Geochronometry of the Iskut River Area - An Update

[104A & B]

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R1 INTRODUCTION

MDRU's project "Metallogeny of the Iskut River Area, Northwestern British Columbia" is employing high precision, U-Pb zircon geochronometry to augment the understanding of the relative and absolute timing of intrusive and extrusive events associated spatially, at least, with base and precious metal mineralization. MDRU's researchers are working together with geologists from the Federal and Provincial Geological Surveys, and with geologists employed by mining and exploration companies active in the area. Data gathered during this study will be integrated with paleontological studies in progress (e.g. P. Smith and G. Nadaraju, UBC) to further refine our understanding of stratigraphic relationships. In this contribution, we report four new U-Pb Zircon results from plutons in the Iskut River area; three are from the Bronson airstrip district, in the vicinity of the Snip mine, and Johnny Mountain and Inel properties; one is from the Eskay Creek area.

R1 EXISTING DATABASE

Alldrick et al. (1986, 1987), Anderson (1989), Anderson and Bevier (1990, 1991), Anderson and Thorkelson (1990) and Bevier and Anderson (1991) have summarised the K-Ar and U-Pb isotopic data available for the Iskut River and adjacent areas (e.g. Stewart) comprising Northwest Stikinia (Wheeler and McFeely, 1987). In brief, these data indicate four principal plutonic events; Anderson and Bevier (1990) suggest that at least the first three of these have associated extrusive equivalents:

	Plutonic Event	Extrusive Equivalent
[1]	228-220 Ma (Late Triassic)	Stuhini Group
[2]	205-187 Ma (Early Jurassic)	Hazelton Group
[3]	177-172 Ma (Mid Jurassic)	Salmon R. Formation
[4]	55-51 Ma (Tertiary)	

Anderson and Bevier (1991) and Bevier and Anderson (1991) propose a widespread unconformity in Northwestern Stikinia separating Toarcian and younger (Mid Jurassic) rocks from underlying Early Jurassic strata, attributed to late Early Jurassic contractional deformation.

R1 SAMPLE DESCRIPTIONS - PETROLOGY AND GEOCHEMISTRY

Four samples collected during the MDRU 1990 field program from the Iskut area were analysed in 1991 :

1. Iskut River (Bronson) Stock, Iskut Joint Venture property
2. Red Bluff Porphyry, Snip property
3. Inel Stock, Inel property
4. Eskay Porphyry, Eskay Creek/GNC properties

Refer to Figure 1 for property locations.

R2 Iskut River (Bronson) Stock

Britton et al. (1990) descibe the Iskut River Stock as follows :

> Phaneritic intrusions of probable early Jurassic age include .... the Iskut river Stock .... A common feature of these intrusions is the presence of coarse (up to 5 centimetres) potassium feldspar phenocrysts.

The sample of the Iskut River Stock collected in 1990 by the first author (AJM-ISK90-333) from the Iskut Joint Venture property (Prime Equities, American Ore, Golden Band Res.; Figure 1) is a plagioclase phyric, locally potassium feldspar phyric, monzodiorite, based upon thin section estimates (plagioclase 60%, poikilitic potassium feldspar 25%, quartz 10%, and biotite 5%). The chemical composition of the rock is given in Table 1. It is interesting to note that the calculated An:[An+Or] ratio is low (<10) and the rock would be classified as a Quartz-Alkali Feldspar Syenite, following the geochemical approach to modal QAPF classification, described by Streckeisen and LeMaitre (1979). Further work will address this apparent discrepancy. Plagioclase euhedra are zoned, with sericitised cores, mantled by rims of relatively unaltered feldspar, locally contained within poikilitic potassium feldspar.

R2 Red Bluff Porphyry

Britton et al. (1990) consider that the Red Bluff Porphyry (which outcrops on both Cominco's/Prime Resource's Snip and Skyline's Johnny Mtn. properties, Figure 1) is also a potassium feldpar phyric, early Jurassic intrusion (see description of Iskut River stock). The sample collected by the first author (AJM-ISK91-041) from the 130 metre Haulage way in the Snip mine comprised an altered, sheared, feldspar megacrystic intrusion; such a rock is not an ideal candidate for U-Pb geochronometry, due to the presence of 1-5% Pyrite as an alteration product (see below). The Red Bluff porphyry and spatially associated mineralization comprises part of a parallel study by MDRU, being conducted by Ettlinger (work in progress). In addition, Rhys (refer to article elsewhere in this volume) is investigating the structure of the Snip Mine, including the Red Bluff porphyry, as part of an M.Sc. thesis in progress at UBC.

R2 Inel Stock

Britton et al. (1990) describe the Inel felsite stock (property location, Figure 1) as follows:

> .... synvolcanic intrusions are thought to be comagmatic and coeval with extrusive rocks. Examples include felsite stocks on the ..... Inel property. These are leucocratic to holofelsic, cream to tan, porphyritc rocks set in an aphanitic groundmass. Contacts are altered and sheared, but the stocks appear to form sill-

> like bodies that are crudely conformable with enclosing strata. On the Inel Property the felsite stock is associated with a small felsite dike swarm.

The Inel stock is also associated spatially with diatreme-like, igneofragmental breccia dikes, indicative of vigorous devolatilization of a magma body, presumably that which ultimately resulted in the Inel stock, or a related, blind intrusion.

Sample AJM-ISK90-162 was collected from the Gulf International Minerals exploration camp site (1990) on the Inel property; the rock is an altered feldspar (15%)-quartz (5%) porphyry in a fine grained quartz-feldspar groundmass. The classification method of Streckeisen and LeMaitre (1979) suggests a quartz monzodiorite composition (data in Table 1).

R2 Eskay Porphyry

A sill-like body (C. Edmunds, International Corona, oral communication, August 1991) of feldspar porphyry outcrops approximately 1 km east of the 22 Zone at Eskay Creek, and straddles the boundary between the Eskay Creek and GNC properties (both properties operated by International Corona; for location see Figure 1). Britton et al. (1989), relying also on Donnelly (1976), described the body thus:

> granodiorite porhyry (with) subhedral phenocrysts of oligoclase, up to 1 millimetre long, (36%), anhedral quartz, 0.3 millimetre diameter, (11%) and 1 millimetre, subhedral grains of orthoclase (8%), ... set in a fine-grained quartz-feldspar matrix. Plagioclase is extensively replaced with chlorite and sericite. Its bulk composition is similar to dacitic pyroclastics seen higher in the section. It may represent a synvolcanic plug or a thick dacitic flow.

In addition, diamond drilling for exploration purposes conducted in 1990 by Prime Resources demonstrated the local presence of potassium feldspar megacrysts, to 2 cm in long dimension (V.P. Van Damme, Project Geologist for Prime Res., Oral Communication, October 1990). The Eskay porphyry exhibits demonstrable intrusive contacts on its northern and western margins, such as inclusions, rafts and complex interfingering of porphyry and hornfelsed argillite country rock, as exposed within the "Porphyry Zone" ; the lower (eastern) contact is not exposed.

From an extensive sample suite of the Eskay porphyry collected in 1990, two were selected for lithogeochemical analysis, in addition to routine petrographic examination: (1) AJM-ISK90-111, collected from outcrop by the first author, and (2) DJA-90-PZ1, collected from talus by the sixth author. The latter sample was, in addition, selected for U-Pb geochronometry (see below). In thin section, AJM-ISK90-111 is a plagioclase (20%)-potassium feldspar (20%) porphyry, grain size to 3.2 mm with accessory (?) amphibole (5%, now completely altered) in an altered groundmass (<0.1 mm) of (?) quartz and feldspar. Sample DJA-90-PZ1 is similar, with slightly coarser grain size, containing phenocrysts to 3.5 mm and a higher proportion of plagioclase (approximately 30%) as opposed to potassium feldspar (10%), and contains accessory biotite (< 5%) and pyrite (1-2%). Both rocks are similar geochemically (Table 1) and may be classified as alkali feldspar granites, based upon the method of Streckeisen and LeMaitre (1979).

It is worth mentioning, briefly, that early Jurassic potassium feldspar megacrystic plutons (e.g. phases of the Iskut River, Red Bluff and Eskay Creek bodies) are texturally similar to rocks ("Premier Porphyries") described in the Stewart area (e.g. Alldrick, 1987), that show a spatial and temporal relationship with the Silbak Premier gold, silver and base metal deposit. Britten and Alldrick (1990) have suggested that there may be, in both the Stewart and Iskut areas, a genetic relationship between the "Premier"-style magmatic event and precious $\pm$ base metal mineralization. This hypothesis will be tested further as part of MDRU's Iskut project.

R1 ANALYTICAL PROCEDURES

All work was carried out in the geochronometry laboratory at the Department of Geological Sciences, University of British Columbia. Zircon-rich heavy mineral concentrates were recovered using standard crushing, grinding, wet shaking (Wilfley table), and heavy liquid separation techniques. Abundant pyrite in the Wilfley concentrate from sample AJM-ISK91-41 (Red Bluff porphyry) was removed from heavy silicates by flotation using warm 7N HNO_3. Pure zircon populations from non-magnetic size fractions were handpicked in ethanol. Zircons from sample DJA-90-PZ-1 (Eskay Creek porphyry) were separated by hand from abundant pyrite in the heavy fraction; because of its importance, this sample was not treated with HNO_3 except during final zircon washing. Abrasion of all zircon fractions was done using the procedure of Krogh (1982), and zircons were handpicked from the abrasion mixture. Zircon dissolution was done in microcapsules using the technique of Parrish (1987), and U and Pb chemistry procedures were modified from the technique developed by Krogh (1973).

U and Pb concentrations were determined using a ^{205}Pb-^{233}U-^{235}U mixed spike (Parrish and Krogh, 1987). U & Pb were loaded together on single rhenium filaments using H_3PO_4 and silica gel and analysed in a VG Isomass 54R solid source mass spectrometer in single collector mode (Daly photomultiplier). Analytical precision was better than 0.1% for $^{207}Pb/^{206}Pb$ and $^{208}Pb/^{206}Pb$, and better than 0.3% for $^{205}Pb/^{207}Pb$. $^{204}Pb/^{205}Pb$ precisions ranged up to 1% due to small ^{204}Pb ion beam currents (in the 10^{-16} Amp. range). Total procedural blanks were approximately 40 picograms Pb and 30 picograms U, based on repeated procedural blank runs during the period in which the analyses were carried out.

Pb/U and Pb/Pb errors for individual zircon fractions were obtained by individually propagating all calibration and analytical uncertainties through the entire date calculation program and summing the individual contributions to total variance. Errors on individual U-Pb dates are quoted at the 2 sigma level (95% confidence interval). The U-Pb analytical data are given in Table 2.

R1 ANALYTICAL RESULTS

The analytical data in Table 2 represent a condensed data set; complete analytical data are recorded on file at the UBC Geochron Laboratory.

R1 DISCUSSION OF RESULTS

The Eskay Creek porphyry (DJA-90-PZ-1) is 185.5 $\pm$ 1.5 Ma (n.b. all errors are two sigma), based on mutual overlap of three error ellipsoids with concordia (Figure 2a). A fourth, lightly abraded, very fine size fraction plots below concordia, probably due to a combination of inheritance and minor lead loss which was not removed by abrasion. The quality of all four analyses is quite good, and there cannot be much doubt that the Eskay Creek porphyry is indeed an early Toarcian (using the Harland et al., 1989. time scale) intrusion.

The Red Bluff porphyry has a minimum age of 195.4 $\pm$ 1 Ma, but is not likely to be much older. The effect of lead loss is evident from dispersion of three error ellipsoids along concordia (Figure 2b). This dispersion of individually concordant points may be due to lead loss during a hydrothermal, mineralizing event shortly after emplacement and crystallization of the intrusion (note that the sample contained significant pyrite). The error ellipse for the coarse, +149 micron fraction plots below concordia, and its errors are relatively large due to low intensity ion beams (a result of sample loss during column chemistry), but its $^{206}Pb/^{238}U$ date is within error of the oldest concordant fraction. The anomalously high Pb/Pb date for this fraction may reflect minor inheritance of older radiogenic lead; it is recommended that another coarse, abraded fraction be done in order to confirm this discordance and to reduce the analytical error.

The Bronson stock is either Early Jurassic (approx. 203 Ma) or Late Triassic (approx. 225 Ma) in age. This uncertainty is due to non-colinearity of the +149 micron error ellipse relative to the ellipsoids for the other three fractions, all of which clearly show the effects of lead loss (Figure 2c). The three colinear points are all discordant, and it is safe to assume a minimum age of 203 $\pm$ 4 Ma, based on the upper intercept of a best-fit chord with concordia (the lower intercept is 142 Ma, but no significance is attached to this date). A chord fit through all four points, and forced through 0 Ma, intersects concordia at 225 Ma, with large intercept errors, leading to a tentative Late Triassic age assignment. A coarse, abraded fraction will need to be rerun to confirm this interpretation.

The Inel stock is 190.0 ± 3.3 Ma old, based on the upper intercept with concordia of a best-fit chord through all four points, forced through 0 Ma (Figure 2d). Forcing the chord through 0 Ma is reasonable given the roughly similar Pb/Pb dates of all four fractions, which have clearly suffered some lead loss. The analytical errors for the coarse, +149 micron fraction are somewhat large, due to low intensity ion beams (small sample load, also reflected in low $^{206}Pb/^{204}Pb$ ratio), but this does not affect the age interpretation for this sample.

R1 SUMMARY

Interpreted ages for the Inel stock and Red Bluff porphyry (190.0 ± 3.3 and 195.4 ± 1 Ma, respectively) fall well within the range exhibited by Early Jurassic plutonism coeval with Hazleton arc volcanic rocks (205-187 Ma, see above). The interpreted age for the Eskay Creek porphyry (185.5 ± 1.5 Ma) is slightly younger than the range exhibited by the Early Jurassic event, although the difference is minimal; at this time, we interpret the Eskay Creek porphyry to be a member of the Lower Jurassic intrusive suite.

The age of the Iskut River (Bronson) stock is uncertain, due to lead loss; it can be interpreted that the rock has a minimum age of 203±4 Ma (Hettangian/Sinemurian). Further work will be required to improve this estimate.

R1 ACKNOWLEDGEMENTS

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TABLE 1 : LITHOGEOCHEMICAL DATA [%]

	AJM-ISK90-333 Iskut River Stock	AJM-ISK90-162 Inel Stock	AJM-ISK90-111 Eskay Porphyry	DJA-90-PZ1 Eskay Porphyry
SiO2	62.7	69.8	67.8	64.1
TiO2	0.42	0.29	0.48	0.58
Al2O3	17.4	16.5	14.7	16.4
Fe2O3	4.09	2.62	3.53	3.69
MgO	1.39	0.69	0.26	0.25
MnO	0.05	0.09	0.05	0.07
CaO	4.45	0.19	0.12	0.14
Na2O	3.97	2.96	1.82	2.40
P2O5	0.17	0.08	0.15	0.17
H2O	0.8	1.8	1.6	1.1
CO2	[dl]	0.04	[dl]	[dl]

Note : [dl] = below detection limit

TABLE 2: U-Pb ANALYTICAL DATA[1]

Sample[2] Fraction	Wt (mg)	U (ppm)	Pb[3]	Isotopic abundance[4] 206Pb=100: 208	207	204	6/4[5]	Isotopic ratios[6] ± 2σ errors: 206Pb/238U ± 207Pb/235U ± 207Pb/206Pb ±; Dates (Ma)[7] ± 2σ errors
DJA-90-PZ-1								
-74	0.5	489	15.3	21.63	5.21	0.0143	4213	0.02856±14 0.19670±94 0.04997±8
NM2/2 lightly abraded								181.5±0.8182.3±0.8193.0±2.0
-134+74	1.5	328	10.1	18.18	5.07	0.0059	9475	0.02909±14 0.19990±98 0.04984±8
NM2/2 ABR								184.8±0. 8185.0±0.8187.6±4.0
-149+134	2.2	279	8.6	16.66	5.13	0.0102	7214	0.02920±16 0.20035±1140.04977±10
NM2/2 ABR								185.5±1. 0185.4±1.0184.1±4.4
+149	5.5	220	6.7	15.03	5.18	0.0131	6648	0.02913±22 0.20024±1460.04986±10
NM2/2 ABR								185.1±1.4185.3±1.2188.4±4.2
AJM-ISK91-041								
-74	1.2	437	13.2	10.60	5.42	0.0290	3001	0.03018±16 0.20788±1200.04995±10
NM2/2 ABR								191.7±1.0191.8±1.0192.9±4.3
-149+134	1.4	341	10.3	7.98	5.21	0.0142	5341	0.03077±16 0.21208±1200.04999±14
NM2/2 ABR								195.4±0.6195.3±1.0194.4±6.4
+149	0.9	317	10.0	10.27	6.37	0.0886	1037	0.03099±30 0.21644±2680.05066±38
NM2/2 ABR								196.7±2.0198.9±2.2225.2±17.4
AJM-ISK90-333								
-74	0.8	580	16.8	9.18	5.11	0.0074	8199	0.02944±16 0.20310±1240.05003±16
NM2/2 ABR								187.0±1.0187.7±1.0196.5±7.8
-134+74	1.9	470	13.9	8.59	5.25	0.0161	5379	0.03020±14 0.20877±1060.05013±6
NM2/2 ABR								191.8±1.0192.5±0.8201.1±3.1
-149+134	3.5	428	12.6	7.71	5.04	0.0017	31665	0.03038±14 0.21004±94 0.05015±6
NM2/2 ABR								192.9±0.8193.6±0.8201.7±2.8
+149	3.8	380	10.9	7.18	5.14	0.0075	11031	0.02976±20 0.20632±1420.05029±4
NM2/2 ABR								189.0±1.2190.5±1.2208.4±2.0
AJM-ISK90-162								
-74	5.3	590	18.4	21.29	5.34	0.0241	4002	0.02843±18 0.19536±1320.04983±6
NM2/2 ABR								180.7±1.2181.2±1.2187.3±3.2
-134+74	2.2	521	17.1	22.52	6.31	0.0896	1084	0.02910±14 0.20054±1120.04999±14
NM2/2 ABR								184.9±0.8185.6±1.0194.4±6.4
-149+134	0.8	487	15.2	17.92	5.51	0.0357	2400	0.02927±14 0.20135±1160.04989±18
NM2/2 ABR								186.0±1.0186.3±1.0189.7±8.2
+149	0.3	484	18.7	28.75	10.98	0.4077	236	0.02956±24 0.20326±3080.04987±62
NM2/2 ABR								187.8±1.4187.9±2.6189.1±28.8

[notes to accompany Table 2]

[1] Complete analytical data, including the measured $^{206}Pb/^{204}Pb$ errors, the mole % blank Pb and the $Pb^{*}/(Pb^{*}+Pb_{common})$ ratios in the analyses, the assumed Stacey-Kramers common Pb ages and their errors, and the correlation coefficients for the Pb/U ratios, are recorded on UBC Geochron Lab data sheets.

[2] -149+74 = size range in microns; all fractions are non-magnetic on Frantz isodynamic separator at 2 amps. and 2^{o} side tilt; all fractions were abraded to remove outer rims.

[3] radiogenic + common Pb.

[4] radiogenic + common Pb, corrected for 0.15%/amu fractionation and for 40 pg Pb blank with composition 208:207:206:204 = 37.30$\pm$0.75:15.50$\pm$0.34:17.75$\pm$0.19:1.

[5] $^{206}Pb/^{204}Pb$ measured, corrected for 0.15%/amu fractionation.

[6] corrected for fractionation (0.12%/amu for U, 0.15%/amu for Pb), blank Pb (see note[4] above), and for common Pb using the Stacey and Kramers (1975) growth curve; errors are 2 sigma, only last digits are shown.

[7] decay constants used in age calculation : $^{238}U = 1.55125 \times 10^{-10}$, $^{235}U = 9.8485 \times 10^{-10}$; $^{238}U/^{235}U = 137.88$ (Steiger and Jager, 1977). Errors are 2 sigma.

FIGURE CAPTIONS

1. Location Map of the Iskut River Project area, showing properties from which samples described in this report were collected.

2a. $^{206}Pb/^{238}U$ Vs. $^{207}Pb/^{235}U$ Concordia graph for the Eskay Creek porphyry

2b. $^{206}Pb/^{238}U$ Vs. $^{207}Pb/^{235}U$ Concordia graph for the Red Bluff porphyry

2c. $^{206}Pb/^{238}U$ Vs. $^{207}Pb/^{235}U$ Concordia graph for the Iskut River (Bronson) stock

2d. $^{206}Pb/^{238}U$ Vs. $^{207}Pb/^{235}U$ Concordia graph for the Inel Stock

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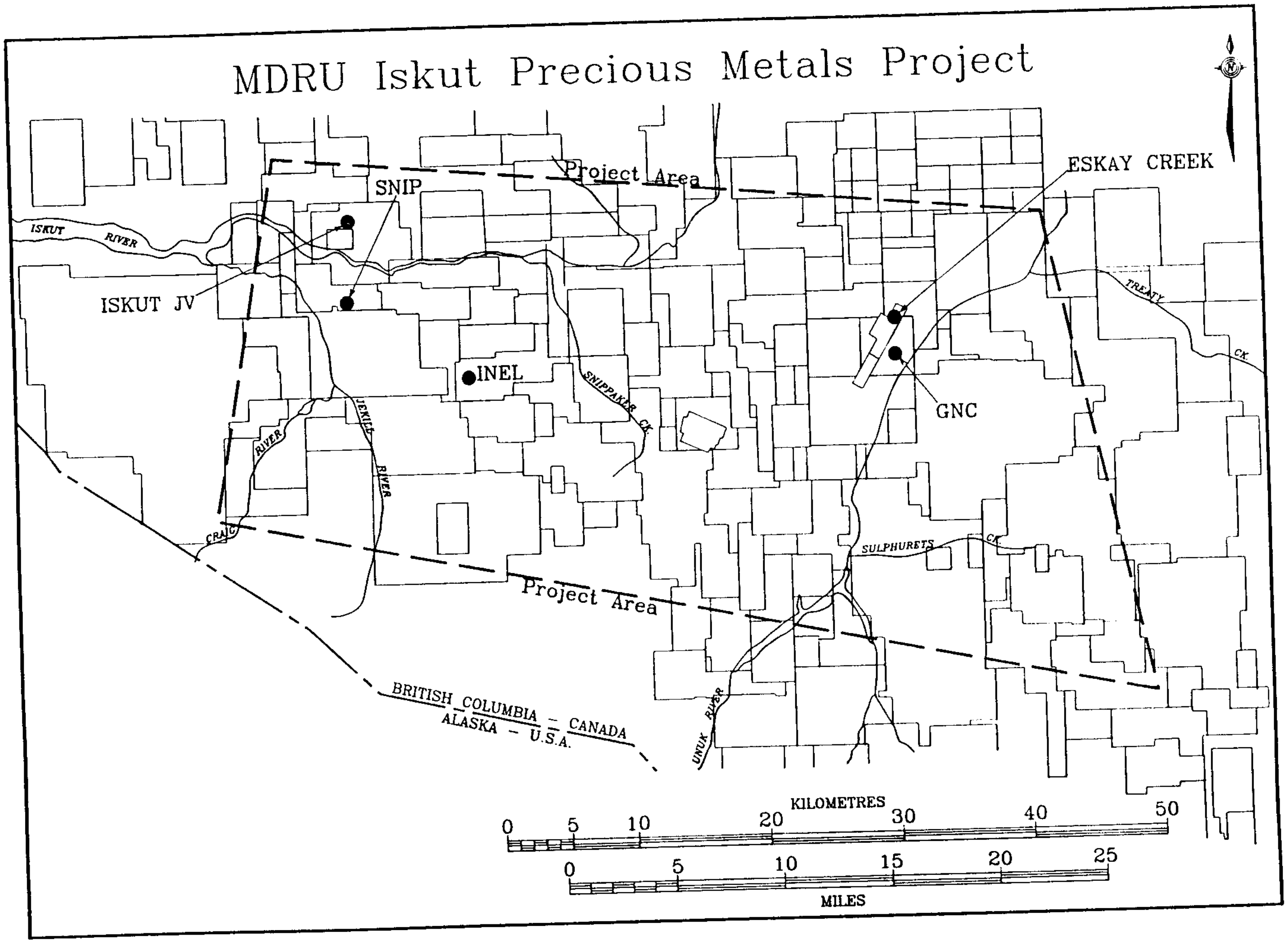
MDRU Iskut Precious Metals Project
Project Area
SNIP
ESKAY CREEK
ISKUT RIVER
ISKUT JV
INEL
SNIPPAKER CK.
TREATY CK.
GNC
JEKILL RIVER
RIVER
CRAIG
SULPHURETS CK.
Project Area
BRITISH COLUMBIA - CANADA
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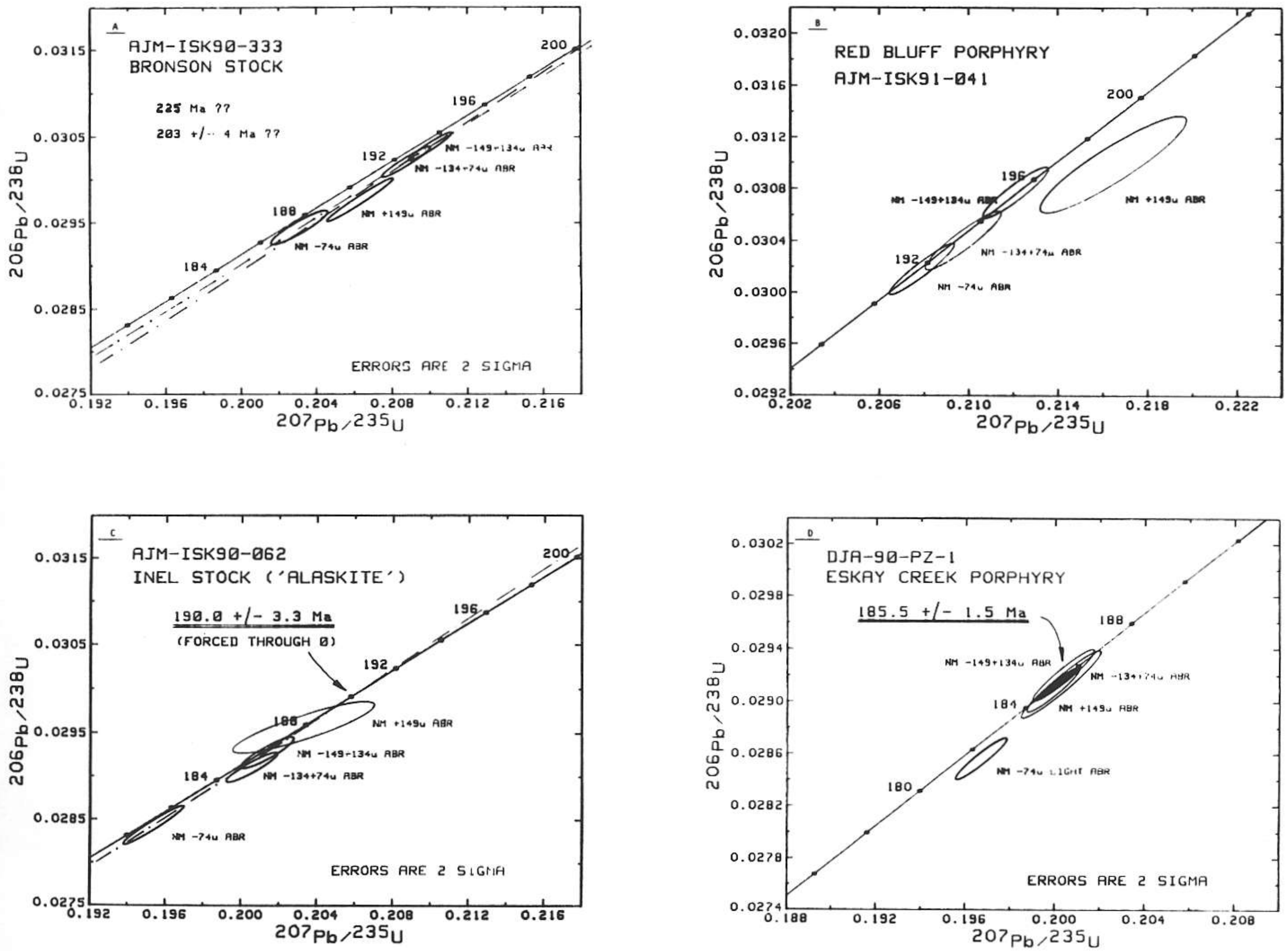

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