Final report for YMEP Focused Regional Project 20-116

THE SANDS OF TIME EXPLORATION PROJECT

GEOCHEMICAL REPORT

Cover image: collecting a bulk sample at site 20JM008.

By and for Jack Milton, Ph.D.

31st January 2021

Dates of fieldwork 3rd July to 6th July 2020

NTS 115J10; 115J11; 115J12; 115J13; 115J14; 115J15

Latitudes 62.641° to 62.771° N

Longitudes 138.922° to 139.409° W

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EXECUTIVE SUMMARY

Samples of stream sediments were taken in the area 11 km SW to 30 km W of the Casino deposit, Dawson Range, Yukon. Silt samples were analyzed for geochemistry, and bulk stream sediment samples were collected for heavy mineral concentration. Mineral concentrates were logged for porphyry indicator minerals, and zircon separates were produced. Zircons were analyzed by LA-ICP-MS for geochronology and geochemistry in an effort to detect Late Cretaceous zircons with fertile indicator geochemistry, associated with concealed and unmapped Casino suite intrusive rocks.

Casino Suite age zircons were detected in three out of six bulk stream sediment samples that all occur in drainages with no known or mapped occurrences of Casino Suite intrusive rocks. The number of zircons detected suggest that a Casino Suite porphyry could be present in one drainage, with a similar size footprint to the Casino deposit. Follow-up of these anomalous drainages with more detailed sampling is recommended to try and trace these anomalous signatures back to bedrock sources that may potentially host Cu-Au-Mo mineralization related to Casino Suite rocks.

INTRODUCTION

A paucity of outcrop and deep oxidation has challenged the traditional methods of early-stage exploration for porphyry Cu-Au-Mo deposits in the Dawson Range, Yukon: stream sediment sampling, soil sampling and prospecting. A method here is proposed and tested within this project to detect Casino Suite intrusive rocks over large areas of the Dawson Range, at relatively low-cost, by dating zircons contained within stream sediments. The small volume ~78-72 Ma Casino Suite intrusive rocks are intimately associated with porphyry Cu-Au-Mo mineralization across the SW Yukon and these granitoids are difficult to distinguish from the granitoids of the Dawson Range Batholith, particularly given the lack of outcrop providing little control on regional geological maps. Late Cretaceous porphyry mineralization occurs in a belt parallel to the Big Creek fault, from Klaza to Casino. A conspicuous gap is present from Casino 150 km NW to the late Cretaceous Taurus and Bluff deposits in eastern Alaska, and within this gap are large areas of Dawson Range Batholith that have not seen much previous exploration activity, with no known late Cretaceous porphyry deposits.

Dating zircon grains in large numbers has until recently been prohibitively expensive, but with the advent of LA-ICP-MS, the cost of doing systematic large-n sampling has come down substantially to levels where it may be deemed feasible for use in mineral exploration (e.g., Lee et al., 2021). Trace element chemistry is measured during the LA-ICP-MS process in addition to the U-Pb dating at little additional expense. The trace element signatures of zircon have recently been linked to predicting porphyry fertility and provide another layer for exploration targeting (Dilles et al., 2015; Lee et al., 2020). Porphyry indicator minerals have been developed to detect porphyry deposits in nearby surficial sediments such as tills, stream sediments and sands (Averill, 2011; McClenaghan et al., 2020).

The Sands of Time project uses stream sediment zircon U-Pb geochronology, zircon trace element geochemistry, porphyry indicator mineralogy of stream sediments, and fine-fraction stream sediment geochemical sampling to explore for porphyry deposits at the headwaters of creeks in the Dawson Range, west of the Casino deposit.

LOCATION

The Sands of Time project is located within the traditional territories of the Selkirk and Tr'ondëk Hwëch'in First Nations, on crown land. A 35 x 10 km area was investigated 11 km south-west of the Casino deposit, 20 km south of the Coffee deposit and 7 km south of the Boulevard project. This project was conducted entirely off-claims and was carried out as prospecting in order to locate claims.

ACCESSIBILITY, CLIMATE, LOCAL RESOURCES, INFRASTRUCTURE, AND PHYSIOGRAPHY

The Sands of Time project is located approximately 305 km NW of Whitehorse, and 150 km due south of Dawson City, Yukon, Canada. No year-round roads connect to the project area. Access is best achieved by helicopter from Dawson City or Whitehorse. Access could be possible by barge from the Yukon River, and then by 4x4 vehicle along exploration roads to the Casino property and adjoining Canadian Creek property. An old exploration trail crosses the project area, and an old airstrip, named Polaris, is located in the project area. There is an airstrip at Casino and Boulevard.

The project area covers part of the Dawson Range from elevations between 550 and 1500 metres. The Dawson Range is characterized by rounded rolling hills with sparse cover of scrubby vegetation in the alpine and more thickly vegetated and forested, moderately to steeply incised valleys. The Yukon River is 25 km to the north of the project where it flows to the west. The cold, long and dark winters of the Yukon make the most comfortable and practical season for exploration run from approximately June through to September.

HISTORY

The project area has a few scattered minfile locations based on the location of the DOYLE, CC, PRINCESS, DUCHESS, and GEP claims that were staked and explored around 1969-1975 immediately after the discovery of porphyry mineralization at Casino in 1969. Historic work includes geological outcrop and float mapping, stream sediment silt geochemistry, soil sampling for Cu-Mo, IP surveying and very limited reconnaissance drilling. A total of 4 vertical holes for a combined length of 600 m were drilled on the CC claims in the centre of the project area, and one 150 m hole was drilled just to the south of the project area on the DOYLE claims.

In 2011 Ryan Gold Corp. ran a ridge line of soils on the BAILEYS claims on the north side of the project area. In 2012, Canadian Dehua International Mines Group Inc. flew a magnetic-radiometric survey over a significant portion of the project area on the QUO and GROUT claims.

No significant mineralization has been located to date.

GEOLOGICAL SETTING

The project area is mostly underlain by Devonian-Permian metamorphic rocks of the Yukon-Tanana terrane; and intrusive and volcanic rocks, mostly of Cretaceous-Palaeogene ages (Fig. 1).

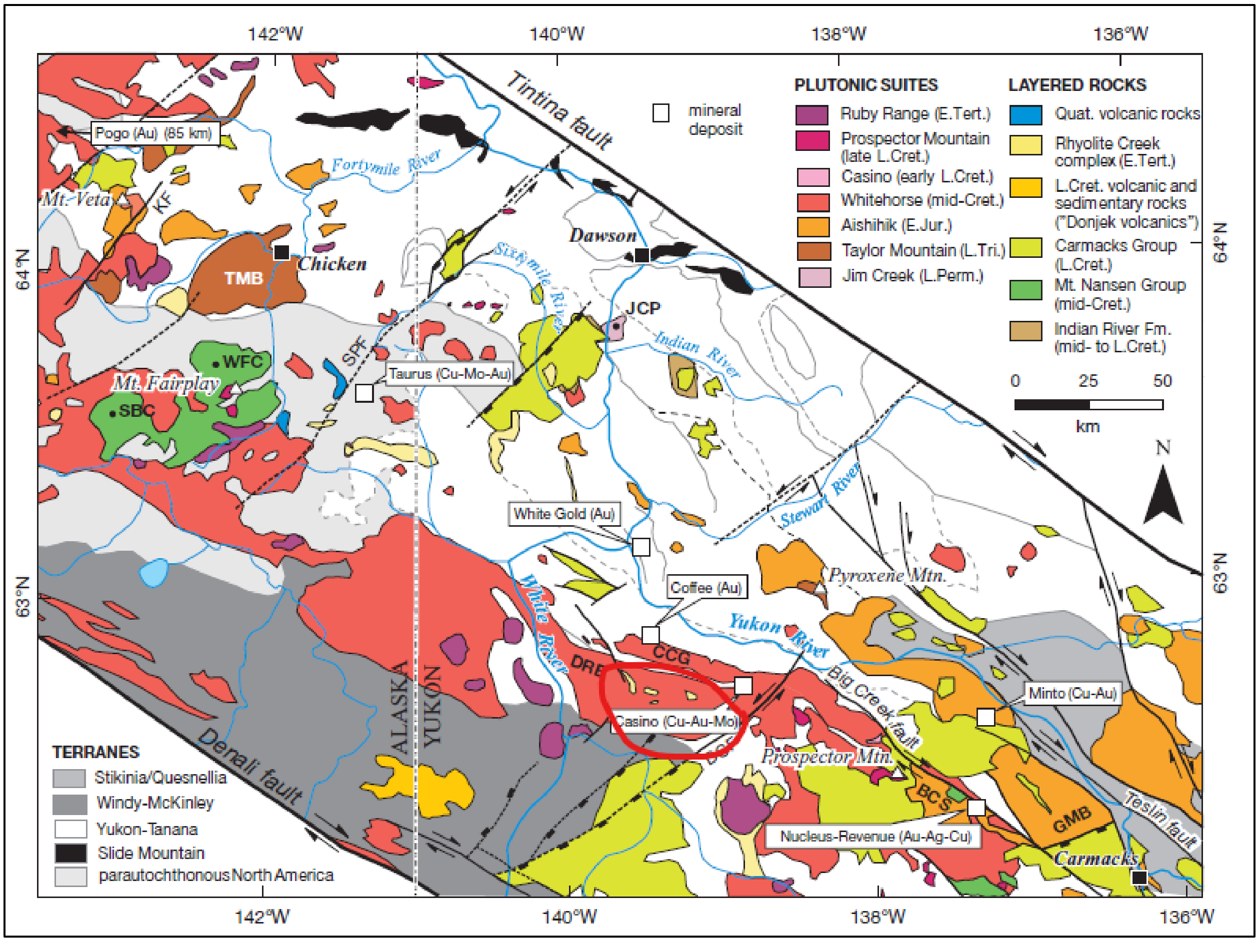

Figure 1 Regional Geology of project area, approximately outlined in red (from Allan et al., 2013).

The plutonic rocks of interest to this project include the Casino (early L. Cret.); Prospector Mountain (late L. Cret.); Whitehorse (mid-Cret.); Ruby Range (Palaeogene); Aishihik (E. Jur.); and Pyroxene Mountain (L.Tri) suites (Allan et al., 2013; Fig. 2). The volcanic rocks of interest include the Rhyolite Creek complex (Palaeogene); Carmacks Group (L. Cret); and Mt. Nansen Group (mid-Cret.) (Allan et al., 2013; Fig. 2). The ages of these intrusive suites are summarized in Figure 3 and a comprehensive update and review of Jurassic magmatism is given by Sack et al. (2020). The key ages relevant to this project are the Casino Suite (~72-79 Ma) (Allan et al., 2013), Prospector Mountain Suite and Carmacks Group (70-68 Ma) (Joyce et al., 2015; Yukon Geological Survey, 2020), Rhyolite Creek Assemblage (~64-54 Ma) (Yukon Geological Survey, 2020). The mid-Cretaceous Whitehorse Suite in this area occurs as: the Dawson Range Batholith (~107-100 Ma, Figure 4), which can show local evidence of deformation; and the undeformed, smoky-quartz bearing Coffee Creek granite (~100-99 Ma) (Godwin, 1975; Ryan et al., 2013; Allan et al., 2013).

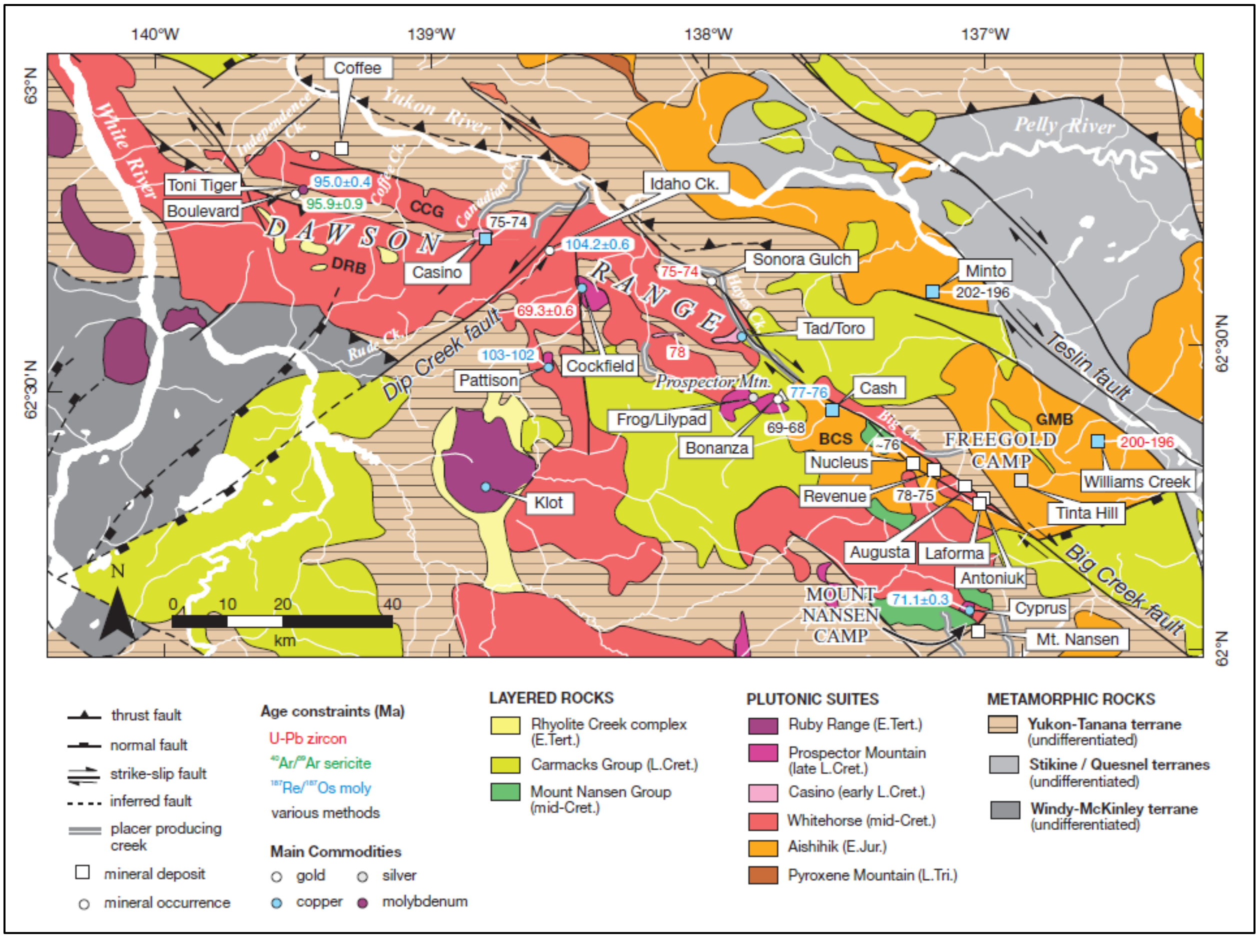

Figure 2 Volcanic and plutonic rocks of interest within the Dawson Range, significant mineral deposits and ages of mineralization (from Allan et al., 2013).

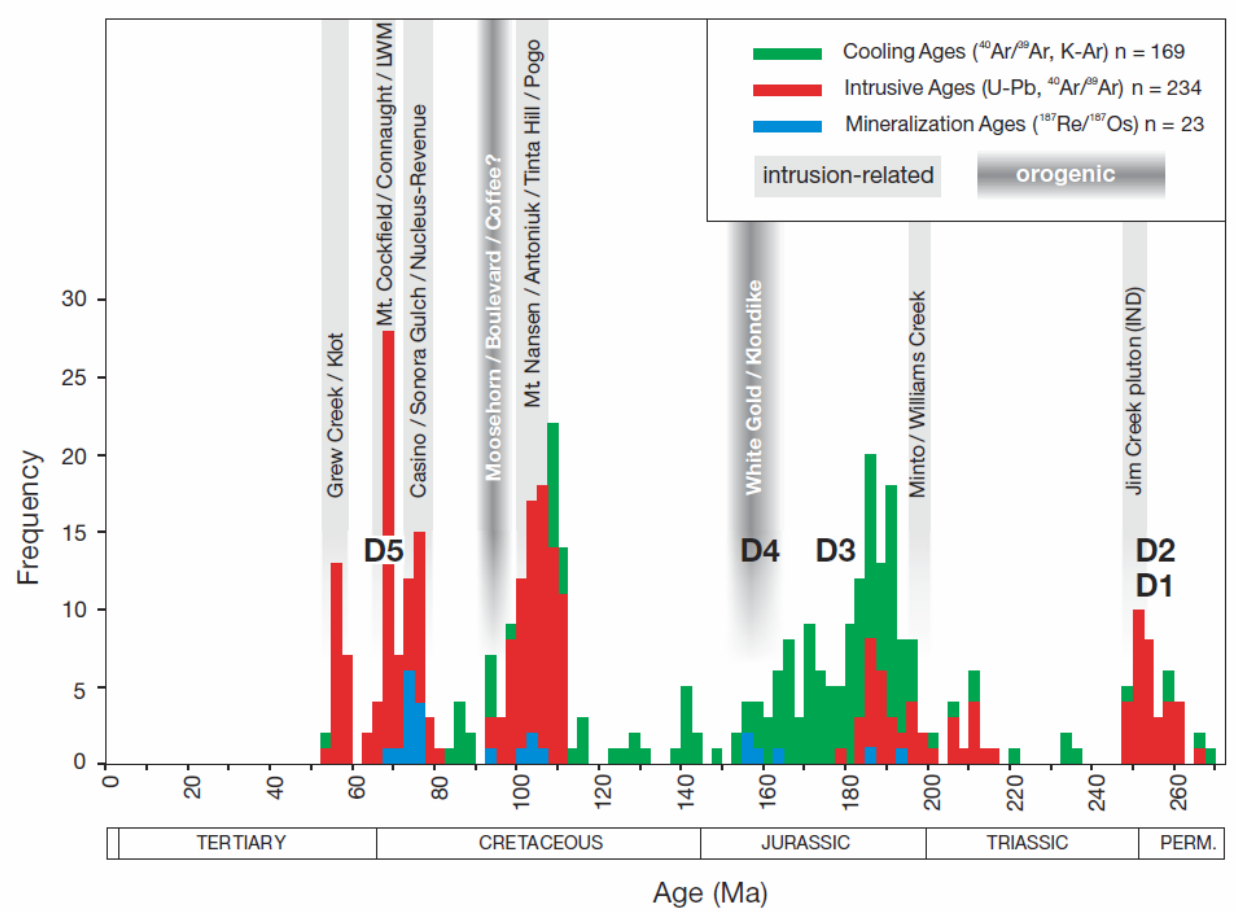

Figure 3 Age summary of intrusive events, mineralization, deformation and cooling ages of the Yukon-Tanana terrane from Allan et al. (2013).

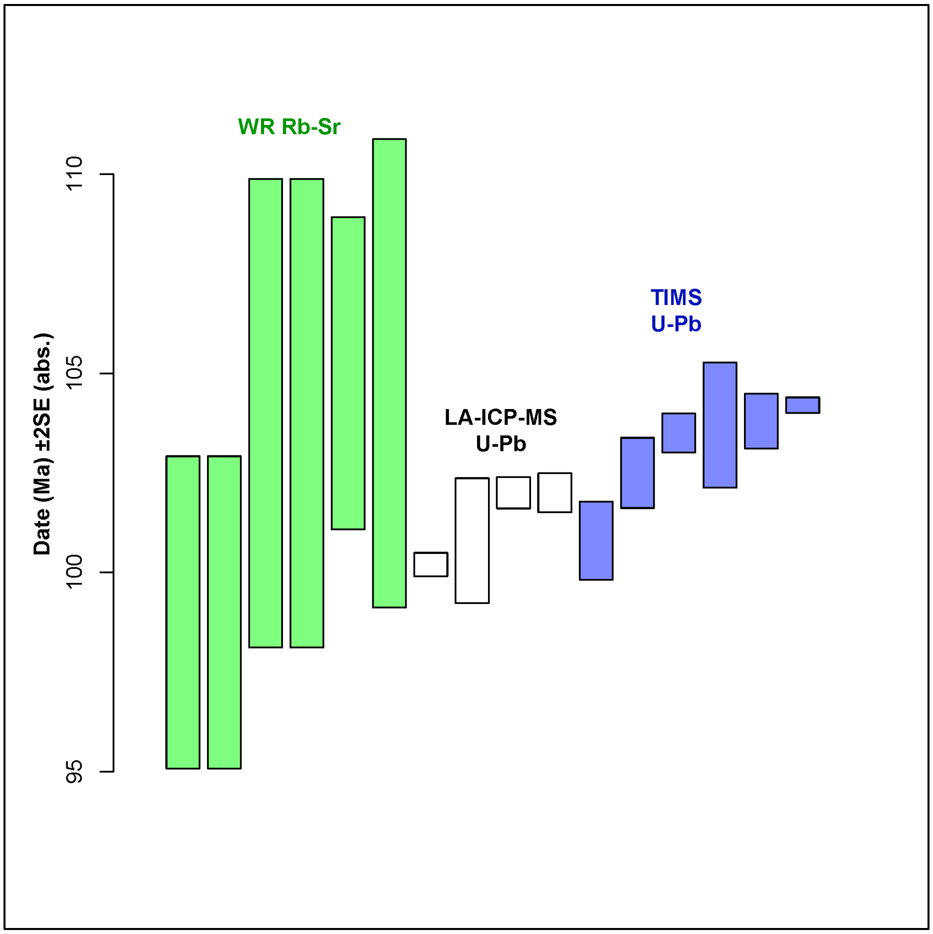

Figure 4 U-Pb zircon dates and whole rock Rb-Sr dates for the Dawson Range Batholith (data from Yukon Geological Survey, 2020).

DEPOSIT TYPES

The area is being targeted for early-Late Cretaceous porphyry Cu-Au-Mo-Ag mineralization associated with the Casino Suite intrusive rocks such as that found nearby at the Casino deposit (Casselman and Brown, 2017). The area is also prospective for gold mineralization similar to that found at the nearby Coffee deposit.

SAMPLING AND EQUIPMENT

Samples of 0.8 to 3.8 kg of fine sediment were collected from the banks of streams or in areas of slack water by hand and placed in pre-labelled Kraft paper bags, in locations where fine sediment was available for sampling.

Bulk samples were taken from the active channels of streams with a shovel and were screened with a 1/12" metal mesh sieve over a 5-gallon plastic bucket lined with a pre-numbered polyethylene sample bag (Figures 5 and 6; cover photo). Coarse material ranging from coarse sand through pebbles to cobbles was targeted from a selection of point locations at each site to ensure that the full range of grain sizes were sampled equally across different bedforms. Between 6.9 and 13.0 kg were collected in each sample (10 kg was targeted). A plastic gold pan was used to scoop water from the creeks to wet sieve the samples. Excess water was carefully tipped out of the buckets after a brief period of settling, ensuring that no silt to sand sized sediment was lost during the process. Sample locations were recorded using a hand-held GPS (Garmin GPSMAP 64s). Notes, and back-up sample locations were taken with an iPad using the FieldMove app and an external Bluetooth GPS (Garmin GLO). Sample collection procedures were broadly aligned with the GSC protocols for bulk sample collection established by Friske and Hornbrook (1991), described in Day et al. (2013) and implemented in a study of PIMS around the Casino deposit by McClenaghan et al. (2020).

Figure 5 Sample site 20JM001 showing typical sampling environment and equipment.

Sampling was carried out by Jack Milton on July 5th, 2020. Access to sampling locations was via Bell 206B JetRanger from Trans North Helicopters to within ~200 metres of each sample site, then on foot to the sampling site.

Figure 6 Sampling site 20JM002 with bulk sampling equipment.

Each sampling site was number using the scheme 20JM00X where X ranged from 1 to 8. All silt samples were suffixed by an 'S' and all bulk stream sediment samples were suffixed by a 'B'. Insufficient fine sediment was present for a silt sample at site 20JM002 and high flow in creeks prevented access to collect bulk samples at 20JM004 and 20JM005.

Two samples from streams that directly drain the Casino deposit were made available by M.B. McClenaghan, Geological Survey of Canada, from the study of PCIMs at the Casino deposit in GSC Open File 8711 (McClenaghan et al., 2020). The samples had already been taken and processed for PCIMs at ODM, and ~0.5 g of the <0.25 mm panned table concentrate in addition to selected picked grains of zircon were made available for this project from archived material. The two samples made available were 115J171014-BS and 115J171019-BS. These samples were acquired to test the methodology of stream sediment zircon geochronology and geochemistry as an orientation study over a known deposit and determine the efficacy of the method as a useful exploration tool.

All sample locations are shown on Figure 7 and can be found in digital appendix 1, including the two GSC sample locations near Casino, that were not visited during this project.

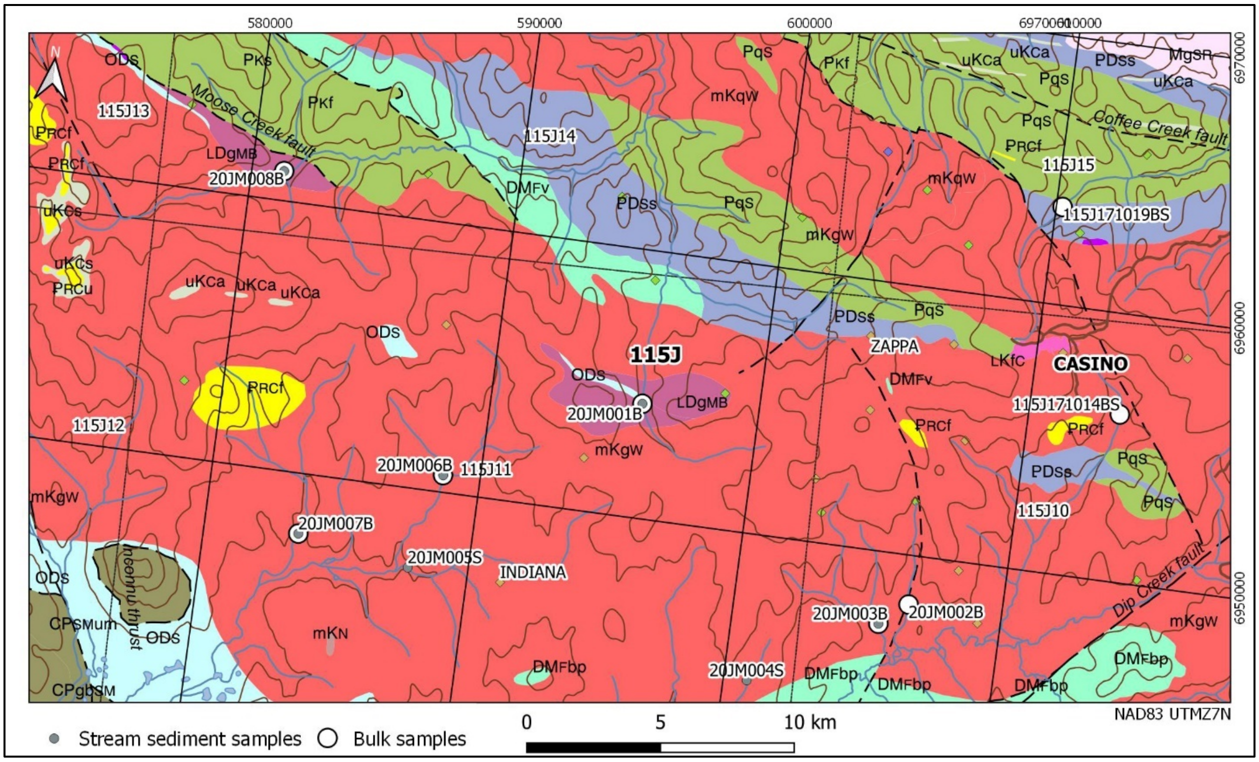

Figure 7 Map of bulk stream sediment samples and stream sediment fine-fraction samples, with geology (YGS, 2020), minfile occurrences including Casino and topography.

EXPLORATION METHODS

Silt Geochemistry

Silt samples were driven from Dawson City to Whitehorse by Jack Milton and submitted to Bureau Veritas preparation laboratory. Samples were dried at 60°C and sieved to -230 mesh (grain size of less than 63 microns). Samples were digested in 1:1:1 aqua regia and analyzed by ultratrace ICP-MS (BV package AQ252_EXT).

Porphyry Indicator Mineralogy (PCIM)

Bulk samples were driven to Whitehorse by Jack Milton, packed in to 5-gallon buckets and shipped via Manitoulin Transport to Overburden Drilling Management, Nepean, Ontario where the samples were processed for PCIMs, gold, and zircon (Figure 8). A ~300 g archival split is taken for each sample, then the sample is passed across shaking tables for gravity concentration and dry sieved to 0.25 mm. The heaviest fraction is micro-panned for gold, zircon and metallic grains. The table concentrate is passed through heavy liquids to separate a >2.8, g/cm^3 specific gravity fraction and the >2.8 SG material and the coarse fraction treated with an oxalic acid wash to aid picking and logging then dry sieved to 0.25 mm. The coarse fraction ferromagnetic grains are removed by magnetic separation and the non-ferromagnetic grains are further separated into SG 2.8-3.2 and >3.2 g/cm^3 fractions by heavy liquids. The remaining material is sieved to 0.25-0.5 mm, 0.5-1.0 mm and 1.0-1.7 mm size fractions. The SG >3.2 fraction is further separated into strongly, moderately and weakly paramagnetic fractions and nonparamagnetic fractions by currents of 0.6, 0.6-0.8, 0.8-1.0, and >1.0 amps, respectively. All fractions and splits are vialled and archived or used for picking PCIMS, metallic grains, zircon, and gold grains under a binocular microscope by an experienced picker. Grains of unknown or equivocal composition are checked using a scanning electron microscope (SEM). Representative grains are picked and vialled for PCIMs of interest, and all gold grains.

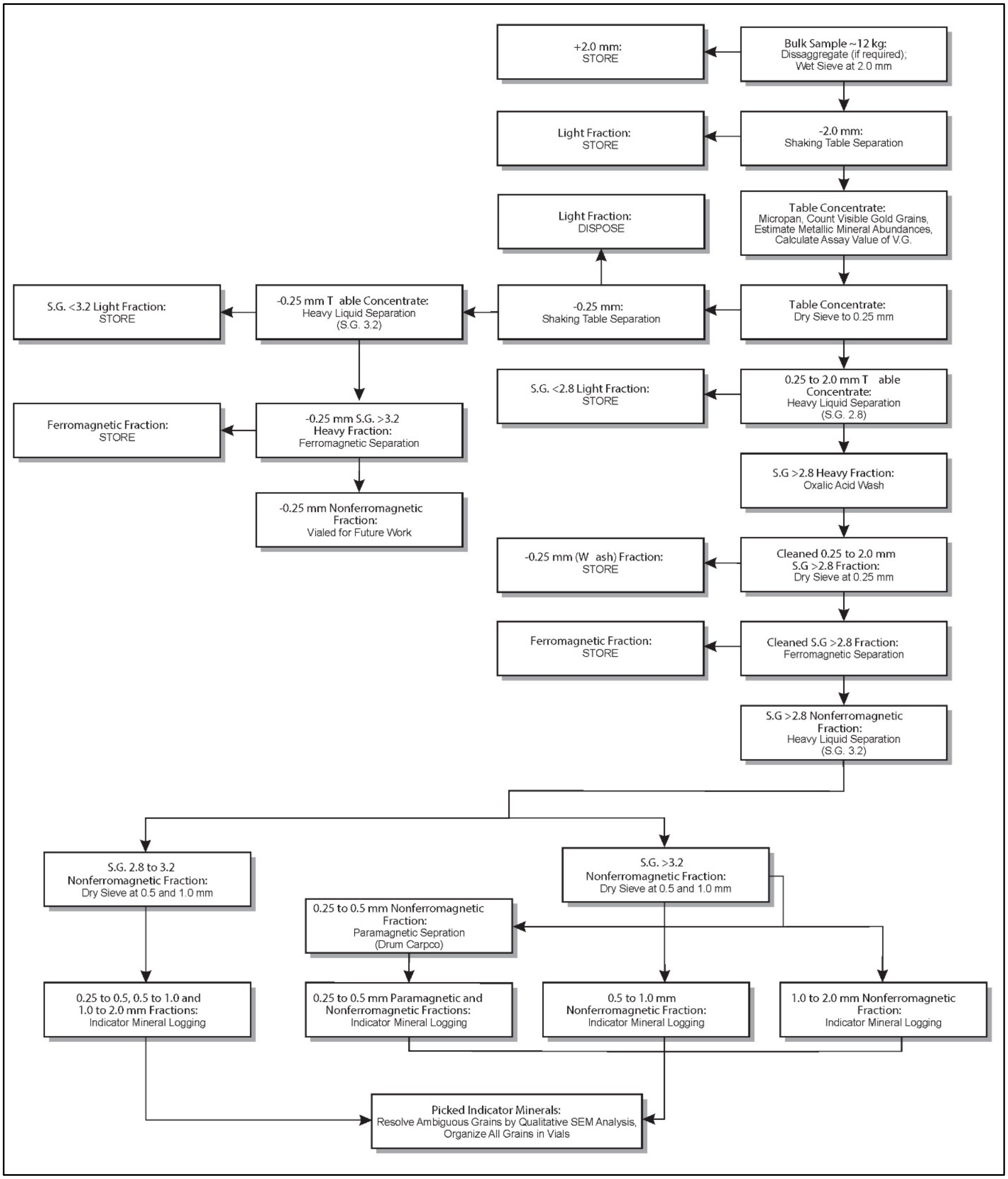

Figure 8 Processing methodology for heavy mineral concentration, gold, metallic and PCIM grain separation (from McClenaghan et al., 2020). Zircons were mostly recovered from the micropanned table concentrate in the <250 micron size fraction. Coarser zircons were recovered in the non-paramagnetic S.G.>3.2 fractions.

Zircon Texture

Zircon grains were picked and mounted in epoxy pucks, polished, and examined under the SEM and an electron microprobe mounted cathodoluminescence (CL) system. The CL imaging was employed in order to examine zircon textures, as this has been shown to correlate well with zircon fertility (Bouzari and Hart, 2019; Bouzari et al., 2020). The CL work was carried out at the University of British Columbia Okanagan campus at the Fipke Laboratory for Trace Element Research (FiLTER).

Zircon Geochronology and Chemistry

Zircon rich concentrates <0.25 mm and coarser picked zircons were sent from ODM to FiLTER UBCO for picking, mounting in epoxy pucks, and polishing. The zircon grains were then dated by LA-ICP-MS and simultaneously analyzed for trace element chemistry, including Ti, U, Th, Pb, REE, Ca, P, Zr, Ta, Hf, Y, and Nb. The spot size was 20 microns and the instrument used was an Agilent 8900 triple quadrupole ICP-MS with full instrument settings given in digital appendix 4. Standards were measured for trace elements (610 standard), U-Pb dating and trace elements (91500 standard) and U-Pb dating (Plesovice standard).

RESULTS

Silt Geochemistry

One sample (20JM001S) out of seven silt samples returned an anomalous Au value of 20.7 ppb whereas all other samples ranged from 1.8 to 6.2 ppb (Figure 9). Whilst not directly comparable to the regional stream silt database, as the grain size analyzed in this project is less than 63 microns (compared to less than 177 microns for regional data), the anomalous value in 20JM001S is above the 98th percentile value of 19.2 ppb for aqua regia ICP-MS Au data from regional stream sediments within mid Cretaceous intrusive rock drainages across SW Yukon. No other elements were deemed anomalous including Cu, Mo, Ag, Pb, Zn, As, Bi and Sb. Full results listed in digital appendix 2.

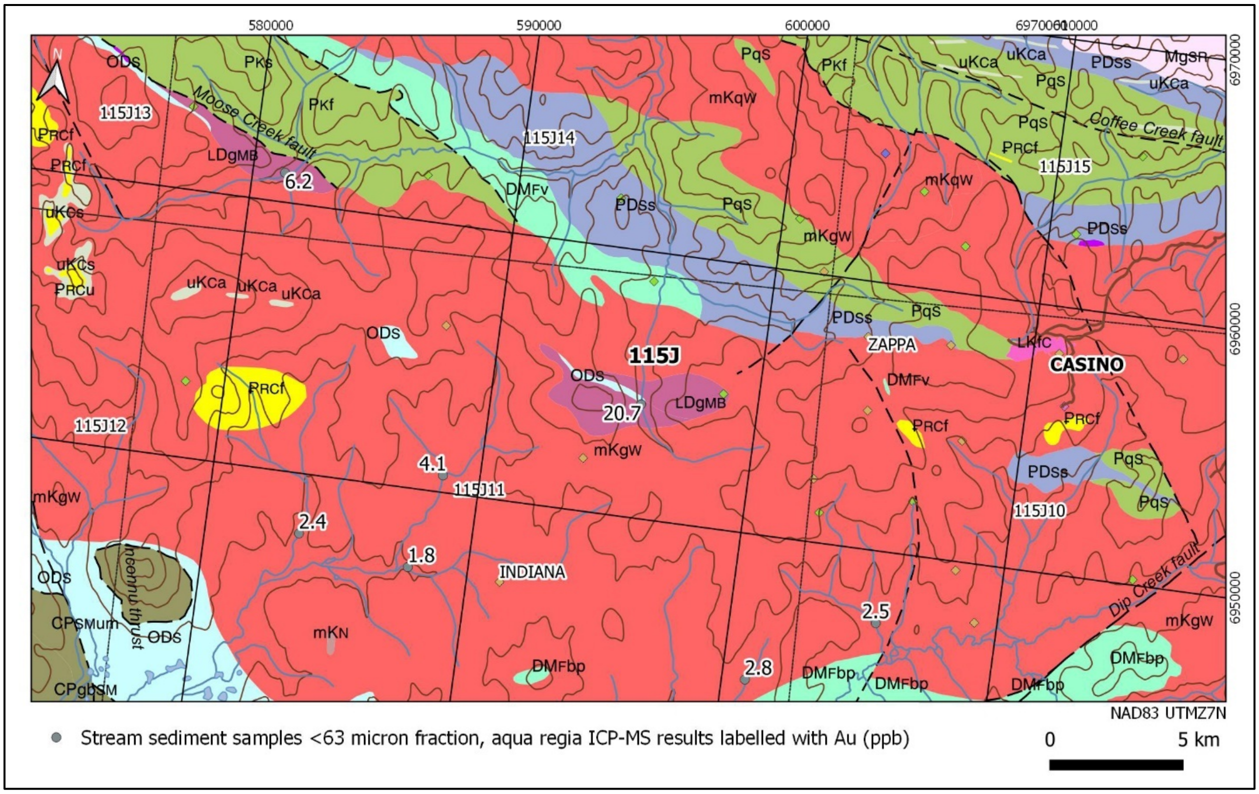

Figure 9 Fine fraction (less than 63 microns) stream sediment aqua regia ICP-MS gold results.

Porphyry Indicator Mineralogy

Full data, weights, and picked minerals are listed in digital appendix 3.

Two reshaped gold grains were found in sample 20JM002B with dimensions of 75x100 microns and 100x100 microns.

Zircons in the panned concentrated were abundant in all samples and ranged from an estimated 5000 to 20,000 grains. Coarse grains of zircon were also picked from most samples.

Porphyry copper indicator mineral counts were low for all samples. Scheelite was picked from all samples except 20JM007B. Scheelite is a favourable indicator, as tungsten minerals ferberite and scheelite are found in the Canadian Creek placer immediately below the Casino deposit (Bostock, 1959). Sample 20JM001B contained the most scheelite, at ~30 grains, sample 20JM002B had 14 grains and 20JM003B had 6 grains. Grossular and andradite were recovered in substantial quantities (1000s of grains) from samples 20JM001B and 20JM006B; these high garnet concentrations correlate well with samples from drainages with substantial areas of Yukon-Tanana schists and gneisses. Owing to the presence of these metamorphic rocks, garnet is not a useful indicator of porphyry mineralization in this district. Barite was identified in a few samples, with 22 grains present in sample 20JM002B.

No mid density porphyry copper indicator minerals were found in any samples. The mid density particles consist mainly of coarse-grained hornblende and hornblende with attached plagioclase, light to dark green metamorphic chlorite, and fine-grained epidote-altered plagioclase. Samples 20JM002B and 20JM003B also contain some supergene goethite.

Zircon Geochronology

A total of 1243 zircons were dated for this project. Between 47 and 213 zircons were dated per exploration bulk sample depending on the size of the drainage. This equates to 3.3 to 4.18 zircons per square kilometre of the targeted drainage. This is below the ideal number of 6 zircons per km^2 needed to detect at least one zircon from a target of 0.5 km^2 of in each drainage with 95% confidence, calculated using binomial probability theory and assuming that there is an equal contribution of zircon to sediment load by rock type area, and that there is no fractionation or bias occurring at any stage of zircon formation, weathering, transport, deposition, sampling, concentration, picking, or dating. Considering these sampling statistics, the presence of even a single zircon of target age in a sample population should be considered worthy of further investigation.

All dates reported in the text are $^{206}Pb/^{238}U$ dates corrected for common lead by the Stacey and Kramers method and errors are reported as absolute two standard errors of the mean dates. Full sample data can be found in digital appendix 4. Unless otherwise stated, all spots were aimed at the centre of the zircon grain. Weighted mean ages are presented in Figure 6 to 13, however these do not represent crystallization ages of the rock suites that they represent. The intrusive suites and volcanic rocks considered are likely comprised of a range of different intrusions that may have crystallized throughout a prolonged span of magmatic or volcanic activity. Detrital zircons in recent stream sediments are a mix of all zircon-bearing lithologies contained within the drainage, and therefore may represent a mix of different age igneous rocks. At best, the weighted means should be considered an average of the intrusive age of rocks within the considered fraction of the zircon sample population, but the precision is not meaningful.

Attempts are made to trace zircons back to bedrock sources within each drainage, by relating zircon dates to intrusive suites and other rock types that are well known across SW Yukon (for reviews see Allan et al., 2013; Sack et al., 2020). In many cases, suggestions are put forth for occurrences of unmapped units within each drainage, however it is recognized that any of the zircons could have a xenocrystic origin and may not indicate the presence of the suggested unmapped rock units in the drainage.

All bulk sample locations and the areas of drainages are shown on Figure 10.

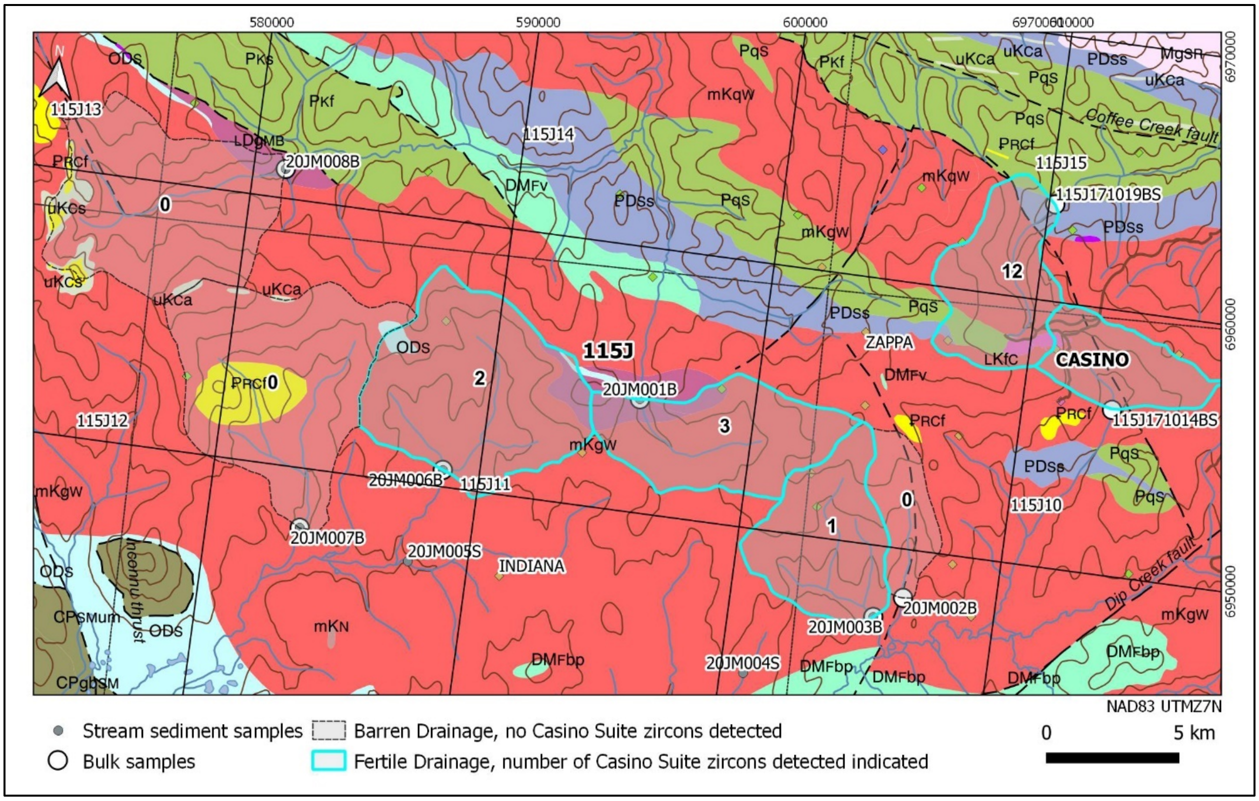

Figure 10 Locations of all bulk sample drainages, showing the number of Casino Suite zircons detected in each drainage. Sample 115J171014BS contained 7 Casino Suite zircons (not labelled).

ORIENTATION STUDY: CASINO SAMPLES

The orientation study of the two samples from creeks directly draining the Casino deposit returned zircons dominantly of the age of the Dawson Range Batholith but the exploration method was successfully validated by the detection of zircons that clearly yielded dates of Casino Suite age in both bulk samples. These ~79-70 Ma zircons can be reasonably assumed to be derived from the Patton Porphyry causative intrusion related to the Cu-Au-Mo magmatic-hydrothermal system at the Casino deposit, or from related intrusion breccias. The sampling density of zircons dated in samples 115J171019BS and 115J171014BS were 5 and 18.2 zircons per square kilometre, respectively – these numbers were based on the amount of Casino Suite rocks mapped in the drainage compared to the total drainage area and were determined by sampling theory for a binomial distribution. The number of Casino Suite zircons detected in the orientation study is much higher than the bulk exploration samples, but it must be considered that the orientation study dated many more zircons per square kilometre of drainage than the exploration samples.

<u>115J171019-BS</u>

This sample site is from a drainage of 25.01 km^2, 6 km downstream north from Casino on Canadian Creek and 125 zircons were dated. Twelve zircons yielded dates between 79.6-70.1 Ma and these are interpreted to be derived from the Casino Suite rocks exposed at the Casino deposit. In addition, one zircon returned a date of

68.7 ±1.6 and this could either belong to the Prospector Mtn Suite or potentially a late phase of the Casino Suite, although it was not included in the weighted mean age calculated in Figure 6.

One hundred and twelve zircons yielded dates from 119.5-96.7 Ma and are interpreted to be derived from the Dawson Range Batholith of the Whitehorse Suite (Figure 11).

One grain returned a date of 267.2 ±5.3 Ma and is likely sourced from the Yukon-Tanana Sulphur Creek Suite augen gneiss mapped in this drainage. Two mid-Triassic zircons (221.6 ±8.8 Ma and 232.5 ±3.7 Ma) have no obvious local bedrock source unless they have a xenocrystic origin in the Dawson Range batholith, or they may be related to unmapped occurrences of mafic intrusions of similar age such as the Snag Creek suite or the Galena sills. A single Early Jurassic zircon (198.2 ±3.7 Ma) has no mapped bedrock source in the drainage but may be related to the Minto Suite intrusive rocks.

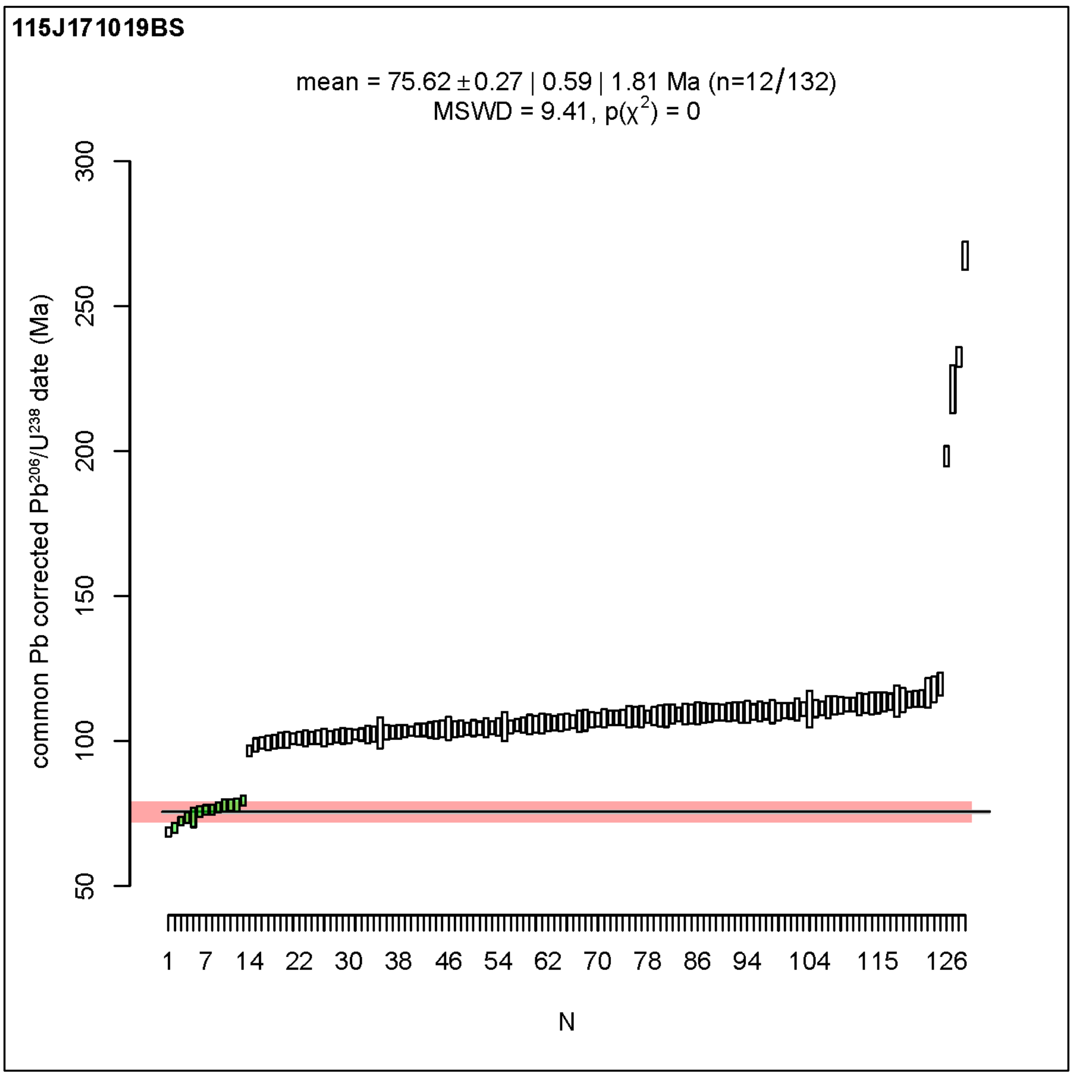

Figure 11 Weighted average age of Casino Suite zircons detected in sample 115J121019BS. Pink window 79-72 Ma represents Casino Suite as defined by Allan et al. (2013).

115J171014-BS

This sample was taken from Casino Creek, approximately 3 km south-east of the Casino deposit. This drainage is 16.06 km^2 yet only 0.194 km^2 of Casino Suite rocks are mapped within it, so a large number (293) of zircons were dated to compensate for the reduced probability of finding Casino Suite age zircons (Figure 12). Seven Casino Suite age zircons yielded dates from 72.8-78.1 Ma. A total of 285 zircons yielded dates 98.2-118.2 Ma and are interpreted to be derived from the Dawson Range Batholith. One zircon yielded a date of 220.1 ±4.5 Ma and has no known mapped bedrock source.

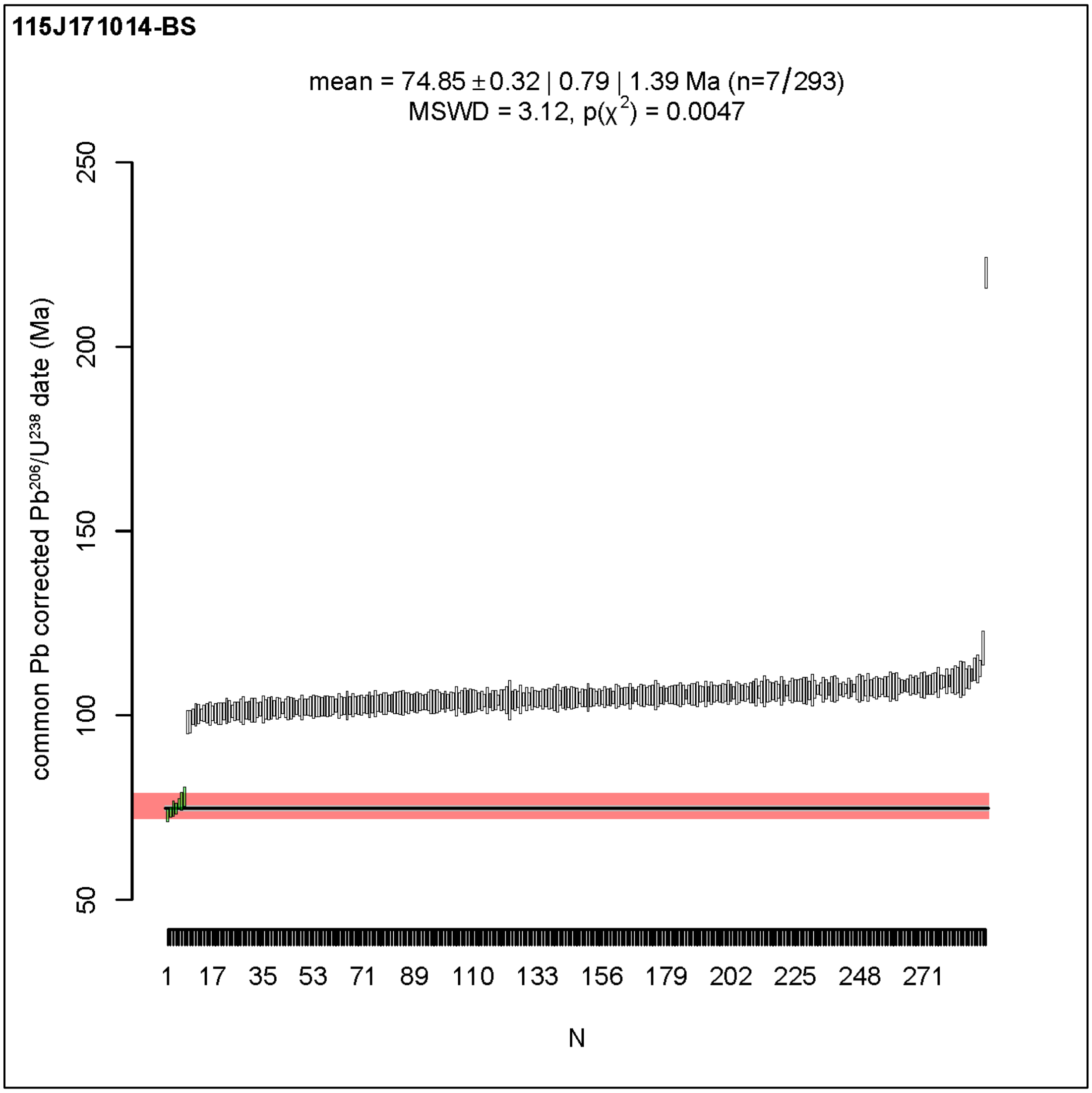

Figure 12 Weighted average age of Casino Suite zircons detected in sample 115J121014BS. Pink window 79-72 Ma represents Casino Suite as defined by Allan et al. (2013).

EXPLORATION BULK SAMPLE DETRITAL ZIRCON RESULTS

20JM001B

This drainage is 29.89 km^2 in area and 118 zircons were dated (Figure 13). One hundred and four zircons yielded dates between 92.4-127.4 Ma interpreted as being mostly derived from the Dawson Range Batholith. Ten grains yielding dates between 92.4 Ma and 100.8 Ma, may be derived from unmapped Coffee Creek granite intrusions or unmapped Mt Nansen volcanic rocks. Three zircons yielded dates of 74.2 ±2.4 Ma, 74.2 ±2.5 Ma, and 76.2 ±2.4 Ma; these grains are interpreted as being derived from local, unmapped occurrences of Casino Suite age rocks. Three grains yielded dates between 58.1-63.5 Ma and are tentatively correlated with unmapped rocks of the Rhyolite Creek volcanics or Paleocene intrusive rocks. A single zircon yielded a date of 154.2 ±6.5 Ma and is tentatively correlated with Late Jurassic McGregor suite intrusions. Two zircons yielded dates of 258.1 ±9.5 Ma and 265.9 ±8.6 Ma and are interpreted to be derived from unmapped Sulphur Creek suite in this drainage. A Neoproterozoic (704 ±25 Ma), two Mesoproterozoic (1408 ±46 Ma, 1581 ±51 Ma) and two Paleoproterozoic (1766 ± 59 Ma, 1773 ±64 Ma) zircons are interpreted to be derived from detrital grains weathered out of Paleozoic Scottie Creek Formation metaclastic rocks that are mapped within the drainage.

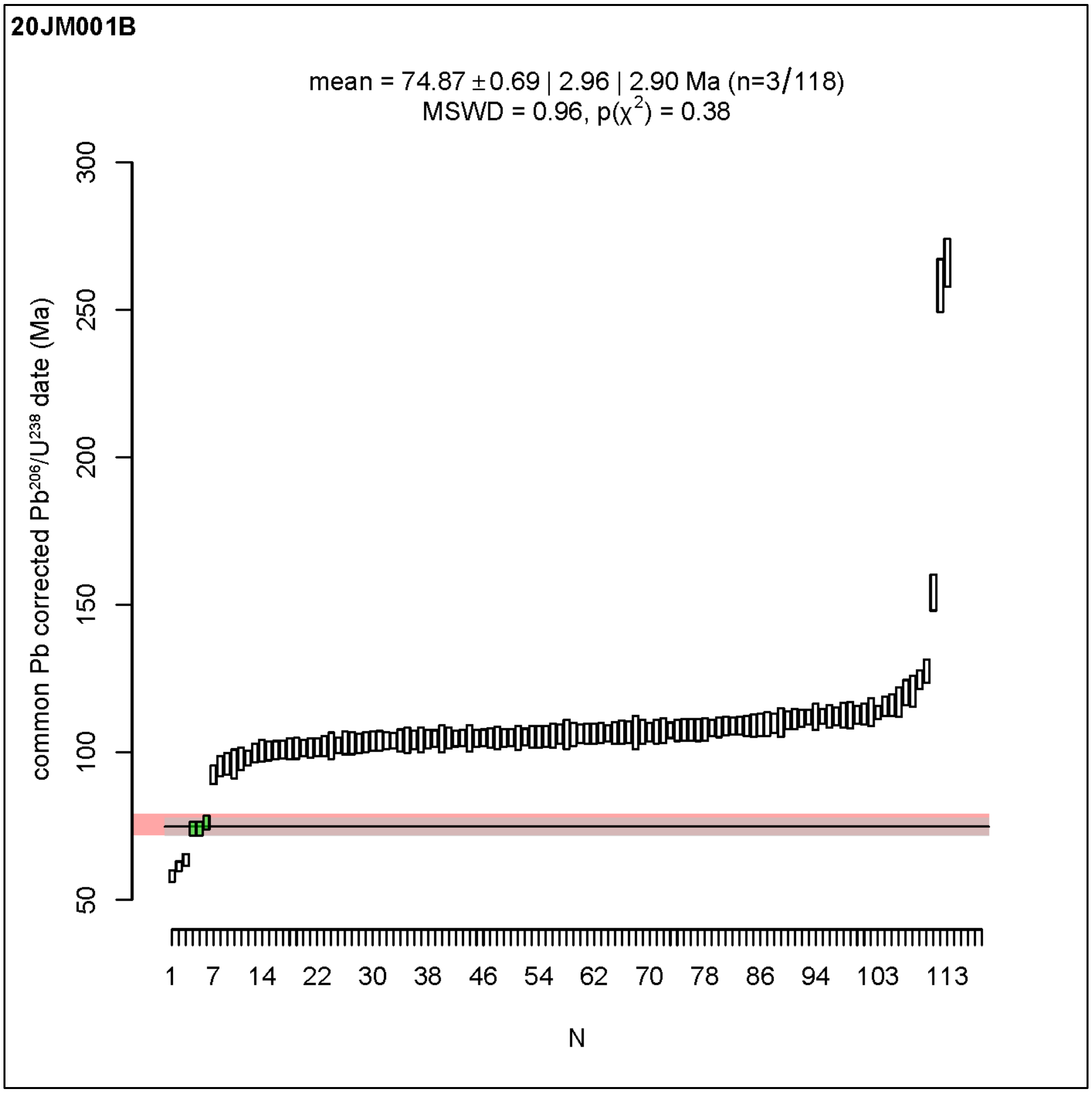

Figure 13 Weighted average age of Casino Suite zircons detected in sample 20JM001B. Pink window 79-72 Ma represents Casino Suite as defined by Allan et al. (2013)

<u>20JM002B</u>

This drainage is 11.25 km^2 in area and 47 zircons were dated (Figure 14). No Casino Suite zircons were detected in this sample. A single zircon was dated at 66.3 ±3.3 Ma and is tentatively interpreted sourced from unmapped Prospector suite intrusions, unmapped Carmacks Group volcanic rocks, or Rhyolite Creek felsic volcanic rocks that are mapped just outside of this drainage. A single zircon yielded a date of 95 ±19 Ma, an imprecise, and equivocal age that could represent Casino Suite or Dawson Range Batholith – follow up analyses are recommended for this grain to test the possibility of a Casino Suite age. 44 grains of zircon returned dates between 102.4-126.9 Ma, interpreted as being derived from the Dawson Range Batholith. A single zircon yielded a date of 197.8 ±7.5 Ma, interpreted as being derived from unmapped Minto Suite intrusive rocks.

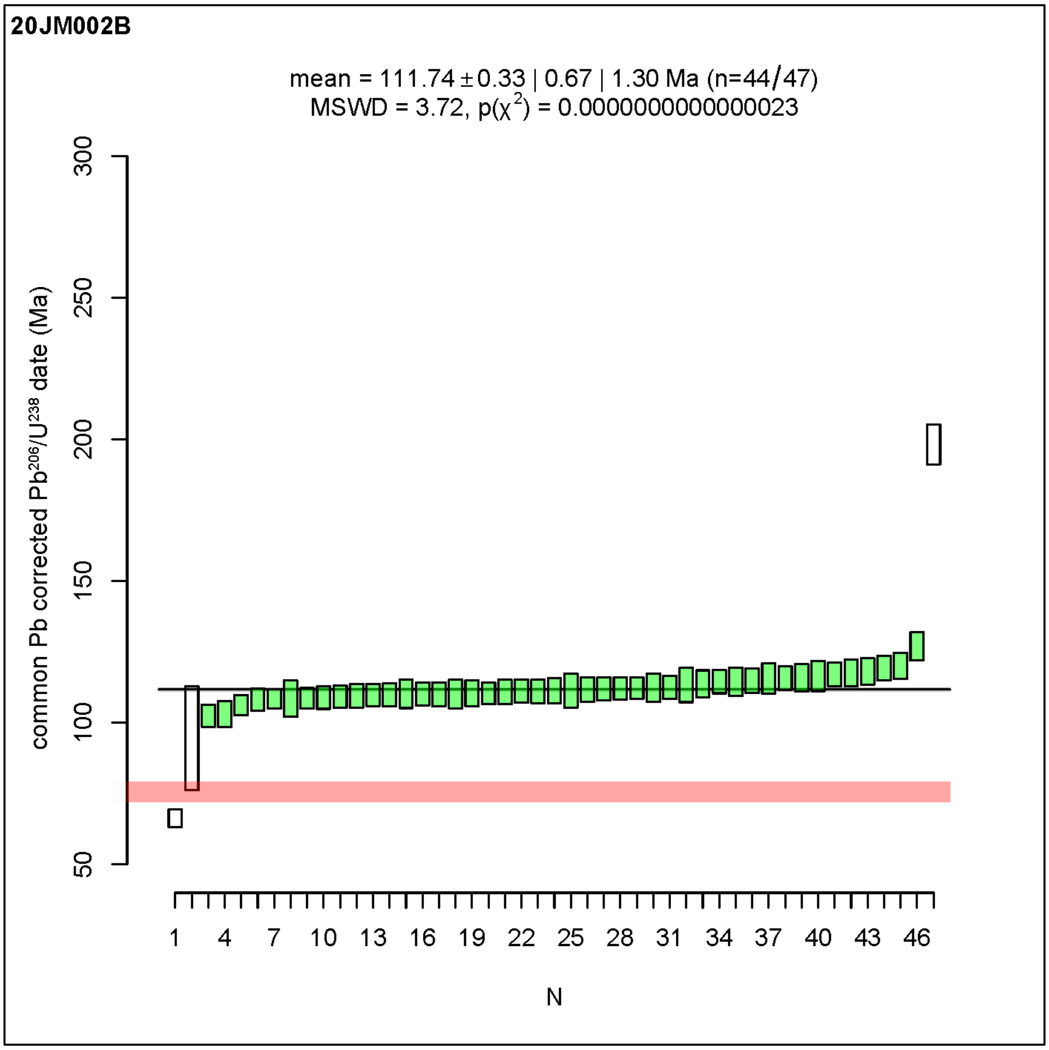

Figure 14 Weighted average age of Dawson Range batholith zircons detected in sample 20JM002B. Pink window 79-72 Ma represents Casino Suite as defined by Allan et al. (2013)

<u>20JM003B</u>

This drainage is 26.17 km^2 in area and 95 zircons were dated. Eleven grains yield dates from 54.3-66.9 Ma and may be derived from unmapped occurrences of any of: the Rhyolite Creek felsic volcanic rocks; Carmacks Group volcanic rocks; or the Prospector Mountain suite. A single zircon yielded an imprecise date of 75.4 ±7.4 Ma, and may be derived from the Casino Suite, but given the error associated with the analysis, could also be derived from the Prospector Mountain suite or Carmacks Group rocks. 70 grains from 88.6-124.5 are likely sourced from the Whitehorse Suite, mostly from the Dawson Range Batholith (Figure 15). A few younger grains of zircon in the Whitehorse Suite (9 zircons from 88.6-110.7 Ma) may be derived from unmapped Coffee Creek granite age intrusions or unmapped Mt Nansen volcanic rocks. Three grains dated at 148.7-

158.0 Ma are possibly derived from unmapped McGregor Suite intrusions – the presence of a 140.3 ±5 Ma K-Ar biotite date, 6.4 km NE of the confluence of Dip and Casino creeks (Wanless et al., 1978), supports the notion of small McGregor suite intrusions in the area. One grain dated at 197.9 ±8.3 Ma is possibly derived from unmapped Minto Suite intrusions. One grain dated at 263 ±15 Ma is possibly from the Sulphur Creek suite. There are a range of Paleozoic to Proterozoic zircons with unknown sources, possibly related to unmapped Yukon-Tanana metamorphic rocks as primary or derived detrital zircon: 289 ±12 Ma; 299 ±13 Ma; 333 ±26 Ma; 377 ±15 Ma; 459 ±27 Ma; 487 ±25 Ma; 912 ±55 Ma; 1177 ±55 Ma. There are a wide variety of zircon ages from this drainage, which is mapped entirely as granodiorite of the Dawson Range batholith.

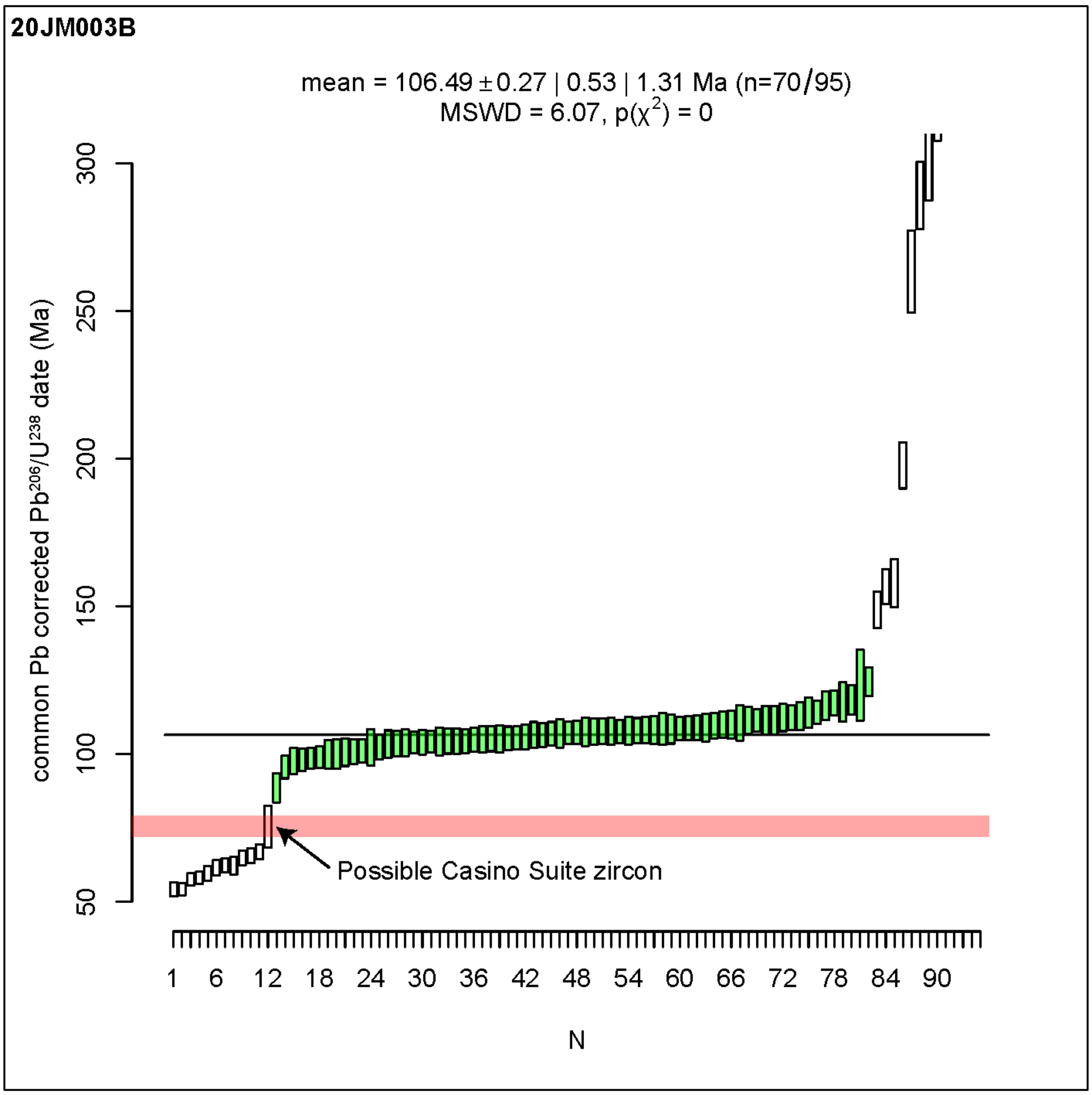

Figure 15 Weighted average age of Dawson Range batholith zircons detected in sample 20JM003B. Pink window 79-72 Ma represents Casino Suite as defined by Allan et al. (2013)

<u>20JM006B</u>

This drainage is 47.74 km^2 in area and 159 zircons were dated (Figure 16). Two zircons are potentially derived from Casino Suite intrusions: 71.6 ±3 Ma; and 72.9 ±2.9 Ma. However, this age range also overlaps that of the Prospector Mountain Suite. A range of younger zircon dates 52.5-67.9 Ma form an overlapping array that are likely derived from Rhyolite Creek volcanic rocks, agreeing with a substantial area of mapped Rhyolite Creek rocks in this drainage. The Whitehorse Suite age zircons in this sample have a younger sub-population of 42 zircons between 90.6 to 100.8 Ma that likely represents Coffee Creek Granite intrusions or volcanic rocks of the Mt Nansen Group (see 20JM007B). This Coffee Creek granite age population maximum age likely overlaps with the Dawson Range Batholith zircons, and the boundary here is arbitrarily taken as 101 Ma. There are 93 zircons from 101.0-116.8 Ma, likely derived from the Dawson Range Batholith. The presence of Coffee Creek granite age intrusions in this drainage is supported by a K-Ar date of 94.3 ±4.3 Ma (Wanless et al., 1978), located at the head of the drainage according to Yukon Geological Survey (2020) mapping. A single 150.9 ±4.5 Ma zircon may be derived from unmapped McGregor suite intrusions. A 173.5 ±8.9 zircon may be derived from unmapped Bennett Suite intrusions, although currently these are only known south of Whitehorse (Sack et al., 2020), or alternatively, along with a 183.1 ±5.5 Ma zircon, these grains may be derived from unmapped Long Lake Suite intrusions. Two zircons, 242.6 ±8.8 Ma and 257.7 ±6.9 Ma, may be sourced from unmapped Sulphur Creek Suite, and six various aged Paleozoic zircons 294.6-403 Ma may be from Yukon-Tanana metamorphic rocks in the area.

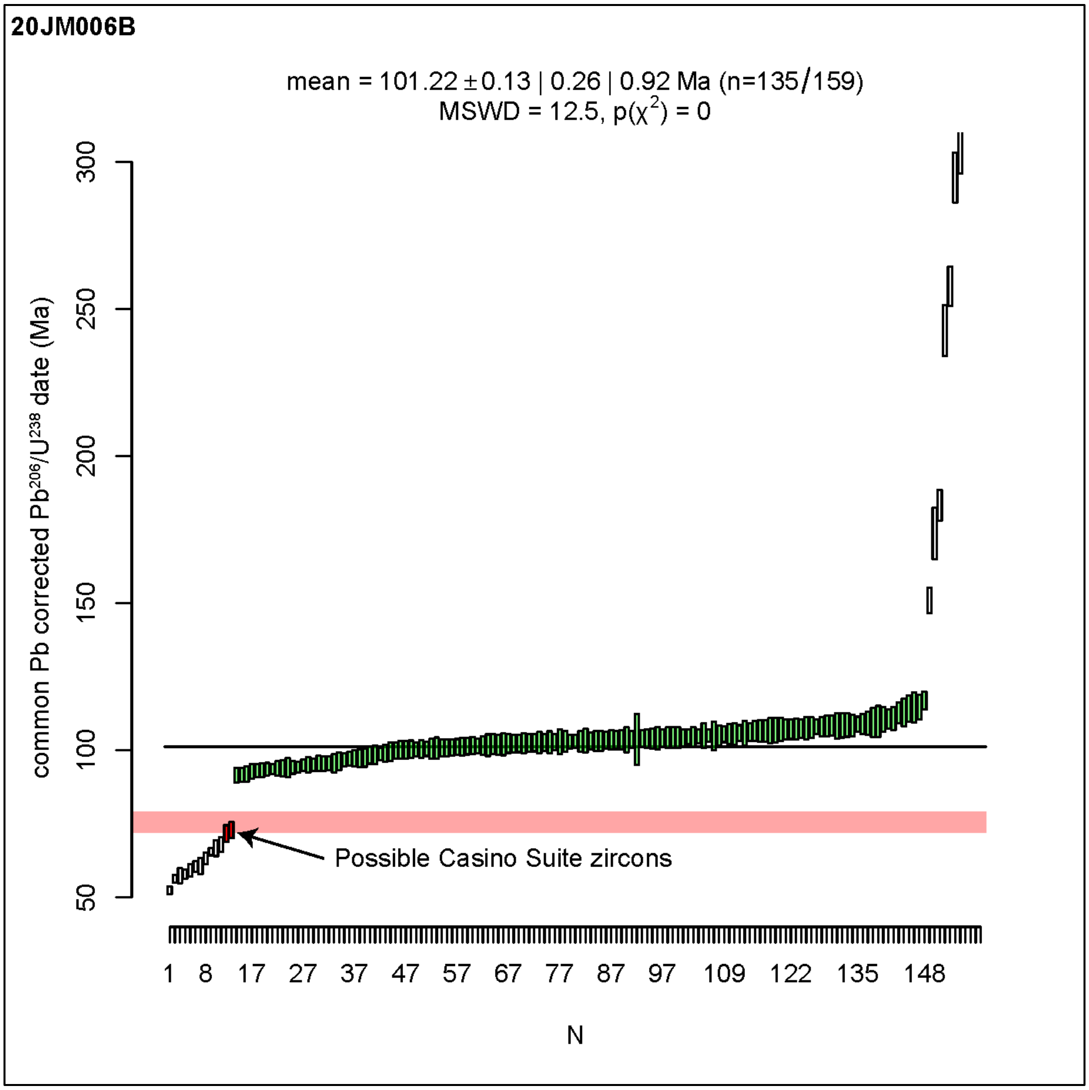

Figure 16 Weighted average age of Dawson Range batholith zircons detected in sample 20JM006B. Pink window 79-72 Ma represents Casino Suite as defined by Allan et al. (2013)

<u>20JM007B</u>

This drainage is 51.73 km^2 in area and 213 zircons were dated, entirely comprising zircons from Whitehorse Suite, 93.4-111.2 Ma (Figure 17). 142 zircons between 93.4 and 100.9 Ma strongly suggest that a significant portion of this drainage comprises Coffee Creek granite age zircon-bearing rocks, and the remaining 71 zircons are likely derived from the Dawson Range Batholith. Approximately 8 km^2 are mapped in this drainage as Rhyolite Creek felsic volcanic rocks (Ryan et al., 2013), yet there are no 57-64 Ma zircons detected in this drainage. This suggests that the felsic volcanic rocks present here may be a volcanic equivalent to the Coffee Creek granite, perhaps the Mount Nansen Group, previously unrecognized this far north in the Dawson Range. This implies greater amounts of mid-Cretaceous exhumation than implied by Ryan et al (2013) for this area. If Rhyolite Creek felsic rocks contribute an equal amount of zircon by mapped area as the Dawson Range Batholith, and there is no zircon related bias, there is a 1.67×10^{-16} probability that the rocks mapped in this drainage are Rhyolite Creek age.

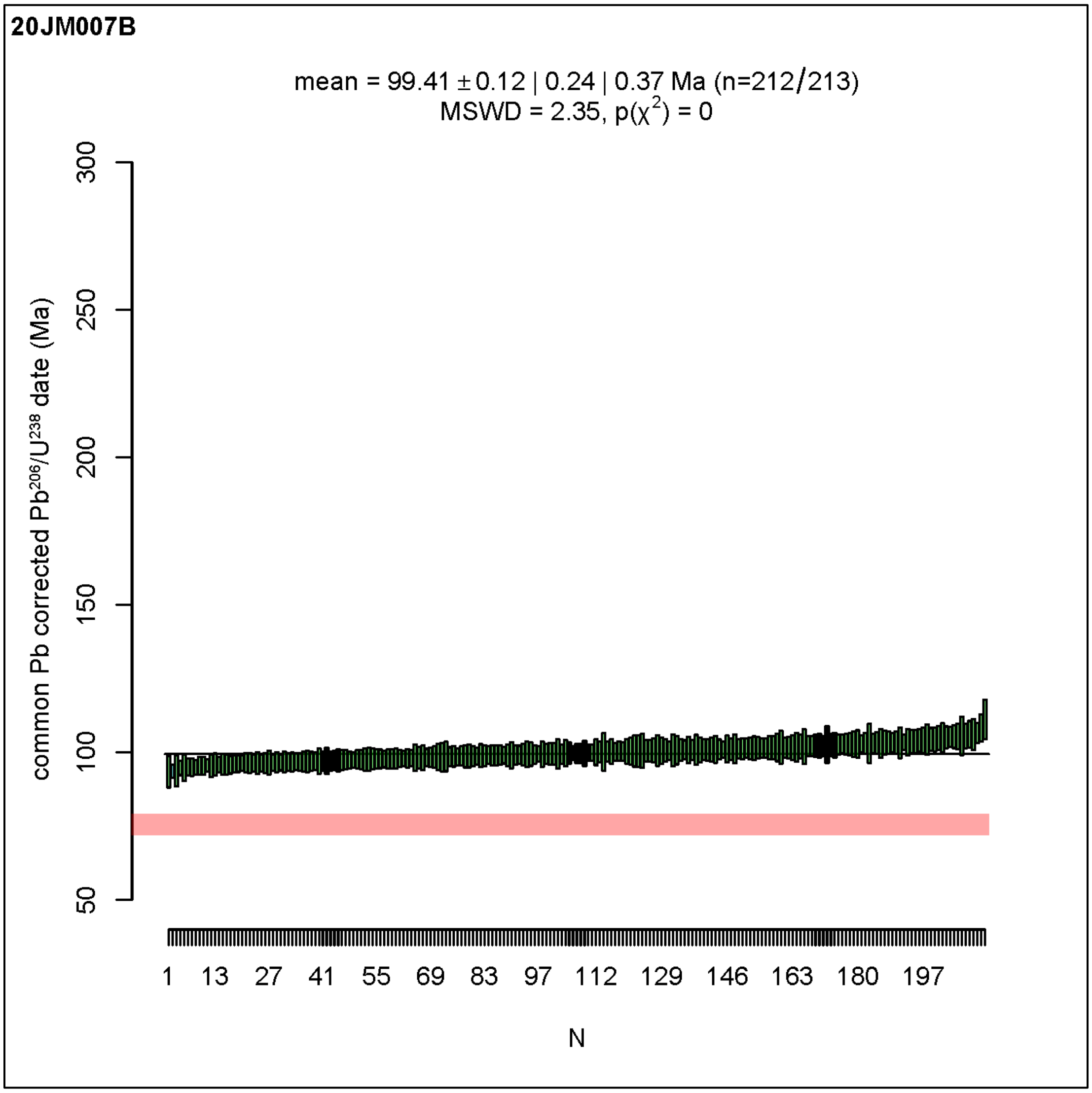

Figure 17 Weighted average age of Dawson Range batholith zircons detected in sample 20JM007B. Pink window 79-72 Ma represents Casino Suite as defined by Allan et al. (2013)

<u>20JM008B</u>

This drainage is 47.68 km^2 in area and 193 zircons were dated, including 187 zircons from the Whitehorse Suite dated between 92.2-118.1 Ma (Figure 18). Within the Whitehorse Suite zircons, 36 zircons returned dates between 92.2 to 101.7 Ma, possibly relating to Coffee Creek granite age zircon-bearing rocks in the drainage. There are no late Cretaceous to Paleocene aged zircons in this sample, despite approximately 3 km^2

of rocks mapped as Carmacks Group and Rhyolite Creek at the rim of the drainage. This supports the argument presented under 20JM007B that the Mt Nansen Group may be present in the area. A single 141.2 ±6.1 Ma could be from unmapped McGregor Suite intrusions. A single 186.9 ±7.1 Ma zircon may be derived from unmapped Long Lake Suite intrusions in the drainage; this age overlaps within error with a K-Ar date of 178.6 ±8 Ma from fresh grains of hornblende from a distinctly layered hornblende-biotite granodiorite to quartz-diorite with some fine grained mafic inclusions located within the drainage according to Yukon Geological Survey (2020) but the original description “on a ridge in headwaters of Coffee Creek about 27.4 km from the confluence with the Yukon River” (Wanless et al., 1978) suggests that the location may be slightly outside the drainage on a ridge 6.2 km SE of the mapped location, or at the mapped location – in either case it supports evidence for intrusions of Long Lake age in this area. Zircons with dates of 238.9 ±8.3 Ma, 242 ±13 Ma, 293 ±16 Ma, and 437 ±12 Ma, have no mapped or suggested sources.

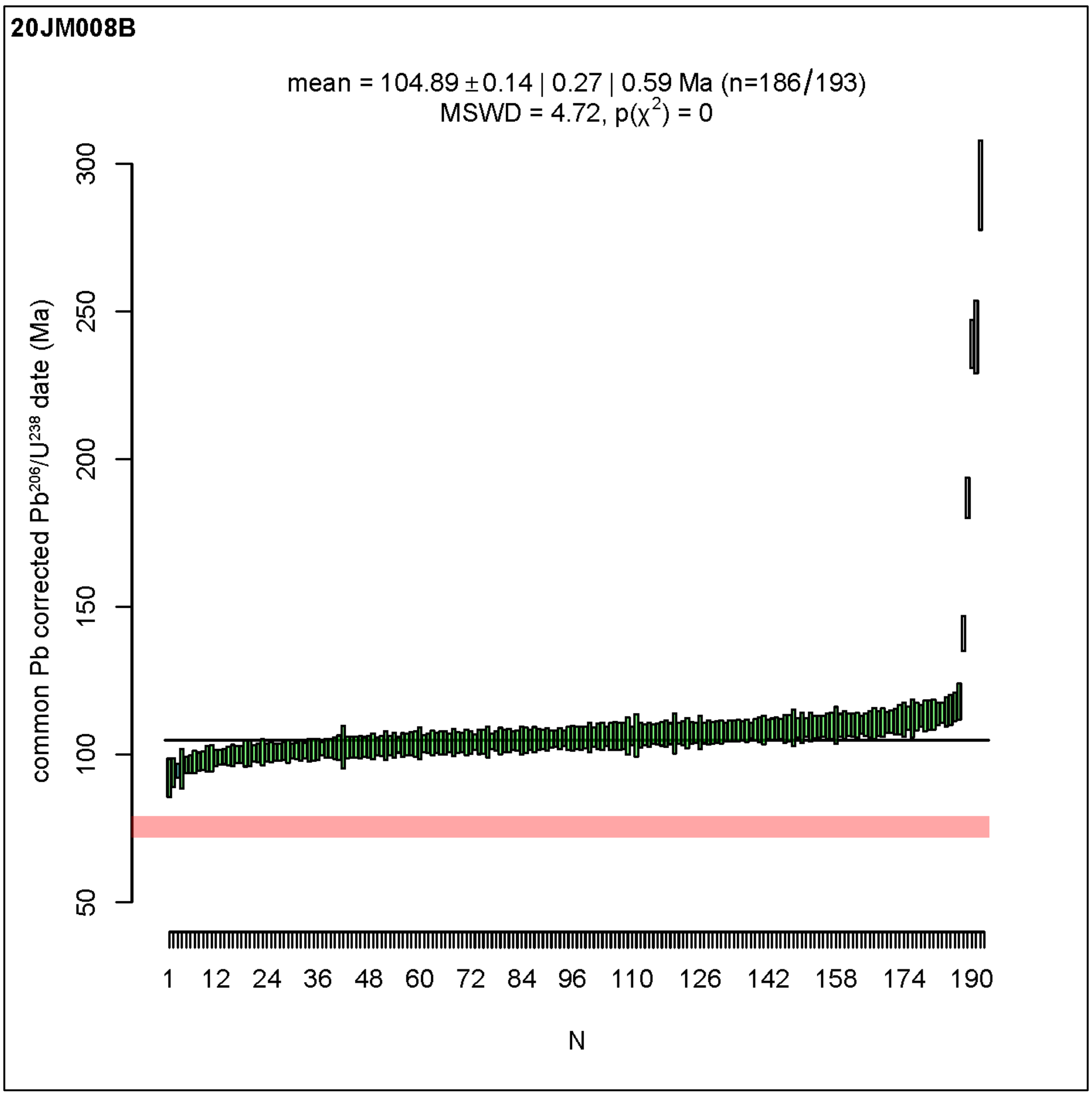

Figure 18 Weighted average age of Dawson Range batholith zircons detected in sample 20JM008B. Pink window 79-72 Ma represents Casino Suite as defined by Allan et al. (2013)

Zircon Texture

Zircons from sample 115J171019BS (from the sample directly draining the Casino deposit in Canadian Creek) were imaged under cathodoluminescence in order to determine if a link could be made between zircon texture, age and porphyry fertility (Figure 19). Tabular-zone, oscillatory-zoned, sector-zoned and not-zoned zircons were noted in the sample, in addition to core and rim textures of mixed zones. A notable feature in some grains was the occurrence of rims that appear to cross-cut earlier growth zones, seen to be linked to porphyry fertility in other studies (Bouzari et al., 2020). CL-imaging was not routinely carried out after the orientation study, as it was deemed too costly, and not as effective as LA-ICP-MS U-Pb dating, as a clear link was not identified between zircon texture and Casino Suite grains.

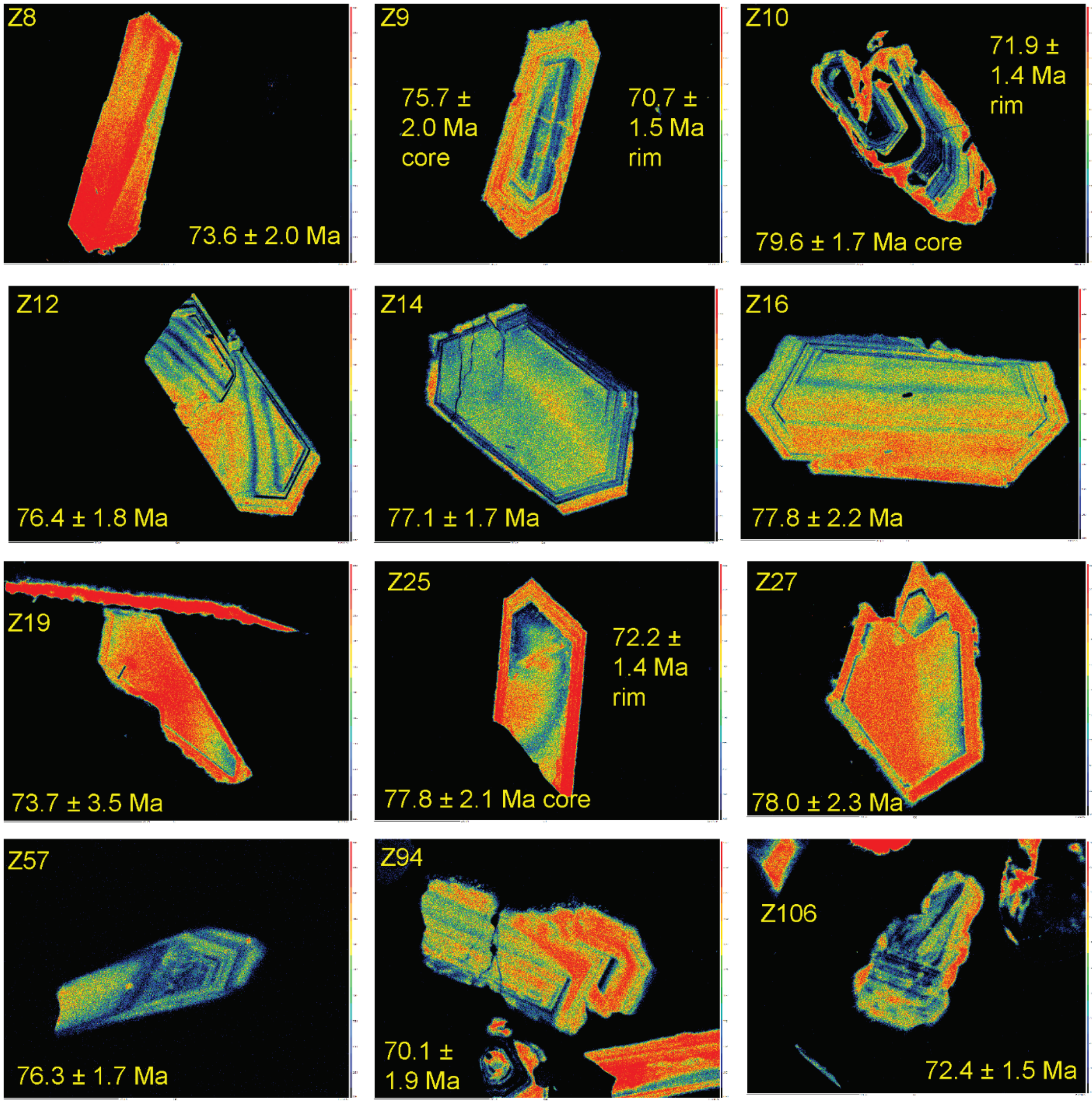

Figure 19 Cathodoluminescence images of Casino Suite zircons from sample 115J171019BS. Note the irregular rims on zircons Z9 and Z10 that cross-cut earlier oscillatory zoned cores. Common Pb corrected Pb206/U238 dates are shown, and rim-dates are given for Z9, Z10 and Z25. Variable scale, each zircon has a long axis between 650 and 120 microns.

Zircon cores and rims were dated within the same grain for three grains: Z9, Z10 and Z25. These returned statistically significant differences between the core and rim dates (Figure 20). The weighted mean of the rim dates, 71.6 ±0.4 Ma, is interpreted to be the best proxy for a crystallization age for the Patton Porphyry Casino Suite intrusive rocks in the project area, and the large gap between core and rim ages suggests a long period of magmatic activity for the Casino Suite intrusions. In zircon Z10, core and rim dates differ by at least

5 Ma, and may imply a long magma residence time of zircon phenocrysts during prolonged zircon growth periods. For detrital zircon exploration, core ages are determined, and these slightly older ages should be considered when interpreting the datasets.

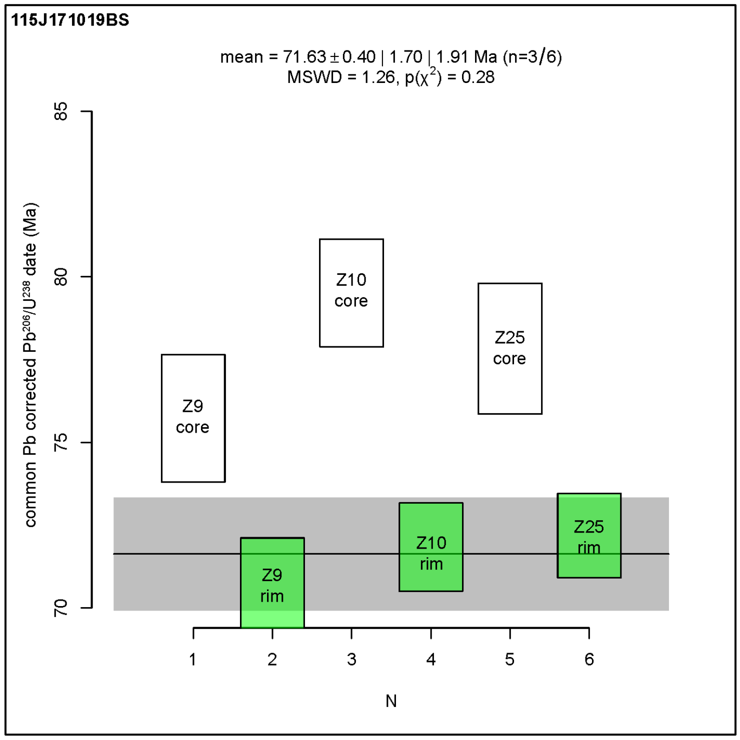

Figure 20 Weighted mean age of Casino Suite zircon rims from three core-rim pairs in sample 115J171019BS.

Zircon Chemistry

Methodology outlined in Lee et al. (2020) was followed and zircons with Ca concentrations above detection (~>430 ppm Ca) and La > 1 ppm were excluded to avoid cases where apatite and melt inclusions may have been ablated. The REE concentrations were normalized to chondrite values (Anders and Grevesse, 1989), multiplied by 1.3596 (after Mazdab and Wooden, 2006). Normalized values (Ce_N, Nd_N, Sm_N, Gd_N) were used to calculate Ce/Ce_N^* ($Ce_N/((Nd_N)^2)/Sm_N$) using the method of Loader et al. (2017) and Eu/Eu_N^* ($Eu_N/(Sm_N{*}Nd_N)^{0.5}$) by the method of Dilles et al. (2015). An exponential power function was used to calculate Ce/Ce_C^* values (methods in Zhong et al., 2019; Lee et al., 2020). Some calculations were hampered by a high detection limit for Nd (~0.1-1.0 ppm varying in each analytical session), Sm and Eu – particularly samples 20JM001B, 20JM002B and 20JM003B that were all measured in one analytical session. Values of Eu, Nd and Sm below detection preclude the calculation of the Eu/Eu_N^* value – the best indicator of porphyry fertility in zircon chemistry. Values of Eu/Eu_N^* above 0.3 are considered fertile for porphyry mineralization. Only the chemistry of zircons from samples containing Casino Suite age zircons are discussed here but full data are in digital appendices. Temperatures were calculated using the Ti in zircon geothermometer (Ferry and Watson, 2007). Zircons with Ti concentrations greater than 30 ppm were discarded from all temperature plots, to preclude the influence of Ti-bearing mineral inclusions such as rutile.

<u>Europium anomalies</u>

The Casino Suite zircons in samples from the orientation study from Canadian and Casino creeks produced Eu/Eu_N* values of 0.38 to 1.08, well above the threshold value of 0.3 that is considered fertile for porphyry mineralization. This is a good indication that Eu/Eu_N* can be used as an indicator of fertility in the Casino area.

Two Casino Suite age zircons in 20JM006B returned Eu/Eu_N* values of 0.29 and 0.36, which is at or just above the threshold value of 0.3 to be considered fertile with respect to porphyry potential. It was not possible to calculate Eu/Eu_N* for all other Casino Suite zircons as: the grains had too high concentrations of Ca or La; or at least one of Nd, Sm or Eu were below detection limits.

Many zircons from the Dawson Range Batholith, Coffee Creek age rocks, and Prospector Mountain suite also displayed high Eu/Eu_N* values, with mean values for each group all exceeding 0.3 (Figure 21). This indicates that Eu/Eu_N* values alone are not a good discrimination tool for fertile plutons in the Dawson Range. The distinctive age of Casino Suite rocks is thought to be a much better indicator of potential mineralization, owing to the common association of Casino Suite rocks and Cu-Au-Mo mineralization across Yukon. The Coffee Creek granite age rocks have a higher average Eu/Eu_N* than the Dawson Rang Batholith, further illustrating a difference between these components of the Whitehorse Suite.

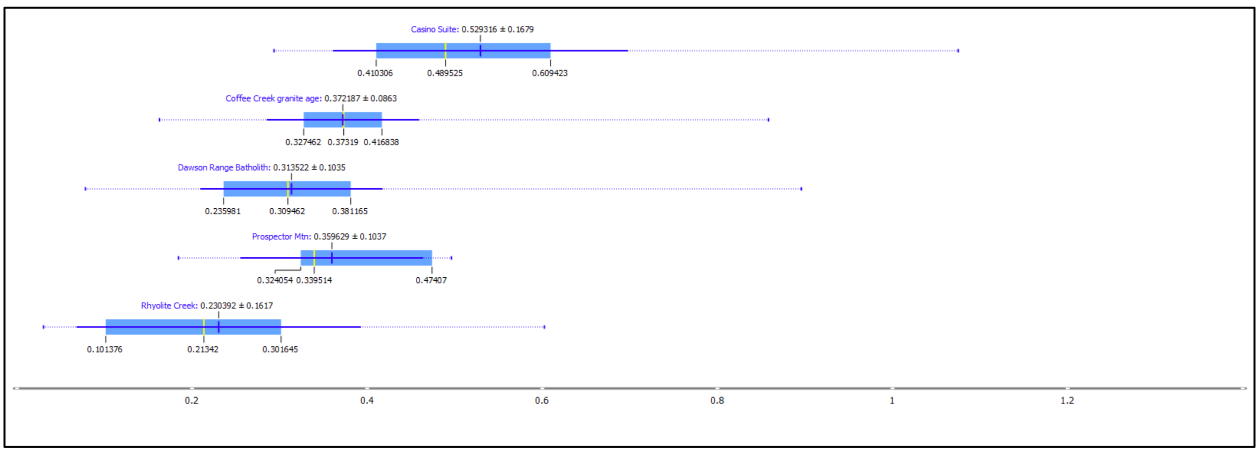

Figure 21 A box and whisker plot showing Eu/Eu_N* values for the Casino Suite, Coffee Creek granite age rocks (<101 Ma), Dawson Range Batholith (>101 Ma), Prospector Mountain Suite (here grouped as 64-70 Ma), and Rhyolite Creek rocks (from top to bottom on the diagram).

<u>Cerium anomalies</u>

Casino Suite zircons have Ce/Ce_N* and Ce/Ce_C* values that are strongly overlapping, but on average higher than Whitehorse Suite intrusions (Figures 22-24). These values are not considered distinct enough to be useful alone in discriminating fertile versus barren intrusions.

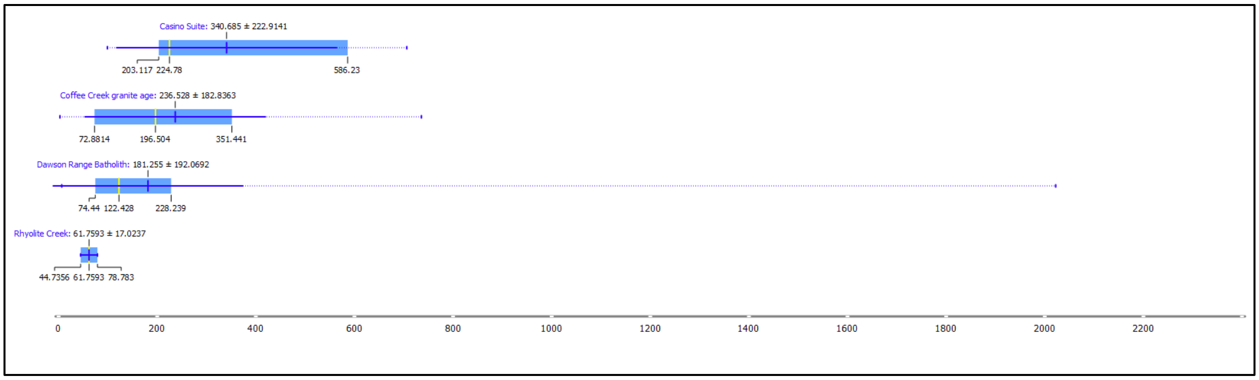

Figure 22 Ce/Ce_C values for Casino Suite, Whitehorse Suite and Rhyolite Creek zircons.*

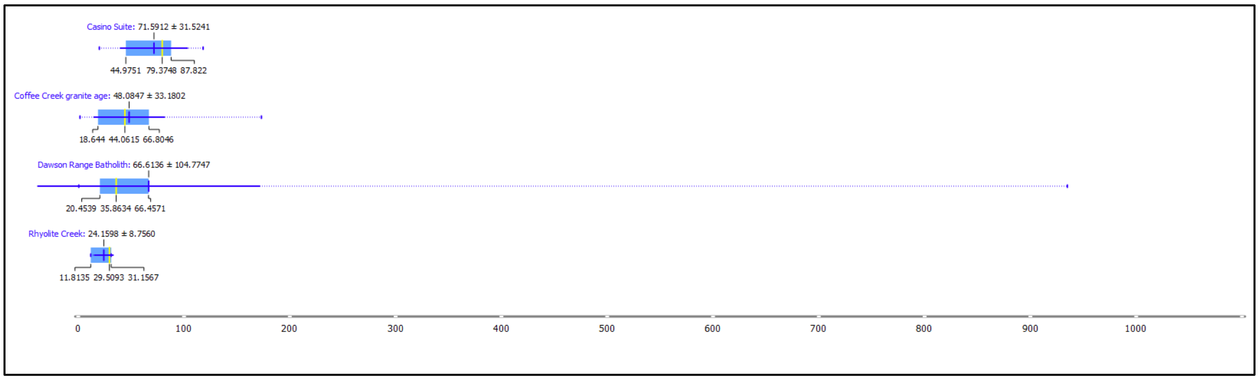

Figure 23 Ce/Ce$_N$ values for Casino Suite, Whitehorse Suite and Rhyolite Creek zircons.*

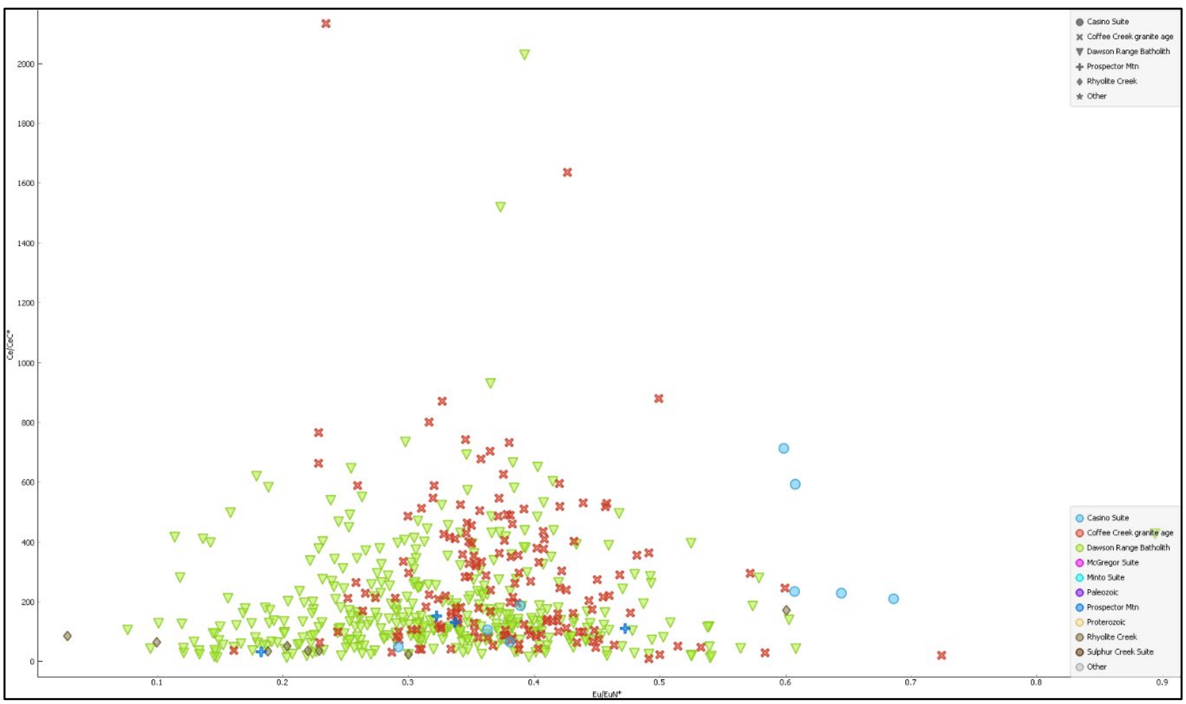

Figure 24 Ce/Ce$_C$ versus Eu/Eu$_N$* Casino Suite, Whitehorse Suite and Rhyolite Creek zircons.*

<u>Estimated crystallization temperatures</u>

The Casino Suite generally displayed lower estimated crystallization temperatures than other suites from results using the Ti in zircon thermometer. Distinctly lower average temperatures are estimated for the Coffee Creek granite age rocks than the Dawson Range Batholith (Figures 25 and 26).

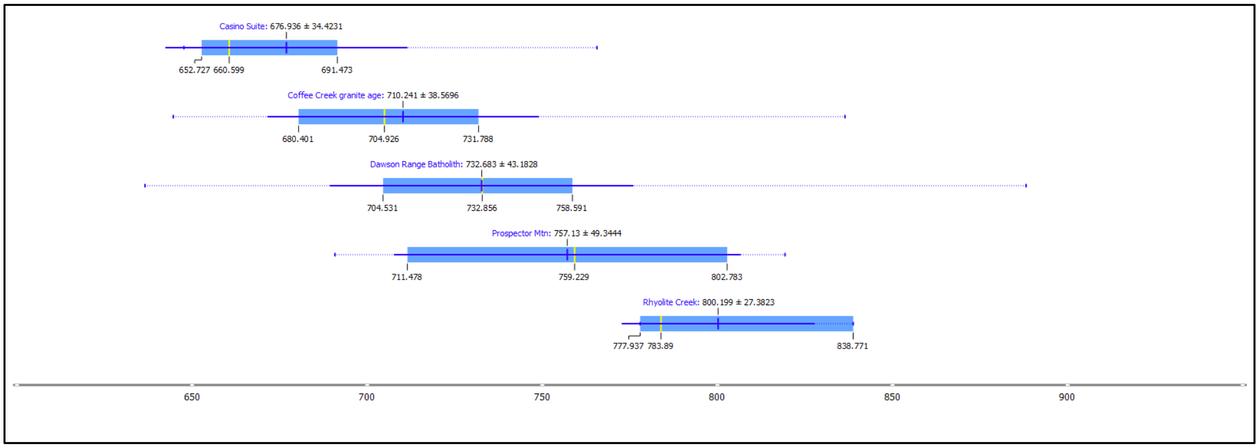

Figure 25 Estimated crystallization temperature from Ti in zircon thermometer of: (top to bottom) Casino Suite, Coffee Creek granite age rocks, Dawson Range Batholith, Prospector Mtn Suite, and Rhyolite Creek rocks.

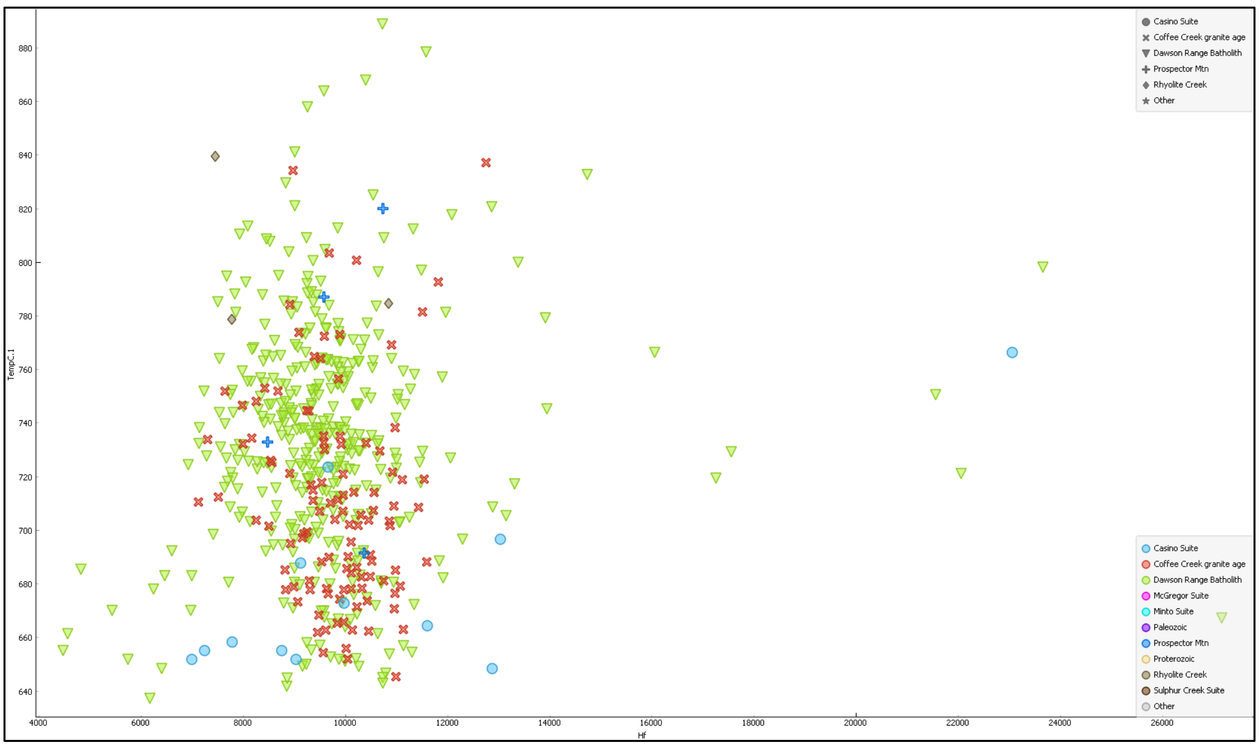

Figure 26 Estimated crystallization temperature versus Hf (ppm) content for the different intrusive suites across the project.

EXPLORATION SIGNIFICANCE AND INTERPRETATIONS

Exploration Potential of Anomalous Drainages

Sample site 20JM001 has 3 Casino Suite age zircons, ~30 grains of scheelite, a fine fraction stream sediment anomaly of 20 ppb Au, some supergene goethite, and seems to be the most anomalous drainage tested in this project. The presence of Casino Suite age zircons in this sample and lack of glacial sediments in the area strongly suggests that there is an unmapped bedrock source of Casino Suite age zircon-bearing rocks in the drainage. Sample sites 20JM003 and 20JM006 are also considered important areas to follow up due to the presence of Casino Suite age zircon in these samples.

The intimate time and spatial association of Casino Suite age rocks with Cu-Au-Mo mineralization is apparent when considering Re-Os dates from molybdenite, Ar-Ar dates from K-feldspar and biotite associated with potassic alteration with the Casino system and the zircon ages of rocks from the Casino Suite (Figure 27). The small volume Casino Suite intrusive rocks are almost always associated with at least some degree of mineralization all across the Yukon, e.g., Casino, Cash, Tad/Toro, Nucleus-Revenue, Klaza. Therefore, the discovery of Casino Suite age zircons in samples within this project is very significant and could lead to the discovery of Casino Suite intrusions in the area that may host associated Cu-Au-Mo mineralization.

The presence of 2 gold grains and 22 barite grains in sample 20JM002B suggests that there may be a weak epithermal gold signature in this drainage.

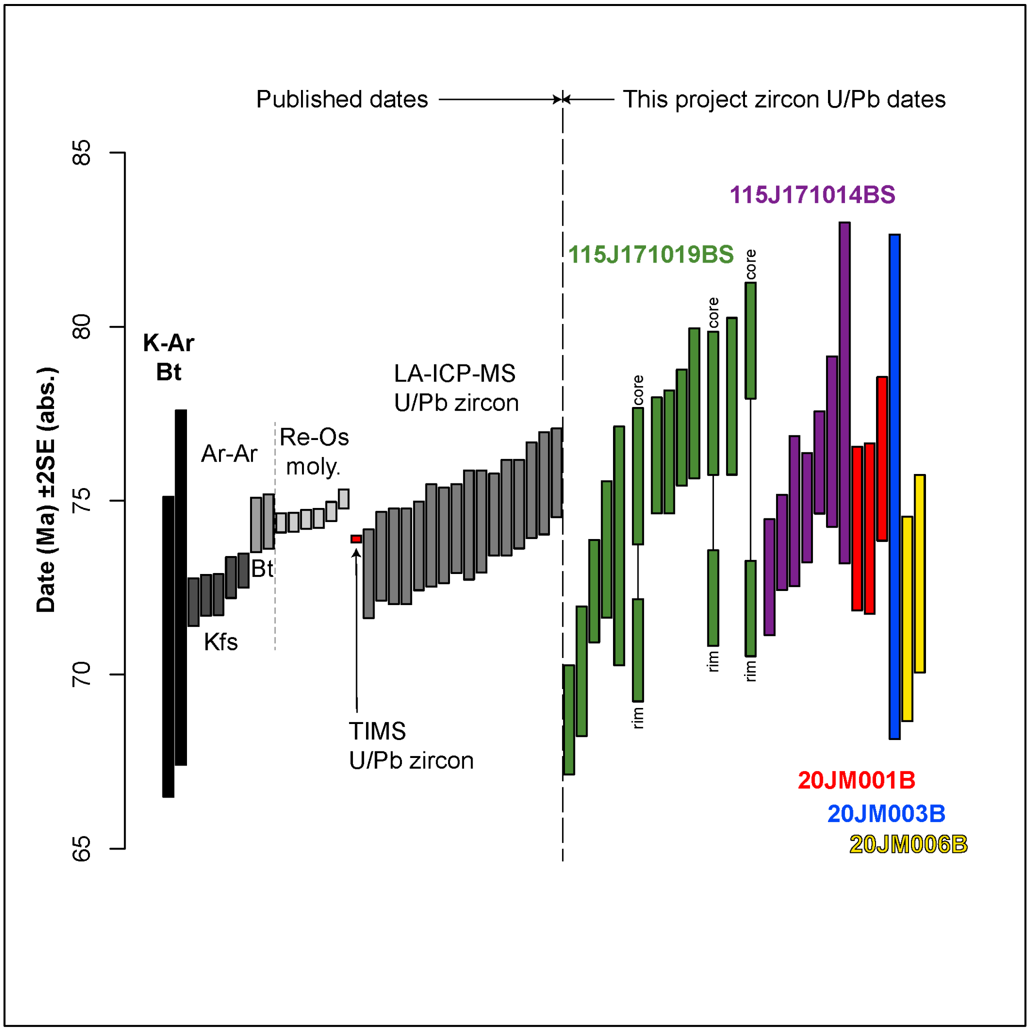

Figure 27 Summary of published dates from the Casino area and the zircon dates of Casino Suite age from this project. Where a core and rim were dated from the same grain of zircon, the dates are connected by a line and labelled. Published dates: K-Ar Bt = secondary biotite, hydrothermal alteration zone, Casino (left) and magmatic biotite from Patton Porphyry, Casino (right) (Godwin, 1975); Ar-Ar, Kfs = K-feldspar from potassic alteration (Selby et al., 2001a), Bt = biotite, secondary (left), magmatic (right) (Joyce et al., 2015); Re-Os moly. = molybdenite from the Casino deposit and the nearby Zappa-Koffee showing (Selby et al., 2001b); TIMS U/Pb zircon from Bt-qz-fs porphyry from outcrop on Patton Hill, Casino (Mortensen, unpub., in Yukon Geological Survey., 2020); LA-ICP-MS U/Pb zircons from rhyodacite, Casino, same sample as TIMS date (Allan et al., 2013).

Predicting the size of the porphyry: sampling bias and statistics

Sampling theory according to a binomial distribution has driven the number of zircons chosen for dating from each sample. The probability of success for dating a zircon of Casino Suite age has been assumed to relate to the fraction of the area of Casino Suite rocks present in a drainage relative to drainage size. For example, a 1

km^2 Casino Suite intrusion in a 10 km^2 drainage has been assumed to have a total stream sediment zircon population of 10% Casino Suite age zircons. This assumes that there is no bias and fractionation in zircon distribution, formation, weathering, transport, deposition, sampling, concentration, picking, or dating – the "zircon bias". Now that there are data on the number of successful outcomes, i.e., number of Casino Suite zircons dated in each drainage, binomial probability theory can be used to calculate confidence limits on the sample population, and from this estimate the expected area of Casino Suite rocks in each drainage within confidence limits, assuming that there is no zircon bias.

Prior to this, an assessment of low-zircon abundance rocks must be made on the contribution to total stream sediment zircon populations. The relative abundance of Sulphur Creek Suite orthogneiss mapped in the drainage associated with sample 115J171019-BS (3.01 km^2) relative to mapped area of Casino Suite rocks (1.719 km^2) but presence of only 1 zircon of Sulphur Creek age compared to 12 Casino suite zircons suggests that the contribution of zircons to the stream sediment load by Sulphur Creek Suite orthogneiss is very low. If areal extent of a lithological unit relative to drainage size was the only control on the stream sediment zircon population, i.e., the probability of a zircon being Sulphur Creek age is 3.01/25.01*100 = 12.04% then the probability of finding only 1 zircon in 125 zircons sampled of Sulphur Creek age is 0.00019%. Therefore, Sulphur Creek Suite rocks contribute very few zircons to the sediment load, and the effect of this on sampling statistics must be considered in drainages containing large areas of Sulphur Creek Suite. For the purposes of these approximations used in stream sediment zircon exploration, the area of Sulphur Creek Suite rocks within a drainage must be subtracted from the total drainage area when determining the proportion of Casino Suite rocks within a drainage when determining the optimum number of grains of zircon to analyze for each sample.

The assumption of no zircon bias can be tested in the control area at the Casino deposit, where the areal extent of Casino Suite rocks is known. In the 115J171019BS drainage, Godwin (1975), mapped 1.719 km^2 of Casino Suite intrusions. Considering the 3.01 km^2 of Sulphur Creek Suite in this 25.01 km^2 drainage, the probability of successfully dating a zircon in the stream sediment is 1.719/(25.01-3.01)*100 = 7.81%, assuming no zircon bias. In sample 115J171019BS, 12 Casino Suite zircons were detected out of 125 trials (125 zircons dated). From this sample population, using confidence limits of a normal distribution to approximate a binomial distribution, it can be stated that the total zircon population in stream sediment is between 4.4% and 14.8% at a 95% confidence level. The prediction of a 7.81% Casino Suite zircon stream sediment population from mapped area of Casino Suite rocks is within these confidence limits, demonstrating that the areal fraction of granitoids within a drainage area is a reasonable approximation to the total stream sediment zircon population.

A similar exercise in the 115J171014BS drainage can be undertaken, showing that a 1.91% probability of detecting a Casino Suite zircon in stream sediments based on area of Casino Suite mapped by Godwin (1975) compared to total area of the drainage is within the 95% confidence limits of the estimate of the total stream sediment zircon population from the sampled zircons of between 0.6 and 4.1% (n=293, x=7).

For sample 20JM001B, n=118 (zircons sampled) and x=3 (Casino Suite zircons detected). For this sample size, and sample proportion, the number of zircons analyzed is not sufficient to use the normal distribution to approximate the binomial distribution. However, binomial probabilities can be calculated such that with a 95% chance of either at most or at least 3 zircons being detected, the total zircon population in stream sediments must be between 1.17% and 5.24%. For this drainage area of 29.89 km2, it can be predicted with 95% confidence that an area of Casino Suite rocks of 0.51 to 1.61 km^2 is present within the drainage, assuming no zircon bias and a direct relationship between areal fraction of Casino Suite rocks in the drainage and stream sediment zircon population. Godwin (1975) mapped the main Casino Suite intrusive complex at Casino to be 1.77 km^2 for comparison of the size of a porphyry footprint.

Additional zircon analyses from 20JM001B, 20JM003B and 20JM006B are highly recommended to provide more robust sampling statistics to support these conclusions.

Regional Geology: is the Mt Nansen Group present NW of the Dip-Creek Fault?

See zircon geochronology of 20JM007B (also 20JM006B and 20JM008B), for evidence for the presence of felsic volcanic rocks of the Mt Nansen Group within the project area.

Systematic differences in the K-Ar dates of Dawson Range batholith rocks on the western versus eastern sides of the Dip Creek fault, indicate differences in cooling history and exhumation (Figure 28). The potential presence of Mt Nansen Group and generally older (i.e., >100 Ma) K-Ar biotite and hornblende cooling ages on the NW side of the Dip Creek Fault, contrasting with the lack of mapped Mt Nansen Group (or potential Rhyolite Creek lookalikes) and younger (generally <100 Ma) K-Ar biotite and hornblende cooling ages on the SE side of the Dip Creek Fault, suggest that the Dip Creek fault was active during the mid-Cretaceous with some component of SE-side up displacement at ~95 Ma. This exhumation would have led to the erosion of Mt Nansen age volcanic rocks on the SE side of the fault and may explain the lack of Mt Nansen rocks in this area. Due to the presence of Carmacks Group on both sides of the Dip Creek Fault, this period of SE side up exhumation was complete by the late Cretaceous. All occurrences of felsic volcanic rocks mapped as Rhyolite Creek on the NW side of the Dip Creek fault and associated conglomerates should be re-examined to establish if they belong to the mid-Cretaceous Mt Nansen Group.

The greater amounts of mid-Cretaceous exhumation implied by the potential presence of Mt Nansen volcanic rocks in the project area increases the exploration potential for epithermal gold-silver and porphyry Cu-Au-Mo mineralization in the area, as the upper parts of mid-Cretaceous to pre-late Cretaceous porphyry-epithermal systems may still be preserved NW of the Dip Creek Fault.

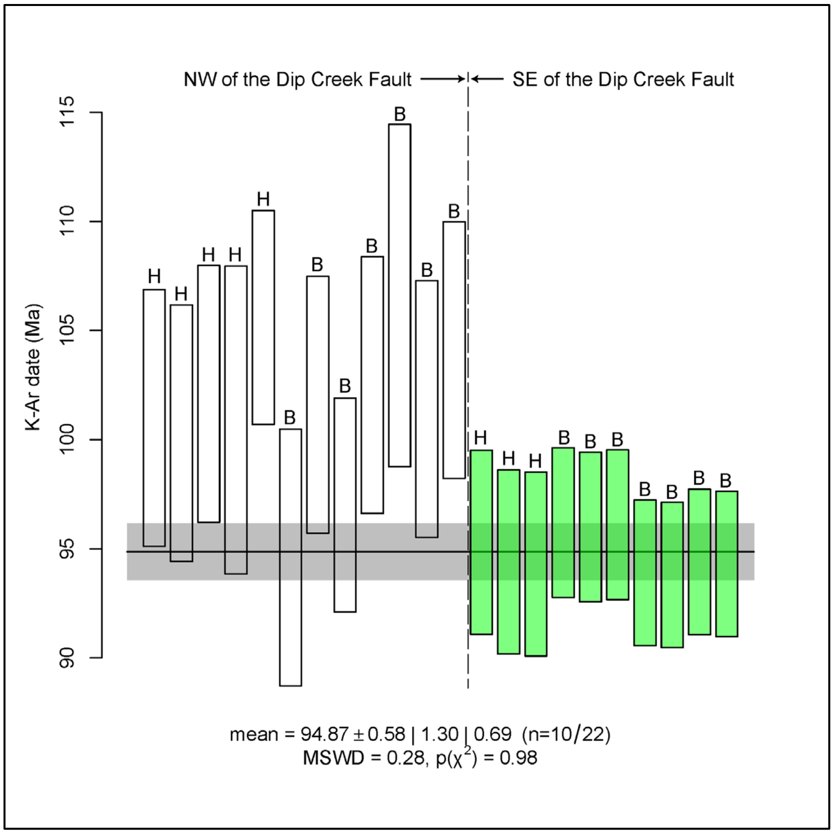

Figure 28 Selected K-Ar cooling ages of hornblende (H) and biotite (B) for samples of Dawson Range Batholith that are located NW or SE of the Dip Creek Fault. Note the systematic difference across the fault, suggesting exhumation at ~95 Ma during the mid-Cretaceous SE of the fault, shortly after the emplacement of the Dawson Range batholith. Data from Wanless et al. (1998); Godwin (1975); and Yukon Geological Survey (2020).

CONCLUSIONS

- Dating grains of zircon in recent stream sediments is an effective tool for exploration in the unglaciated Dawson Range.
- Zircon chemistry shows trends related to the major intrusive suites in the area but is not distinct enough to be used alone as an exploration method.
- Porphyry indicator minerals show potential to discover porphyry Cu-Au-Mo deposits in the Dawson Range.
- Several anomalous drainages have been identified that may host unmapped occurrences of Casino Suite rocks that may host associated Cu-Au-Mo mineralization.
- A Casino Suite porphyry covering up to the same area as the Casino deposit is predicted for the drainage hosting site 20JM001B.
- Zircon dating of stream sediments has identified potential unmapped occurrences of other igneous suites and could be used as a tool in regional geological mapping.

RECOMMENDATIONS

Additional zircon dating should be carried out on samples 20JM001B, 20JM003B, and 20JM006B in order to obtain better sampling statistics and try to establish a better degree of confidence in the estimate of the fraction of Casino Suite zircons in the stream sediment zircon population. Several hundred additional grains from each of these samples should be dated for best results. A minimum of 150 grains from each of these sample should be dated – with increased numbers, higher confidence could be had to return to the area to do additional sampling. Additional analyses should also be carried out on the zircon grains that have an unequivocal age that overlaps the Casino Suite with the Prospector Mountain Suite, Carmacks Group, Rhyolite Creek or Whitehorse Suite. Core and rim dates should be obtained, with multiple spots per grain, if the grains are of sufficient size to accommodate multiple analyses.

Further sampling in the field would comprise following the drainages up-creek taking samples above confluences, in order to trace the zircons back to a bedrock source. This should be combined with prospecting in the drainages for porphyritic rocks, intrusion or explosion breccias, veining, alteration and mineralization. Further bulk sampling for PIMS and zircon-dating should be carried out in addition to fine-fraction stream sediment sampling. Horseshoe-shaped contour soil sampling traverses should also be carried out to try and detect porphyry Cu-Au-Mo mineralization, with particular focus on any Au and Mo anomalies generated.

2020 EXPENDITURE STATEMENT

Item	**Cost**
Senior geologist fieldwork (4x$500)	$2,000.00
Senior geologist analytical work (6.5x$500)	$3,250.00
Daily field expenses (4x$100)	$400.00
Report	$2,500.00
Truck	$900.00
Helicopter 206B	$5,491.84
Heavy mineral separation and PCIM logging	$4,486.76
Sample shipping	$141.83
Stream sediment, aqua regia ICP-MS	$385.10
LA-ICP-MS and CL imaging	$13,684.00
Total	**$33,239.53**

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STATEMENT OF QUALIFICATIONS

- I graduated with a Ph.D. in Geological Sciences from the University of British Columbia in 2015.
- I graduated with an M.Sc. in Mining Geology from the Camborne School of Mines, University of Exeter, 2009.
- I graduated with a first-class honours B.Sc. in Applied Geology from the Camborne School of Mines, University of Exeter, 2008.
- I have worked in mineral exploration continuously since graduation on projects in Yukon, N.W.T. and B.C.

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DIGITAL APPENDICES

Appendix 1: Sample locations.

Appendix 2: Fine fraction stream sediment aqua regia ICP-MS data.

Appendix 3: Heavy mineral concentrate and PCIM logging results.

Appendix 4: Zircon geochronology and geochemistry.

Appendix 5: High resolution figures from this report.