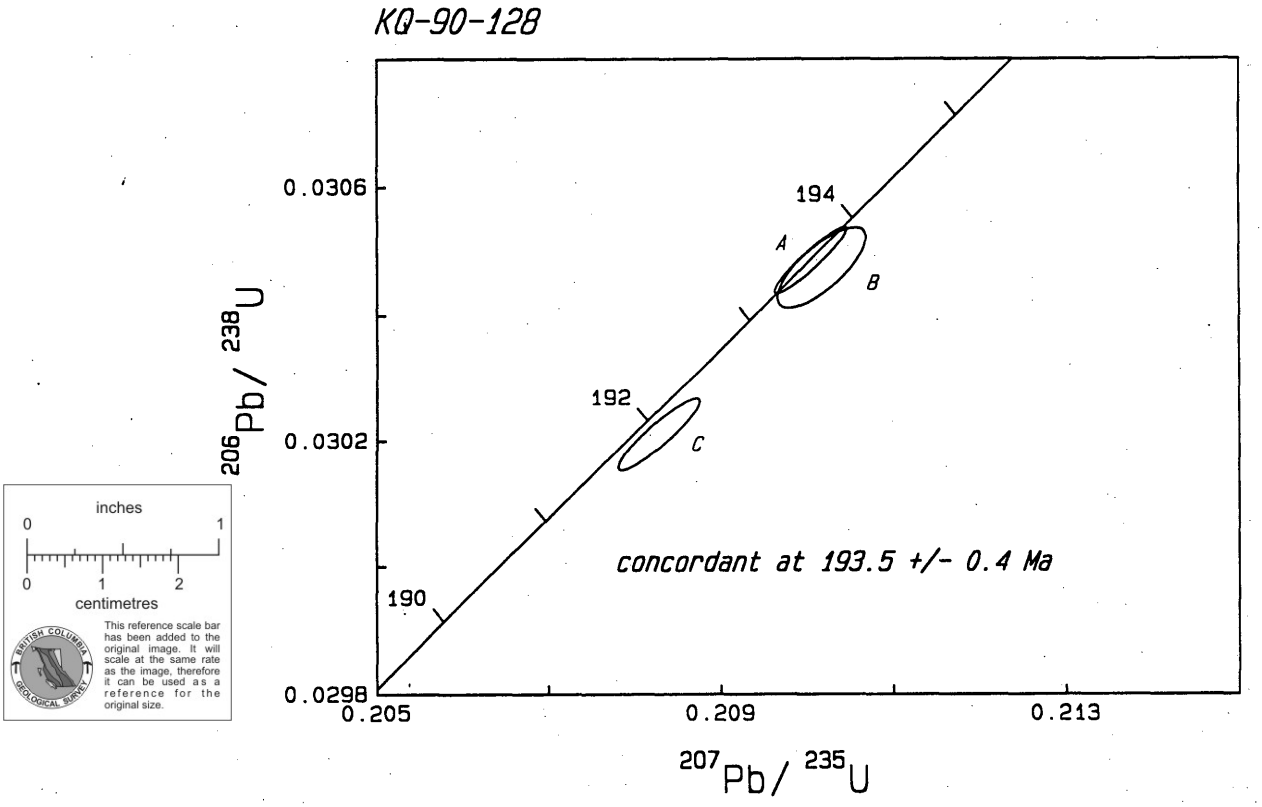

Figure 3. U-Pb concordia plot for sample KQ-90-128.

for chronostratigraphic correlation within the Hazelton Group of northwestern British Columbia, and for regional metallogenic models.

REGIONAL AND LOCAL GEOLOGY

The Kitsault Lake area (Fig. 1) is underlain by Lower Jurassic volcanic and sedimentary rocks of the Hazelton Group and Middle and Upper Jurassic clastic sedimentary rocks of the Bowser Lake Group (Alldrick et al., 1986; Dawson and Alldrick, 1986). Drab green- and maroon-grey, massive andesitic tuff-breccia predominates in the upper part of the Hazelton Group volcanic succession in the area. Some dust and ash tuff occurs along the east side of Kitsault Lake below dark graphitic sedimentary rocks of the Bowser Lake Group. In diamond-drill core thin accretionary or armoured(?) lapilli units are also present locally. Greig (1991) has documented tight, westerly vergent folds in the Bowser Lake Group in the area.

On the Kit and Ace/Galena properties south of Kitsault Lake (Fig. 1) are scattered outcrops in small fault blocks of dark, carbonaceous, pebbly mudstone (diamictite) with lithic, muscovite, and highly altered volcanic and pyrite clasts, as well as calcareous, pyritic siltstone, and buff-weathering, well-bedded celestite (Fig. 2). Minor barite, strontianite, pyrite, sphalerite, galena, arsenopyrite, and traces of orpiment occur with the celestite in gash veins. These units, although not well exposed, form a distinctive sequence that can be correlated in outcrops and diamond-drill holes from one fault block to another. They are both underlain and overlain by massive, fragmental andesitic units. Most of the sulphides are fine grained and disseminated or occur in wispy veinlets. Framboidal pyrite and soft-sediment deformation features are common in these units. Arsenopyrite characteristically occurs as scattered, minute lath-shaped crystals in dark carbonaceous siltstone or pebbly mudstone. In old (1968) drill core from the Ace/Galena area (Fig. 1), 1-2 cm thick conformable(?) layers of pale, fine grained sphalerite are also present. Carter (1969) described the detailed geology and mineral occurrences on the Ace/Galena property.

Four main lines of evidence indicate a syngenetic, volcanogenic exhalative origin for the strontium(-zinc) occurrence. These are: 1) the well-bedded nature of the celestite; 2) the distinctive bedded, carbonaceous rock units with sulphide and highly altered volcanic clasts; 3) the occurrence of thin, relatively massive bedded sphalerite units on the Ace/Galena property; and 4) the relatively massive andesitic tuff-breccia units in both the hanging wall and footwall of the strontium(-zinc) occurrence.

The U-Pb dating sample (KQ-90-128) is from a medium maroon-grey, feldspar-(quartz-)phyric lapilli tuff unit on the southeast side of "Quartz-Eye lake" (local informal name) about 400 m south of the Discovery showing (Fig. 1). This unit is probably a welded dacitic ash-flow tuff(?), and the maroon colouration is probably the result of subaerial oxidation at the time of eruption. The sampled unit occurs about 100 to 200 m(?) stratigraphically below the strontium(-zinc) occurrence.

ANALYTICAL TECHNIQUES

Zircons were separated from a 25 kg sample using conventional Wilfley table and heavy liquid methods. Analytical techniques employed in this study are summarized by Parrish et al. (1987). All analyses reported are from strongly abraded single grains. Errors in ages are quoted at the 2σ level.

ANALYTICAL RESULTS

Zircons recovered from the sample form stubby euhedral prisms that are clear and unzoned, pale pink in colour, and contain abundant clear rod- and bubble-shaped inclusions, but no visible cores. Two strongly abraded fractions and one unabraded fraction were analyzed (Table 1). The two abraded fractions are concordant with overlapping ^{206}Pb-^{238}U ages of 193.5 ± 0.4 Ma (Fig. 3), which gives the crystallization age of the sample. The unabraded fraction is slightly discordant with younger Pb-U ages, reflecting recent Pb-loss.

DISCUSSION AND CONCLUSIONS

The 193.5 ± 0.4 Ma (Pleinsbachian) age for the feldspar-phyric unit that stratigraphically underlies the Discovery showing is interpreted as the age of formation of the syngenetic strontium(-zinc) deposit in the Kitsault Lake area. Although the stratigraphic section is different and the Kitsault Lake occurrence, as explored thus far, does not contain significant gold or silver, the setting near the top of the Hazelton Group volcanic pile is analogous to that in the Eskay Creek area, about 120 km to the northwest, with its important precious and base metal deposits.

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KITSAULT LAKE VOLCANIC EXHALATIVE SR(-ZN) OCCURRENCE, NORTHWEST BRITISH COLUMBIA

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An unusual volcanic exhalative Sr(-Zn) occurrence is present in the upper part of the Lower Jurassic Hazelton Group in the Kitsault Lake area of northwest British Columbia. Celestite, sphalerite, pyrite with minor amounts of barite, strontianite, galena, arsenopyrite, greenockite and trace amounts of orpiment occur in association with dark carbonaceous, pebbly mudstone (diamictite) interbedded with andesitic tuff-breccia. The sulphate minerals are bedded with sulphides disseminated both in the sulphate and diamictite units. Pyrite also occurs in deformed colloform layers, framboids, wispy veins and clasts in the diamictite.

A felsic lapilli tuff unit, about 100 to 200 m(?) stratigraphically below the exhalative Sr(-Zn) occurrence, has yielded a U-Pb zircon age of 193.5 ± 0.4 Ma. The stratigraphic setting is analogous to that of the important Eskay Creek deposit about 120 km to the northwest.

Most celestite deposits occur in evaporite-redbed environments. The authors are unaware of any other documented occurrence of volcanic exhalative celestite. This bedded sulphate unit could be a distal volcanic exhalative product in a basin adjacent to a paleotopographically higher exhalative hydrothermal centre.